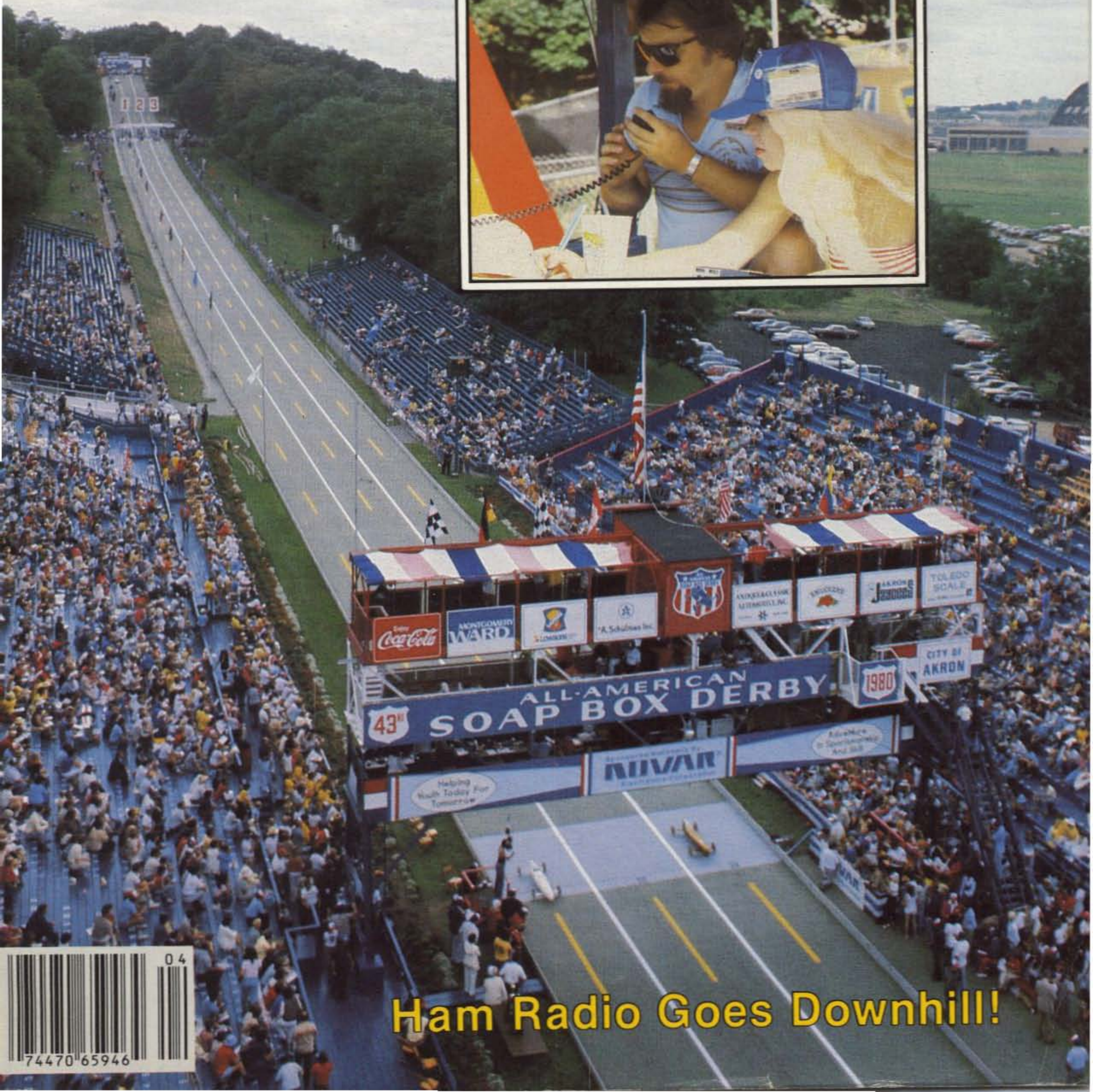
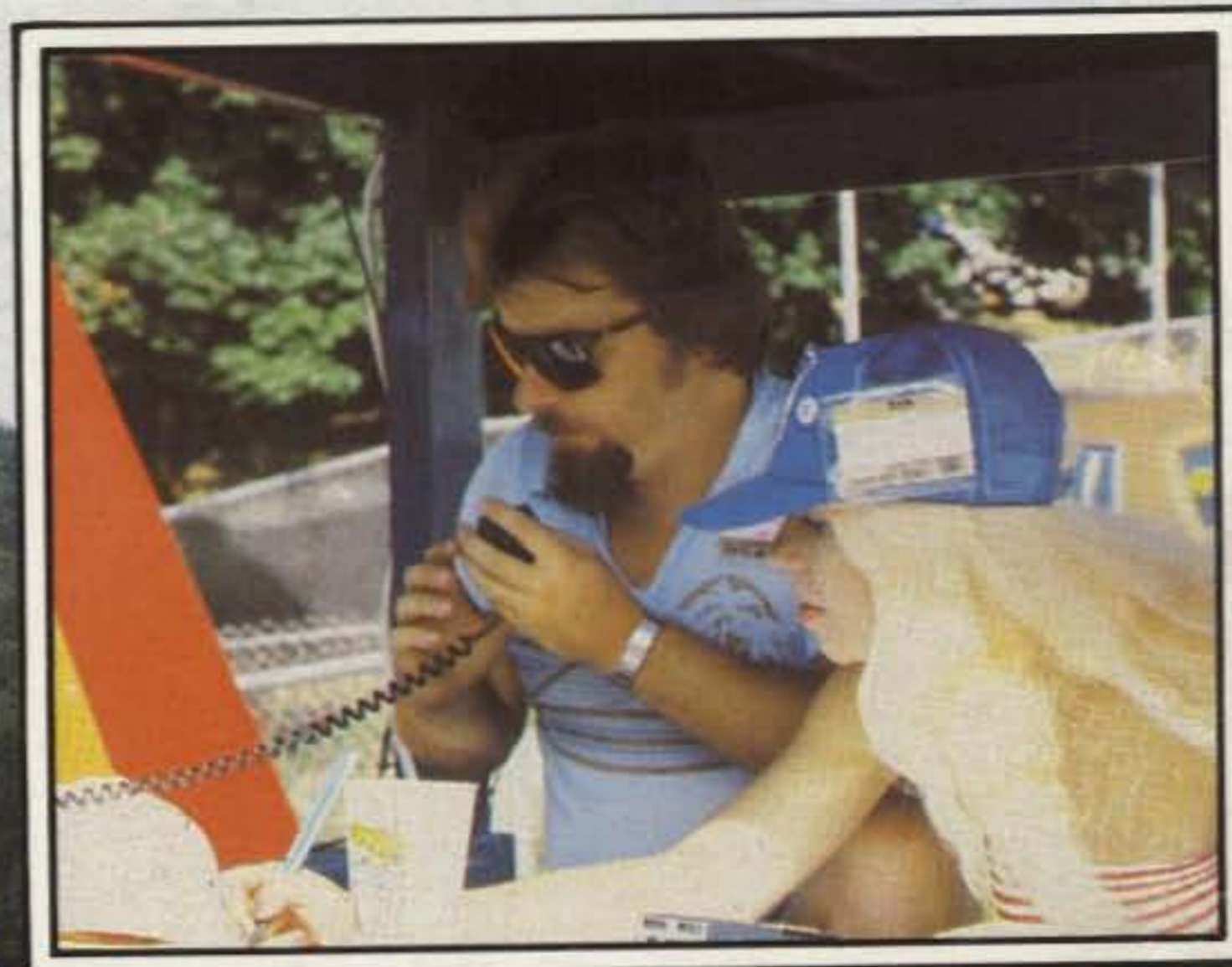


73 MAGAZINE

FOR RADIO AMATEURS



Ham Radio Goes Downhill!



tempo does it again

THE WORLD'S FIRST 440 MHz SYNTHESIZED HAND HELD RADIO

Tempo was the first with a synthesized hand held for amateur use, first with a 220 MHz synthesized hand held, first with a 5 watt output synthesized hand held...and once again first in the 440 MHz range with the S-4, a fully synthesized hand held radio. Not only does Tempo offer the broadest line of synthesized hand holds, but its standards of reliability are unsurpassed...reliability proven through millions of hours of operation. No other hand held has been so

thoroughly field tested, is so simple to operate or offers so much value. The Tempo S-4 offers the opportunity to get on 440 MHz from where ever you may be. With the addition of a touch tone pad and matching power amplifier its versatility is also unsurpassed.

The S-4...\$349.00
With 12 button touch tone pad...\$399.00
With 16 button touch tone pad...\$419.00
S-40 matching 40 watt output
13.8 VDC power amplifier...\$149.00



Tempo S-1

The first and most thoroughly field tested hand held synthesized radio available today. Many thousands are now in use and the letters of praise still pour in. The S-1 is the most simple radio to operate and is built to provide years of dependable service. Despite its light weight and small size it is built to withstand rough handling and hard use. Its heavy duty battery pack allows more operating time between charges and its new lower price makes it even more affordable.



Tempo S-5

Offers the same field proven reliability, features and specifications as the S-1 except that the S-5 provides a big 5 watt output (or 1 watt low power operation). They both have external microphone capability and can be operated with matching solid state power amplifiers (30 watt or 80 watt output). Allows your hand held to double as a powerful mobile or base radio.

S-30...\$89.00* S-80...\$149.00*

*For use with S-1 and S-5



Tempo S-2

With an S-2 in your car or pocket you can use 220 MHz repeaters throughout the U.S. It offers all the advanced engineering, premium quality components and features of the S-1 and S-5. The S-2 offers 1000 channels in an extremely lightweight but rugged case. If you're not on 220 this is the perfect way to get started. With the addition of the S-20 Tempo solid state amplifier it becomes a powerful mobile or base station. If you have a

220 MHz station, the S-2 will add tremendous versatility. Price...\$349.00 (With touch tone pad installed...\$399.00)
S-20...\$89.00

Specifications:

Frequency Coverage: 440 to 449.995 MHz
Channel Spacing: 25 KHz minimum
Power Requirements: 9.8 VDC
Current Drain: 17 ma-standby 400 ma-transmit (1 amp high power)
Antenna Impedance: 50 ohms
Sensitivity: Better than .5 microvolts nominal for 20 db
Supplied Accessories: Rubber flex antenna 450 ma ni-cad battery pack, charger and earphone
RF output Power: Nominal 3 watts high or 1 watt low power
Repeater Offset: ± 5 MHz

Optional Accessories for all models

12 button touch tone pad (not installed): \$39 • 16 button touch tone pad (not installed): \$48 • Tone burst generator: \$29.95
• CTCSS sub-audible tone control: \$29.95 • Leather holster: \$20 • Cigarette lighter plug mobile charging unit: \$6

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10W	80W	80A10	\$149
30W	80W	80A30	\$159
2W	50W	50A02	\$129
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UHF (400 to 512 MHz) models, lower power and FCC type accepted models also available.



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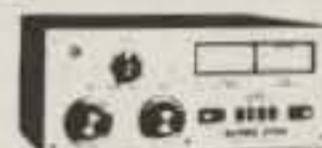


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TR-2400



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1750 Meter XMTR



NEW!

\$145.00

This 160-190 KHz transmitter kit is easy to build. The power supply and exciter portions are factory wired and tested, the Litz wire coils are wound and complete instructions are supplied so you can build it in one evening. The main unit with control panel (shown above) installs at your operating position. The active antenna matching network mounts at the base of your vertical antenna. A 50' antenna is permitted. Shorter antennas can be used. Transmitter operates from 115-v AC. One watt input crystal controlled (crystal supplied). No license needed. Meets all FCC requirements. Not for use in Canada.

Enter the fascinating world of low frequency radio. Order your transmitter today! Free brochure on request.

Complete your 1750 meter station with:



VLF CONVERTER

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Converts the band 10-500 KHz to 3510-4000 KHz so you can hear it on your short wave receiver. Stable crystal control. Sensitive IC mixer and RF stage. Covers the 1750 meter band, navigation radiobeacons, ship-to-shore, European low frequency broadcast band. Free brochure on request.



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Amplifier \$77.50

Plug-in Loops \$59.50

A low noise receiving antenna. Connects to your receiver or VLF converter. Plug-in loops cover 10 KHz to 15 MHz (VLF plug-in covers 150-550 KHz). Rotates 360°, tilts ±90° to null out interference. Man-made noise limits low frequency reception. The loop antenna helps! Free brochure on request.



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.....WA0OHO 52

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Then turn your Apple II on to
RTTY!.....WB6MEP 66

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Perfect Parabolas

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Cover: Photo by Henry Ruminski WD8JOI, Cuyahoga Falls OH.

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green



DOING SOMETHING ABOUT IT

There is one basic reason why the ham market has been soft during the last year and it has little to do with the job market, stagflation, or the recession. The main reason why hams have not been buying very much ham gear lately is that there have been far fewer new hams... and this means fewer enthusiastic newcomers looking for fun.

If amateur radio was growing at the rate of 11% as it did before the proposal of "Incentive Licensing," we would be welcoming about 75,000 new Novices a year. That would represent the 11% growth plus those needed to make up for the dropouts and silent keys. That represents a buying market of over \$100M. Even when you spread that amount around among about 200 ham stores, that represents another half million dollars in sales for each store.

Tufts Electronics has moved things around in their store and set up a classroom for teaching the Novice course. It has been so successful that they are now planning for General and Ad-

vanced courses as well. They have been charging \$35 for the course, which runs for ten weeks, one night a week. Judging from the interest shown in the courses, Tufts is now estimating that they will be able to license about 50 new hams a month.

The money for the courses goes for some of the instruction materials, some for the instructor, and the rest for advertising and overhead. Clubs running Novice courses have found that the more a student has invested in a course, the more likely he is to complete it. That makes sense, when you think about it, but the anti-profit nuisance who turns up now and then wanting the classes to be free louses it up for everyone.

Perhaps you can talk this over with your local ham supplier and get him to set up Novice courses. Remind him that each Novice historically buys about \$1,500 in ham gear and books, so it is well worth his while to see that we have as many newcomers as possible. We should also do all we can to get our clubs to have Novice classes

and try to empty out the high schools for prospects. Remember that about 80% of these teenage Novices will decide to make electronics their career... and they just might be the answer to the loss of technology to Japan.

One more reminder: The 73 series of code tapes is the world's fastest way to learn the code... and the 73 theory course is the best one on the market because it stresses learning the theory rather than memorizing questions and answers. These are ideal teaching adjuncts to any Novice class.

RADAR CRUISE CONTROL

One of the benefits of the recent interest in police radar and its detection has been a good deal of research on the use of radar for cars. RCA, in particular, has been working on the problems and has come up with a system which would enable a car to automatically follow the car ahead, keeping pace with it. This is a small radar unit which is connected to the cruise control of a car, either allowing the following of the car ahead or

else maintaining speed until a car is detected ahead, at which time the radar would disable the cruise control automatically.

Speaking of radar, the car magazines all seem to be of the opinion that Reagan will be backing an end to the 55-mph speed limit, putting the responsibility for speed control back on the states. Many of the western states are not at all enthusiastic about the limit.

There seems to be convincing proof that our government agencies have been covering up the facts about the speed limit and have been supplying us with highly distorted reports on the supposed benefits. Rather than either saving lives or oil, the speed limit may have both increased traffic fatalities and saved hardly any oil. The major benefit has been to the makers and dealers selling radar units to the police... and detectors to the public. Cozy arrangement.

The other major benefactors of the speed limit have been the CB industry and the communities which have gotten the take from the speeding tickets... billions of dollars.

Some psychologists have pointed out that one of the results of making virtually everyone a criminal is to alienate the public from the police and thus encourage crime... and reduce the cooperation needed.

Perhaps the bright spot of all this will be the developments we can see coming as a result of the radar research.

SAROC

Having been unable to locate anyone who attended, I'm going by reports from third parties: UGH.

Not only were there fewer than 1,000 in attendance, what few there were apparently were

TECH WIZARDS

We seem to be getting more and more technical questions whose answers require more and more of our time which we seem to have less and less of. We would like to revive the Technical Aid Group concept which appeared here 10 years ago.

Please, you wizards out there who *want* to help (without compensation), send us your qualifications (experience, degrees, area of expertise, if any, etc.) and complete address. Then when readers have questions they can talk to an expert.

Don't take this lightly—some questions are difficult and will require some digging. But if you can help, you might save someone a lot of grief.

Write to Editorial Offices, *73 Magazine*, Pine Street, Peterborough NH 03458, attention: Tech Wizards.

TRAVELING HAMS

We believe that there are many interesting stories related to ham radio across this wide world that are begging to be told. When you do travel, keep that in mind. You may be the only outsider who is a ham to visit a hidden valley somewhere. Neither *73* nor any other amateur radio publication has the staff to do this adequately; we are depending on you.

When you have a trip coming up, let us know. We may have heard about something along your route that may be of interest to us all. You might even make a few dollars to put toward your next trip. So, put a note pad and pencil in your camera case and start thinking like a roving reporter.

If you are interested, send your travel plans to Editorial Offices, *73 Magazine*, Pine Street, Peterborough NH 03458, attention: Traveling Hams.

Hand-shack.

Synthesized, big LCD, 10 memories, scanning, DTMF TR-2400

Put a ham shack in your hand. The TR-2400 is the ideal hand-held for 2 meters FM. It features a large LCD readout that can be read in direct sunlight or in the dark, 5-kHz-step PLL synthesized operation, 10-channel memory, scanning, and 16-button autopatch DTMF encoder.

TR-2400 FEATURES:

- **Large LCD digital readout**
Readable in direct sunlight (better than LEDs). Readable in the dark (with lamp switch). Virtually no current drain (much less than LEDs) and display stays on. Rugged and dependable in hot or cold temperature ranges. Shows receive and transmit frequencies and memory channel.
- **5-kHz-step frequency selection**
PLL synthesized keyboard channel selection system. No "5 up" switch needed. Selects from 144.000 to 147.995 MHz.



CONVENIENT TOP CONTROLS

- **UP/DOWN manual scan**
Single or fast continuous 5-kHz steps from 143.900 to 148.495 MHz for Amateur and MARS or CAP simplex or repeater operation.
- **10 memories**
Retained with battery backup (only 2.0 mA). "M0" memory may be used to shift the transmit frequency any desired amount to operate on repeaters with nonstandard split frequencies.
- **Built-in autopatch DTMF encoder**
All 16 buttons of keyboard provide telephone dual-tones while transmitting.
- **Automatic memory scan**
Checks all 10 memory channels. Programmable to lock automatically on either BUSY (signal present) or OPEN (no signal) channels.
- **Repeater or simplex operation**
Convenient mode switch shifts transmit frequency +600 kHz or -600 kHz or to the frequency stored in "M0" memory.



- **Subtone switch**
Activates subaudible tone encoder (not Kenwood-supplied).
- **Extended operating time**
With LCD and overall low-current circuit design. Only draws about 28 mA squelched receive and 500 mA transmit (at 1.5 W RF output), for longer operating time between charges.
- **Two lock switches**
Prevent accidental frequency change and accidental transmission.

Microphone PTT and audio terminals

Charger terminal

Earphone Jack

- **Reverse operation**
Push-button switch shifts receiver to transmit frequency and transmitter to receive frequency.
- **BNC antenna connector**
Easy to connect external antenna.
- **LCD "arrow" indicators**
Show "ON AIR" "MR" (memory recall), "BATT" (battery status), and "LAMP" switch on.
- **High-impact case and zinc die-cast frame**
Extremely rugged with antenna counterpoise.
- **External PTT microphone and earphone connectors**
Easily accessible on right side of transceiver.
- **Compact and lightweight**
Only 2-13/16 inches wide, 7-9/16 inches high, and 1-7/8 inches deep. Weighs only 1.62 pounds (including antenna, battery, and hand strap).

Standard accessories included:

- Flexible rubberized antenna with BNC connector
- Heavy-duty (450-mAh) NiCd battery pack
- External-standby (PTT) plug
- External-microphone plug
- AC charger
- Hand strap
- Earphone

More information on the TR-2400 is available from all authorized dealers of Trio-Kenwood Communications, Inc., 1111 West Walnut Street, Compton, California 90220.

Optional accessories:

- ST-1 base stand (shown) which provides 1.5-hour quick (90%) charge, 4-pin connector for dynamic microphone, and SO-239 antenna connector.
- BC-5 DC quick (90%) charger (1.5 to 2.0 hours)
- SMC-24 speaker/microphone
- LH-1 deluxe leather case (top-grain cowhide)
- PB-24 extra battery pack with charger adapter
- BH-1 belt hook

 **KENWOOD**
...pacesetter in amateur radio



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siphoned off by a competing event put on by the local ham club, which has not been silent in its bitter feelings about the SAROC hamfest... an event put on mostly by one chap for profit... and supported almost solely by *Ham Radio* magazine.

The show did get a great review in *HR's* Half Right Reports, thus preserving their record for objectivity. Will there be another debacle next year? It seems unlikely.

VEGAS

Though I didn't go to the SAROC mess this year, I did have to get out to Vegas for the Winter Consumer Electronics Show (CES) a couple of days later. The weather was perfect and the town was crowded with about 60,000 attending the CES. With the casinos vying with each other to provide low-cost eats, you can do very well in the town on about \$6 per day. Even

the local people come to the strip to get in on the \$1.49 breakfast buffets.

Other than that, most of the things in Vegas are so tacky that I really dislike the place. The casinos are packed most of the day and night with people pulling the levers of the slots. Are they having fun? I watched several hundred of them and I saw not one smile. Even when the jackpot would eventually dump on them they accepted it stoically and went back to seeing how fast they could get the coins back into the machine.

At the airport, while I was waiting for my plane, I watched a shabbily-dressed couple get \$100 in dollars and start feeding them into a slot machine. By the time I'd finished my ice cream, the \$100 was gone. I never saw one sign that either of them was enjoying the experience. They just stood there silently, as though hypnotized, sliding in

the dollars, three at a time.

It is not really difficult to win in Vegas... at least until they get to know you... but you have to know what you are doing and spend some time learning how. I've written about this in one of my other magazines in more detail. Obviously, before you tackle the professionals, you want to have your system not only perfected, but very well practiced. This is where the computer comes in... affording you practice without having to pay for it. It is far better to learn for free and take your lumps than to try to get your gambling education at \$2 a throw.

Quite a number of people have come up to me at shows and tried to argue that you can't really win at gambling in Vegas. When I pry into their knowledge of the subject, I find that they know virtually nothing about it.

Continued on page 120

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

by Bandel Linn K4PP



"Your 1/2-Watt QRP rig is putting in a bone-crushing signal here in central India..."

OSCAR AND IC451A (The Perfect Couple)

ICOM presents a multifunction multimode base station transceiver for use either as part of an OSCAR satellite link on mode B or J, or for use with your favorite 440MHz FM repeater. The IC451A incorporates features customers ask for most:

- 3 Memories with Memory Scan.
- Programmable Band Scan.
- Squelch on SSB! Silent Receive when no signal is present.

- Variable Repeater Split.

Imagine programming 2 of your favorite SSB QSO frequencies as well as the OSCAR 8 mode J downlink beacon into memory, and silently scanning these frequencies while working other bands in your shack.

The IC451A may be ordered from your authorized ICOM Dealer in either 430-439.9999MHz or 440-449.9999MHz models.



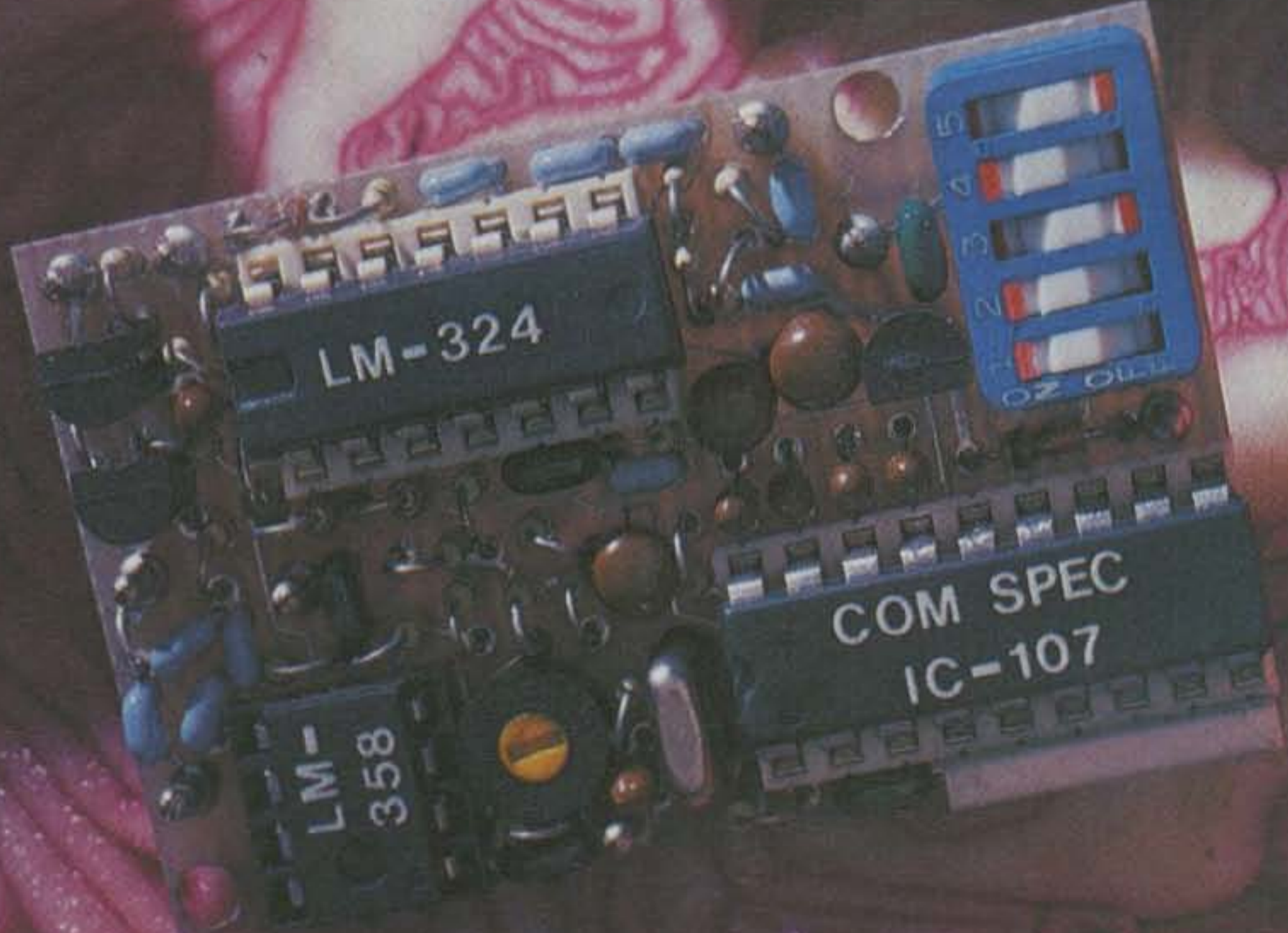
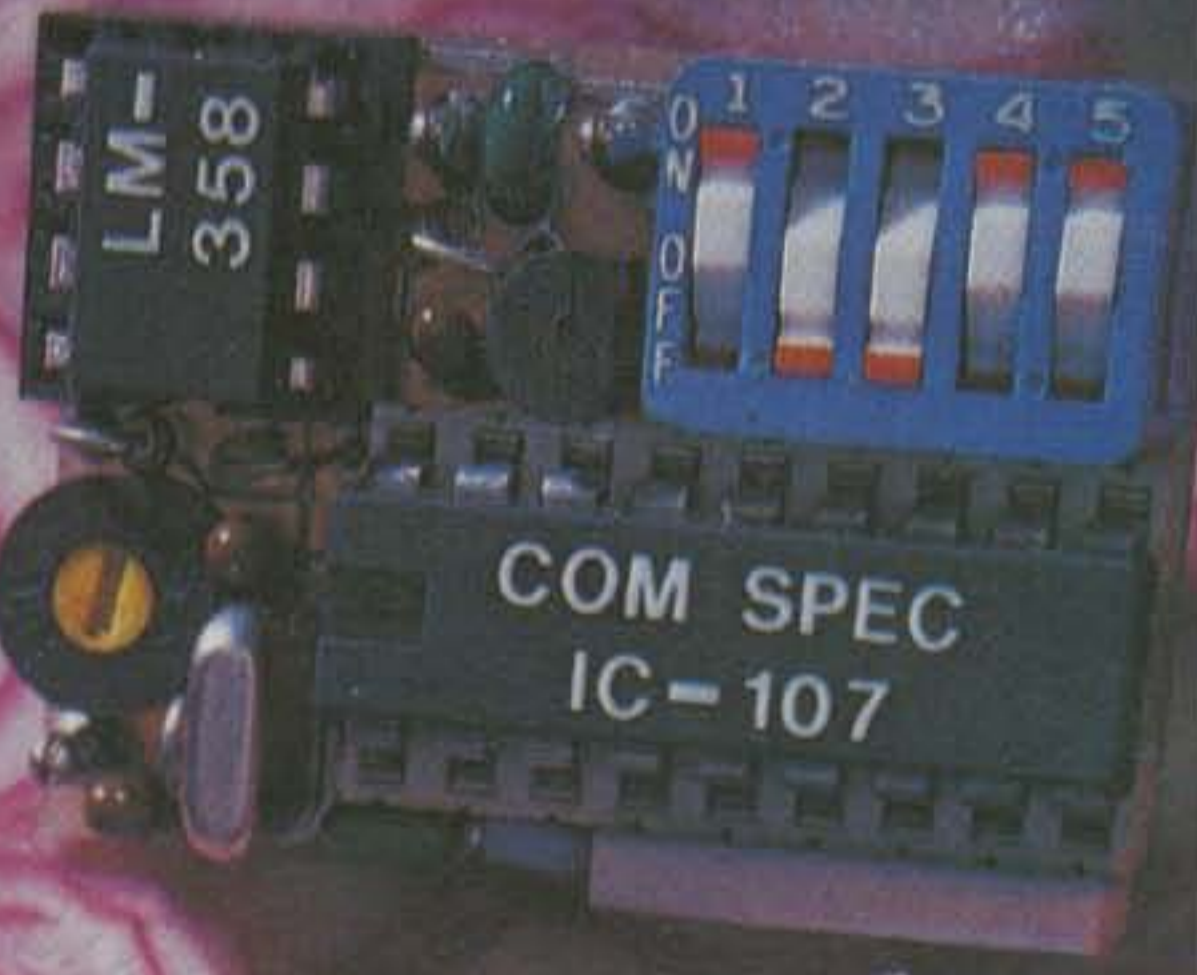
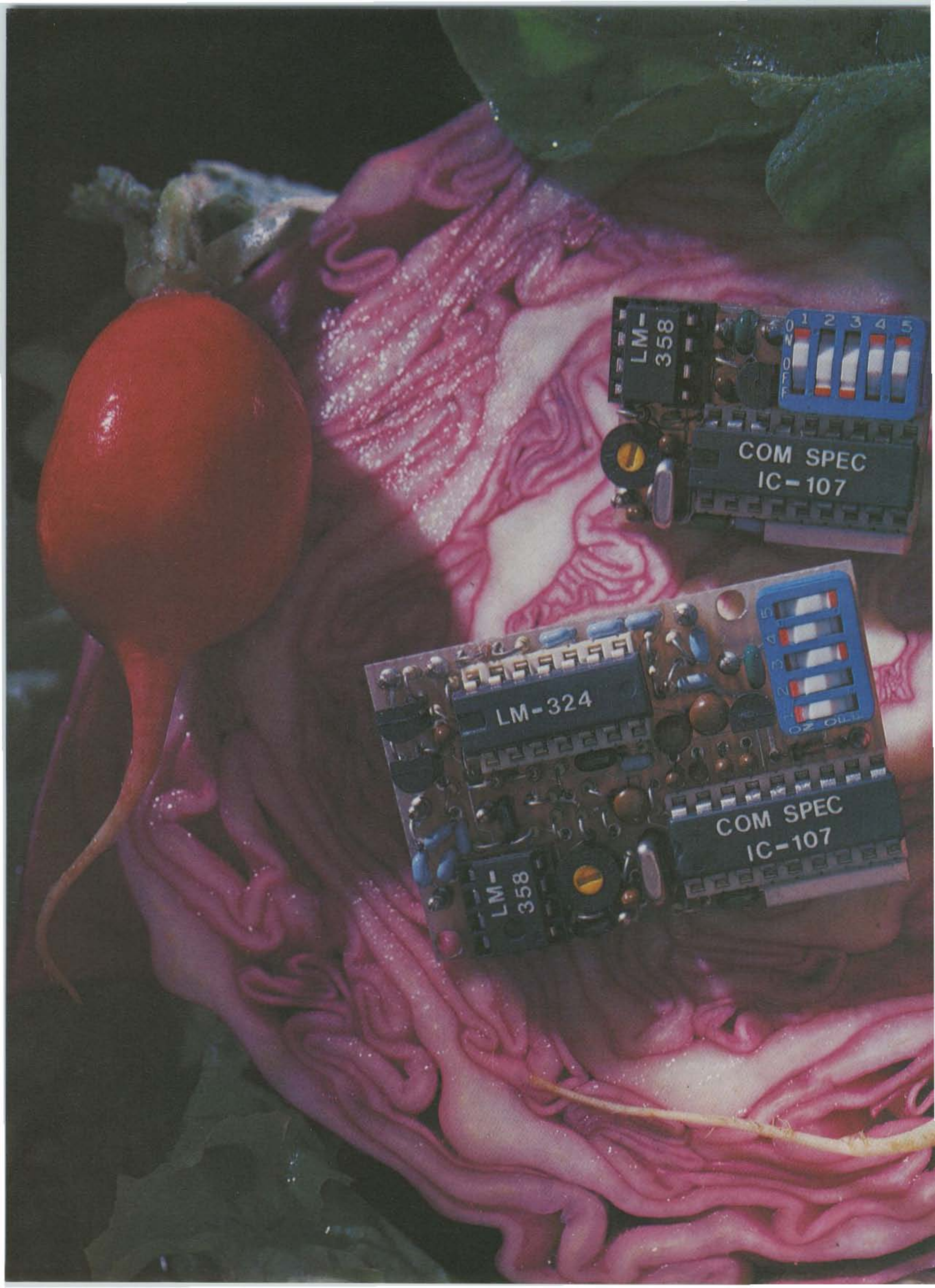
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All stated specifications are approximate and subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emissions.



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Our new crop of tone equipment is the freshest thing growing in the encoder/decoder field today. All tones are instantly programmable by setting a dip switch; no counter is required. Frequency accuracy is an astonishing $\pm .1$ Hz over all temperature extremes. Multiple tone frequency operation is a snap since the dip switch may be remoted. Our SS-32 encode only model is programmed for all 32 CTCSS tones or all test tones, touch-tones and burst-tones. And, of course, there's no need to mention our 1 day delivery and 1 year warranty.



TS-32 Encoder-Decoder

- Size: 1.25" x 2.0" x .40"
- High-pass tone filter included that may be muted
- Meets all new RS-220-A specifications
- Available in all 32 EIA standard CTCSS tones

SS-32 Encoder

- Size: .9" x 1.3" x .40"
- Available with either Group A or Group B tones

Frequencies Available:

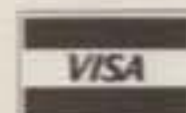
Group A			
67.0 XZ	91.5 ZZ	118.8 2B	156.7 5A
71.9 XA	94.8 ZA	123.0 3Z	162.2 5B
74.4 WA	97.4 ZB	127.3 3A	167.9 6Z
77.0 XB	100.0 1Z	131.8 3B	173.8 6A
79.7 SP	103.5 1A	136.5 4Z	179.9 6B
82.5 YZ	107.2 1B	141.3 4A	186.2 7Z
85.4 YA	110.9 2Z	146.2 4B	192.8 7A
88.5 YB	114.8 2A	151.4 5Z	203.5 M1

- Frequency accuracy, $\pm .1$ Hz maximum -40°C to $+85^{\circ}\text{C}$
- Frequencies to 250 Hz available on special order
- Continuous tone

Group B						
TEST-TONES:	TOUCH-TONES:		BURST-TONES:			
600	697	1209	1600	1850	2150	2400
1000	770	1336	1650	1900	2200	2450
1500	852	1477	1700	1950	2250	2500
2175	941	1633	1750	2000	2300	2550
2805			1800	2100	2350	

- Frequency accuracy, ± 1 Hz maximum -40°C to $+85^{\circ}\text{C}$
- Tone length approximately 300 ms. May be lengthened, shortened or eliminated by changing value of resistor

Wired and tested: TS-32 \$59.95, SS-32 \$29.95



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AWARDS

Bill Gosney WB7BFK
Micro-80, Inc.
2665 North Busby Road
Oak Harbor WA 98277

I wish to thank the many readers who have supported the 73 Awards Program and this Awards column over the past year and a half. I've received letters from all over the world supporting both projects.

In answer to the many letters received recently, the 73 Awards Program is quite extensive. As you read through the September and October, 1980, editions of 73, you see featured nearly twenty individual awards being made available to licensed amateurs. We would like to cater to your many ideas for adding a few more awards to the program, but we have to limit our portfolio so that it is manageable by the staff. As we all know, 73 Magazine is only one function of the Peterborough crew!

Please, don't let my comment discourage you. You people have a lot of super ideas for different awards. Personally, I would recommend that you initiate and fund your award concept locally. What a great way for a radio club, for example, to gain international recognition! Take the Whidbey Island DX Club... with the founding of the International Island DX Award, we have seen applications made from even the rarest of countries

and stations. We've seen the popularity of the club and its DX Award grow significantly over the past three years to where now it is the center of attraction.

A radio club award can mean a way of strengthening the club's treasury. Those projects which previously were restricted due to finances now can become reality. The easiest part of it all, once you have your award program organized and can send your rules to me to publish in this column, is just standing by... within a month you'll begin seeing letters of application pouring in.

The most important comment I can offer about a newly-founded award is that it has to be something different to be in demand. So, give your award idea some thought. Plan your requirements with the thought in mind that your award is not for everyone. Make the rules somewhat difficult, yet not too restrictive. Don't make the award so simple that you practically give it away. If an operator doesn't have to work towards a goal, the certificate on the wall won't be of any value to him or those who see it on display.

Finally, I would like to see clubs getting involved with award programs on a larger scale. The majority of award sponsors seem to be major magazine publishers and national radio societies. Somewhere

along the line, most of the clubs lost their confidence and only a few have taken the initiative to design an award and offer a challenge to award seekers of the world.

Perhaps now clubs will recognize the significance award programs have to an active group. Why not form a committee and consider such an endeavor this week?

CQ AWARD

The CQ Radio Club of Torrington offers a certificate for contact with its club members. This is open to any amateur station on any band, any mode, at any time.

To qualify, amateurs within Connecticut must make 15 contacts with members; other state-side amateurs need to contact only 10 member stations; DX stations must establish 5 member contacts.

There are no charges for this award; however, donations to offset postage would be appreciated. Send your list of contacts to: Robert J. O'Neil W1FHP, Awards Manager, Hard Hill Road, Bethlehem CT 06751.

THE HEX AWARD

Paul Hilton N3BCZ recently wrote and provided me with details of an award being sponsored by the Lancaster Radio Transmitting Society, Inc. The award is a beautiful hand-colored certificate, authenticated by the officers of the Lancaster organization.

To qualify, applicants must make contact with at least thirteen Lancaster County radio operators. There are no mode restrictions, but contacts via repeater are not valid.

To apply for the award, send your QSL confirmations to the club trustee. Be sure to enclose sufficient postage for the safe return of your cards. In his letter, Paul failed to mention if there was an award fee. It is assumed there is not. You may forward your application to: Robert Wenger, 402 S. State Street, Ephrata PA 17522.

If you are an active county hunter, which a heck of a lot of our readers are, you might take a hard look at four very challenging awards being offered by Ray Teeter N2RT.

THE UNITED STATES OF AMERICA COUNTY AWARD

The USA County Award is

available to applicants who can meet the requirements of any of the 12 award categories.

There is a category for each call district, and an applicant must work the required number of counties in that district to qualify.

1st call district—67 counties
2nd call district—83 counties
3rd call district—94 counties
4th call district—749 counties
5th call district—584 counties
6th call district—58 counties
7th call district—257 counties
8th call district—226 counties
9th call district—266 counties
10th call district—681 counties
Alaskan call district—4 counties (judicial districts)
Hawaiian call district—5 counties

When applying, you *must* state which call district you are applying for. Claiming all call districts requires 12 applications, and the recipient also will receive a nice trophy.

For each Call Area Award, there are three award classes. Class A—all counties in the call area worked; Class B— $\frac{2}{3}$ of the counties worked in the call area; and Class C— $\frac{1}{3}$ of the counties worked in the call area.

To apply for the USA County Award, prepare a list of claimed contacts in order by county within each call area. Be sure to list the usual logbook information, including the county and state of the contact. Do not send QSL cards! Have your list verified by at least two amateurs or a local radio club secretary. While there are no mode or band restrictions for this award, you may request endorsements and receive recognition at no additional charge if a request for such is made at the time of application.

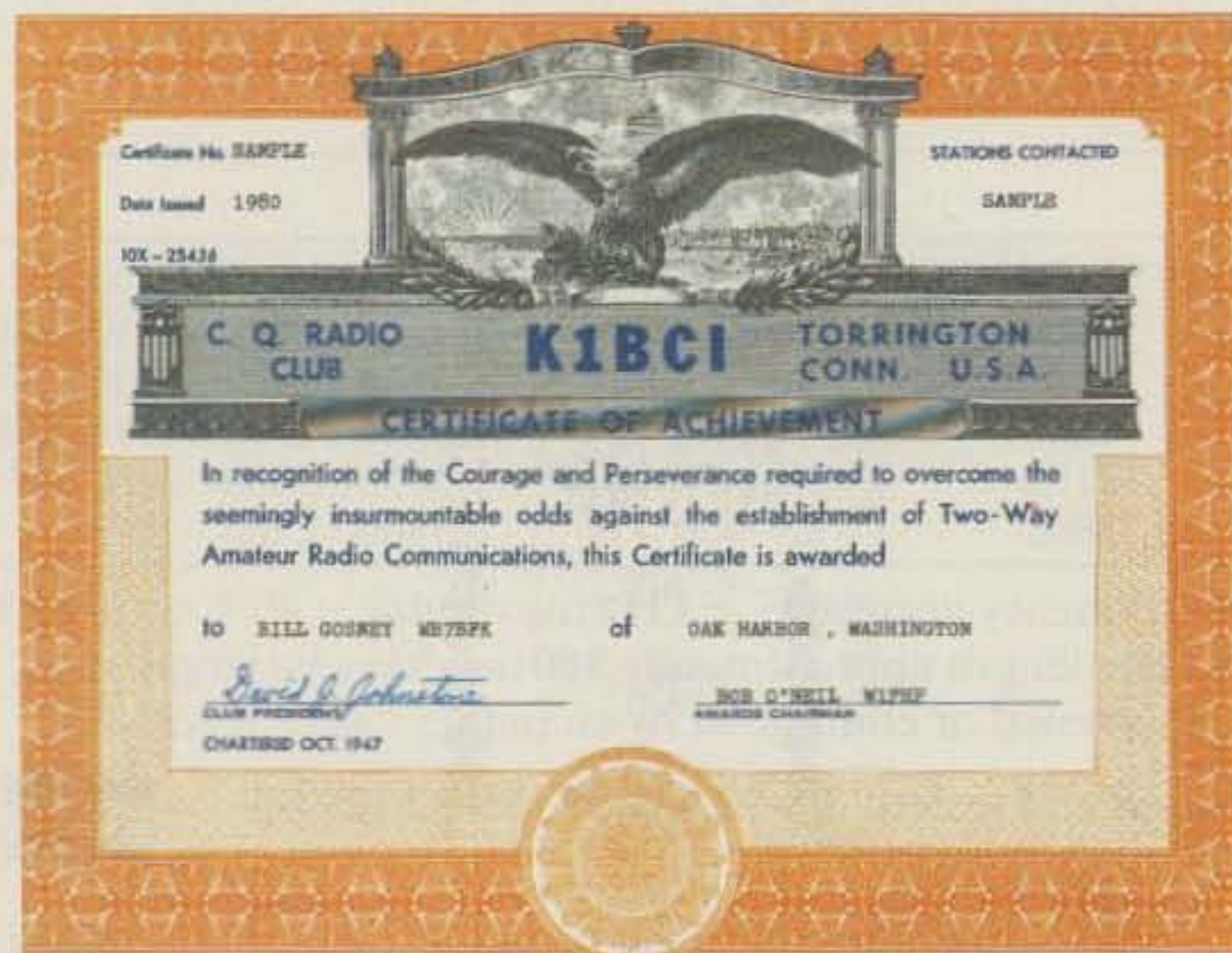
For each Call Area Award being applied for, enclose an award fee of \$1.00 and forward to: Ray Teeter N2RT, RD 2, Canaan Heights, Locke NY 13092.

CHN MOBILE ACHIEVEMENT AWARD

Also made available by Ray Teeter, the CHN Mobile Achievement Award is offered in three award categories.

To qualify, applicants must either (1) work mobiles in all the counties of any one state, (2) work the same mobile in all counties of any one state, or (3)

Continued on page 44



FULL BANDWIDTH FIREWORKS,

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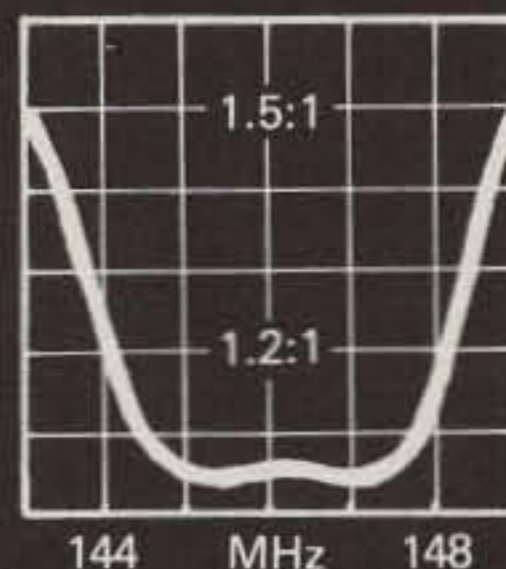
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CONTESTS



Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

QRP ARCI ANNUAL QSO PARTY 2000 GMT April 18 to 0200 GMT April 20

The contest is open to all amateurs and all are eligible for the awards. Stations may be worked once per band for QSO and multiplier credits.

EXCHANGE:

Members—RST, state-province-country, and QRP number.

Non-Members—RST, state-province-country, power input.

SCORING:

Each member QSO counts 3 points. Non-member QSOs are 2 points, and stations other than W/VE count 4 points each. Multipliers are as follows: More than 100 Watts input, $\times 1$; 30-100

Watts, $\times 1.5$; 10-30 Watts, $\times 2$; 3-10 Watts, $\times 4$; 1-3 Watts, $\times 6$; less than 1 Watt input, $\times 10$.

Final score is total QSO points times total number of states-provinces-countries per band times the power multiplier.

FREQUENCIES:

Novice—3710, 7110, 21110, 28110.

SSB—1810, 3985, 7285, 14285, 21385, 28885, 50385.

CW—1810, 3560, 7040, 14060, 21060, 28060, 50360.

Try SSB on even hours, and don't forget Novice frequencies.

AWARDS:

Certificates to the highest scoring station in each state, province, or country with two or more entries. Other awards will be given depending on activity. One certificate to highest scoring Novice/Technician overall. One certificate for the station showing three skip contacts using the lowest power.

LOGS AND ENTRIES:

Send full log data, including full name, address, and bands used, equipment, antennas, and power used. Entrants desiring results sheet and scores, please

enclose a business-sized envelope with sufficient return postage. Logs must be received by May 20th to qualify. Send all logs and data to: QRP ARCI Contest Chairman, William W. Dickerson WA2JOC, 352 Crampton Drive, Monroe MI 48161.

YL ISSB QSO PARTY—PHONE

0001 GMT April 18 to
2359 GMT April 19

Two six-hour rest periods are required. Operating categories include: single operator, DX/WK teams, and YL/OM teams. All bands will be used, and the same station may be contacted on different bands for contact points but not as country multipliers. Two meters may be used, but contacts must be direct and not through repeaters.

EXCHANGE:

Name, RS, SSBer number, country, state, and partner's call. If no partner, leave blank. If non-member, send "No Number."

FREQUENCIES:

3925, 7290, 14332, 21373, 28673. Listen for DX on 3765 and 7090. Listen for VK on 3690 on 75-meter phone, as their top frequency is 3700. It is requested that stations spread out to relieve congestion on 14332. Use frequencies from 14280 to 14345. Remember the nets on 14313 and 14336. Also DX stations use 14160 to 14190 for contacts among themselves.

SCORING:

Score five points for each member contacted on any continent. Non-member contacts count one point. Only member station contacts count for multipliers. Multipliers are each state, country, and province. Also, each team contacted, but

Continued on page 117

RESULTS

1980 HELVETIA CONTEST

Europe

CT4MS	1,764
DK6ZG	16,704
EA7ALG	13,965
F9KP	18,972
G3ESF	10,455
GD4GWQ	945
HA0KDA	17,940
HA7SQ	7257
IN3NJB	5,924
IS0QDV	1,296
LA2GN	4,089
LZ2KKZ	13,650
OE1DSA/3	22,935
OH9NV	15,147
OH3PB	13,572
OK3KFF	9,207
OK1AVD	8,316
ON7YD	10,688
OZ1BLO	1,260
PA3AFF	720
SM4CGM	2,223
SP8ARY	1,938
SP1KRU	1,680
UK4PNZ	29,700
UA2EC	792
UK5IBM	22,680
UK2WAF	21,504
UO5OWC	4,617
UP2BAW	35,787
UQ2MF	1,599
RU2RCU	7,200
YO2BEO	3,306
YU2CRM	8,880
YU3AIJ	5,520
Y43ZNA	9,360

DX Stations

EA9GT	3,612
JA1ADN	11,664
JT1AN	105
OA4ZP	396
OD5LX	924
PY4KL	741
UA9CAL	22,320
UD6CN	2,160
UJ8JAS	576
UL7QF	1,660
UM8MBA	540
VE2WA	2,592
VE3HNO	351
VE4MF	960
VE5JQ	624
VO1AW	11,172
VK3AEW	2,592
KA1EP	8,694
N2UN	15,675
W3ARK	10,701
W4OEL	20,532
W5EIJ	867
W6UA	9,120
W7ULC	4,860
W8DA	10,062
AE9X	270
W0LHS	108
HB9BAI/4X	20,352
9G1KL	2,304

CALENDAR

Apr 4-5	ARRL Open CD Party—Phone
Apr 8-9	DX/YL to NA/YL Contest—CW
Apr 11-12	ARRL Open CD Party—CW
Apr 15-16	DX/YL to NA/YL Contest—Phone
Apr 18-19	YL ISSB QSO Party—Phone
Apr 18-20	QRP QSO Party
Apr 25-26	Helvetia Contest
May 2-3	County Hunters SSB Contest
May 9-10	Rocky Mountain Division QSO Party
May 10	DARC Corona 10-Meter RTTY
May 16-18	Michigan QSO Party
May 23-24	Europe and Africa Giant RTTY Flash
Jun 6-7	VK/ZL/Oceania RTTY DX Contest
Aug 8-9	European DX Contest—CW
Aug 15-16	SARTG Worldwide RTTY Contest
Sep 12-13	European DX Contest—Phone
Sep 12-13	G-QRP-Club CW Activity Weekend
Sep 12-14	Washington State QSO Party
Sep 26	DARC Corona 10-Meter RTTY
Nov 8	DARC Corona 10-Meter RTTY
Nov 14-15	European DX Contest—RTTY
Dec 26-31	G-QRP-Club Winter Sports

RESULTS

1980 MICHIGAN QSO PARTY

Michigan

W8PBO	98,600
K8RO	67,235
WA8VNZ	66,470
W8YY	52,445
K8AQM	50,660
WA8MAM	50,150
WA8QAF	42,948
N8ADW/8	41,820
WB8AYW	40,885
WB8ZJL	37,520

Out-of-State

VE3DAP	17,784
K3NB	14,620
W1AQE	8,244
WA9BZW	7,440
N0BNW	6,640
W3PYZ	5,740
W7ULC	5,565
WD8SBR	5,066
K9CW/2	4,536
N3AHA	2,938

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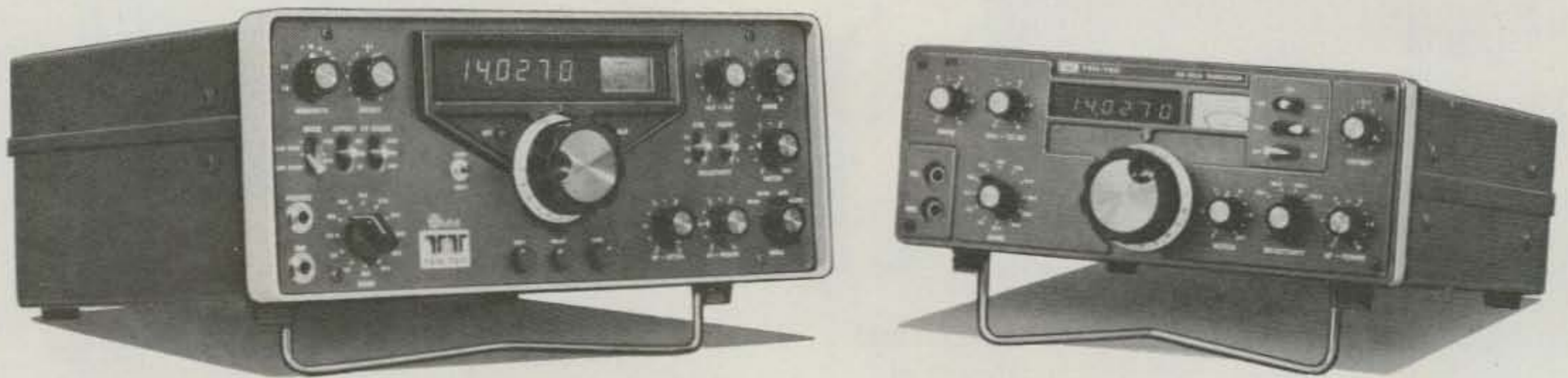
In the U.S. and Canada, visit your nearby Heathkit Electronic Center where Heathkit Products are displayed, sold and serviced. See the white pages of your phone book. In the U.S., Heathkit Electronic Centers are units of Veritechnology Electronics Corporation.



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Medford

Michigan

Omar Electronics
Durand

Radio Parts, Inc.
Grand Rapids

Missouri

Henry Radio
Butler

Ham Radio Center, Inc.
St. Louis

Mid-Com Electronics
St. Louis

Nebraska

Omaha Amateur Center
Omaha

Nevada

Amateur Electronic Supply
Las Vegas

New Jersey

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New Mexico

Pecos Valley
Amateur Radio
Roswell

New York

Grand Central Radio
New York

Ham Radio World
Oriskany

North Carolina

Bino Communications
Greensboro

Ohio

Ken-Mar Industries
North Canton

Universal Amateur Radio
Reynoldsburg

Amateur Electronic Supply
Wickliffe

Oklahoma

Radio Incorporated
Tulsa

Oregon

Eugene Radio Supply
Eugene

Pennsylvania

Supelco Inc.
Bellefonte

South Hills Electronics
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Ham Buerger Inc.
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Seattle

C-COMM
Seattle

Wisconsin

Amateur Electronic Supply
Milwaukee

FCC

TYPE-ACCEPTANCE REQUIREMENTS EXTENDED FOR EXTERNAL RADIO FREQUENCY POWER AMPLIFIERS (DOCKET NO. 21117)

The Commission has decided to extend for an indefinite period its type-acceptance requirements for external radio frequency power amplifiers of the kind used to amplify Citizens Band radio transmissions illegally.

The Commission instructed its staff to draft an order extending the type-acceptance and related technical requirements indefinitely. The requirements were adopted in 1978, effective for three years, to cope with the problem created by the large number of amplifiers being marketed and promoted for use in and around the CB frequencies. External amplifiers of the sort used to amplify CB signals illegally can cause serious interference to TV and radio reception.

Type acceptance, in this case, requires submission of a sample of the model amplifier to the FCC for approval, along with technical data, before it is manufactured and placed on the market. The number of proto-

type units that can be manufactured in preparation for submission for type acceptance is limited to 10.

The requirements apply to all amplifiers and amplifier kits capable of operation below 144 MHz. They cover most amplifiers used in the Amateur Radio Service.

The Commission said numerous manufacturers and distributors of amplifiers designed for illegal operation have ceased manufacture and marketing since the requirements were adopted, though some are continuing.

The effectiveness of the type-acceptance requirements in halting promotion of amplifiers for illegal applications indicates that they should be continued, it said. Notice of the continuation was given in the order that originally implemented the type-acceptance requirement.

Action by the Commission, December 18, 1980, by Second Report and Order (FCC 80-750). Commissioners Ferris (Chairman), Lee, Washburn, Fogarty, and Brown.

CORRECTIONS

In the January, 1981, Review section, the first two TS-820 mod kits (front end and balanced mixer) were incorrectly sourced to S-F Amateur Radio Services. These mods are, in fact, produced by W6TOG, and are available through authorized distributors (S-F is not one). All mail-order inquiries should be directed to the address given below. Both the QRO kit and the Magicom board are available still from S-F at the address given at the end of the review.

Jerome H. Ginsberg W6TOG
TM Limited
6108 Hazelhurst Place, Suite 9
North Hollywood CA 91606

In "A Programmer's Potpourri" (September, 1980, p. 95), Program 11(a), please insert F = 0 at line 0225.

Peter Stark K2OAW
Mt. Kisco NY

In my January, 1981, article "Cheap and Simple," p. 51, an error can be found in the Parts List. Capacitors C1 and C2 should be switched. While this error exists in the Parts List, the text of the article is correct, C1 is 10 uF, 25 V, and C2 is 13,000 uF, 25 v.

Vern A. Weiss WA9VLK
Kankakee IL

LEAKY LINES



Dave Mann K2AGZ
3 Daniel Lane
Kinnelon NJ 07405

Most of us thought that the world had learned its lesson about appeasement when Neville Chamberlain and Edouard Daladier engineered the Munich Pact, thus preparing the way for Adolf Hitler's rapacious appetite for territorial aggrandizement. We thought that appeasement had been thoroughly discredited as a bankrupt tactic, unworthy strategically and unworkable from a practical sense.

It appears that we have not learned that historical lesson, and we may be compelled to re-learn it.

We show overweening leniency toward parasites and criminals; we extend the hand of friendship (generally prompted by either economic or political expediency) toward foreign nations which despise us; we lower academic standards so that unqualified boobs can occupy space in our universities, and, closer to home, we grant concessions to the undeserving in amateur radio.

Two things happen when you appease. You sharpen the recipient's appetite for more, and you make it unnecessary for him to appreciate what he has, for he comes to the swift conclusion that he deserved to get it all the time. Giving something for nothing is a certain prelude to disaster.

Through the years, we have witnessed a gradual frittering-away of quality in favor of quantity, and nowhere is this more clearly evident than in ham radio. The implementation of the "mail order" license was a costly mistake. Likewise, the re-institution of Incentive Licensing was a kick in the teeth, not only to the Amateur Service, but to every ham holding a General

class ticket, for it arbitrarily deprived him of privileges once fairly earned and rightfully enjoyed. At the same time, it fell far short of the intended mark, which was to encourage upgrading on a wide scale.

The sad fact is that only a small proportion pursued the golden goal of Extra class. They went as far as Advanced simply because their sole interest in upgrading was to continue operating on accustomed frequencies. I have asked literally thousands of hams why they upgraded, and most had not done it in order to improve skills or knowledge but merely in order to be able to work DX or avoid the congestion in the crowded General portions. Certainly the piddling few kilohertz of sequestered space in the CW portions and in 15- and 75-meter phone bands did not strike anyone as all that attractive, at least not when measured against the difficulty of learning Extra class theory and increasing the CW speed up to twenty words per minute.

I cannot speak for all amateurs, of course, but as a DXer of long standing, I can state with conviction that to those who share that interest with me, there is little point in acquiring the Extra; it is meaningless in real terms.

Newington, ever-obsessed with the idea of recruiting more and more members, has sold itself a delusion: that there is an unlimited pool of potential amateurs out there, and that any and all of them should be recruited through any means, even code-free licensing. Perhaps amateur radio has gained several good people who were at first unqualified, but it is even more likely that there is a huge army of lads who could never be anything but a detriment, no matter what was done for them.

All that separates the deserving from the undeserving is the FCC examination. And for the ARRL to keep granting credence to the idea of an "entry level" code-free license (a cryptic term which means a giveaway) is an absolute abomination, a breach of faith with every League member. The major contributing

factor toward the mess on 27 MHz is that anyone can apply and get a license without lifting a finger to prove that he is qualified. The regulations may call for the CBer to possess a copy of the appropriate rules, but he is not required to read them or to be familiar with their provisions. He does not have to know anything, nor does he have to demonstrate his willingness to learn anything. All he needs to do is to buy a piece of equipment, hook it up to an antenna, plug it into the wall socket, and begin yammering into a microphone.

And now the powers that be are again proposing that the door be opened to more unqualified "space cadets," so that they can bring their ignorance into the Amateur Service. Pursuant to a request by FCC Chairman Ferris, and with the support of three "high level" officials on the Commission Staff, a Notice of Proposed Rulemaking is being drafted which is intended to implement a waiver of the code for amateur licenses.

That this ostensibly is aimed at bringing in those who are involved in computer science is altogether beside the point. Of course there is an important future in amateur radio for all sorts of applications of the new digital techniques. An editorial in *QST* for June, 1980, mentioned several areas: station control, contest logging, satellite applications, repeater "bookkeeping," orbital predictions, azimuth-elevation tables, signal processing, automatic error correction, antenna design computations, direction-finding techniques, and message handling. But, as I say, all this is beside the point. The fact is that the doorway to ham radio has never been closed. Anyone with a desire to become an amateur can acquire the necessary knowledge and skill. The only thing that ever stood in the way was an applicant's laziness and inertia.

But the FCC operates on the present-day assumption that

high standards are set up as a deliberate bar to the entry of the broadest possible number, that difficult criteria are evidences of some desire to exclude, and are therefore undemocratic. And, instead of opposing this with all the strength at its command, we see our ARRL expressing uncertainty with respect to amateurs' feelings in the matter. I will wager anything that with the possible exception of a few isolated bubble-headed utopian idealists, the huge majority of U.S. amateurs firmly oppose the granting of any code-free license.

Some insist that because some, even most, have no use for CW, it ought to be abolished as a prerequisite. I say, bullfeathers! It may not be in general use by the majority; I won't argue the point. But to me, its chief purpose is to test the willingness of applicants to earn the license.

There are some individuals who can't qualify for driving and flying licenses. They are incapable of sufficient coordination, or their minds can't grasp the written material. But you don't see anyone proposing an "entry license" for them. You don't see bar associations endorsing an "entry level" so that incompetents can practice law, nor do you see a State Medical Board asking for changes that would permit the non-qualified to acquire "entry level" licenses to practice obstetrics or neurosurgery!

Yet, this is precisely what proponents of such schemes are really driving at. Do you seriously believe that they do so because they are sincerely interested in the growth and future of amateur radio? Or is it somehow tenuously connected to a bonanza in the sales of equipment to new licensees? Not that I object to that; it is important to our free enterprise system. But, at the same time, nothing prevents anyone from buying the *License Manual* in order to qualify for a

Continued on page 120

NO-CODE LICENSE?

Here's your chance to speak up! Send us a postcard with your **Yes or No** answer to this question:

Should there be *any* form of no-code license in the Amateur Service?

Mail your reply to Editorial Offices, *73 Magazine*, Pine Street, Peterborough NH 03458.

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RTTY LOOP

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

April may be the month for fools, but the biggest fool of all around here would be me if I ignored your letters and questions. So this month let's turn to the mailbag.

Some time back, I mentioned that Dave Lundquist WA2UWK was in need of information for the Lenkurt 25-A demodulator that he had acquired. Indications are that Dave got all the information that he asked for, and more. With the help of Sheldon Daitch WA4MZZ and Rich Strehlow KA0CSG, and who knows how many others, both Dave and I now have a bit more information on the Lenkurt.

This unit was (is?) in use by various wire services to distribute signals on slow-speed teleprinter channels. It is configured to allow tone pairs from around 300 Hz to 7 kHz, center frequency, to be used. Thus, several different signals could share the same line, using different audio tone frequencies, with the differentiation made by the receive filter in the Lenkurt unit. Hopefully, Dave will be able to adapt the thing to amateur RTTY. Good luck, Dave!

There seems to be quite a bit of interest in connecting various teleprinters to low-level TTL circuits. A1C Randy L. Bray, stationed at Bergstrom AFB, Texas, writes that he tried to drive a compact Model 28-KSR Teletype® from a demodulator yielding a TTL-level output. A slight lack of drive there, no? Well, being the industrious serviceman that he is, Randy went on to devise the circuit shown in Fig. 1. This uses a matched pair of

4N25 optoisolators to convert the TTL level to a plus-minus six-volt swing, suitable for driving the polar input of his printer. To take care of occasional upside-down stations, he uses one section of a 7404 TTL hex inverter, which may be switched in to upside-up the upside-down renegade. Looks like a nice piece of work, Randy.

Along the lines of interfacing, Reginald Theriault, from Rimouski, Quebec, is currently using a Model 28-ASR Teletype and a HAL ST-5 demodulator on 60-wpm, 5-level RTTY. He has recently come by a video terminal and wonders how to use it on RTTY. Reg, the terminal you describe is set up, as are most terminals, to use the eight-bit ASCII code, described in RTTY Loop a few months back. As a serial RS-232 output is available, the physical connection of the terminal to a demodulator such as the ST-5 should not be too hard. However, you will be running ASCII, not Baudot/Murray code. Although this is legal in the United States, I am not sure about Canada's viewpoint. Further, most RTTYers are still using Murray/Baudot (try to keep things fair!). There are two main ways to convert to five-level code, if you want to: a stand-alone hardware conversion or a computer.

The hardware conversion would use a UART to input the serial data and convert it to parallel, a ROM and associated chips to look up and change code groups, and another UART to output the transformed code, perhaps at a different speed. This method is cheap, it works, and several schemes have been published in 73 through the years.

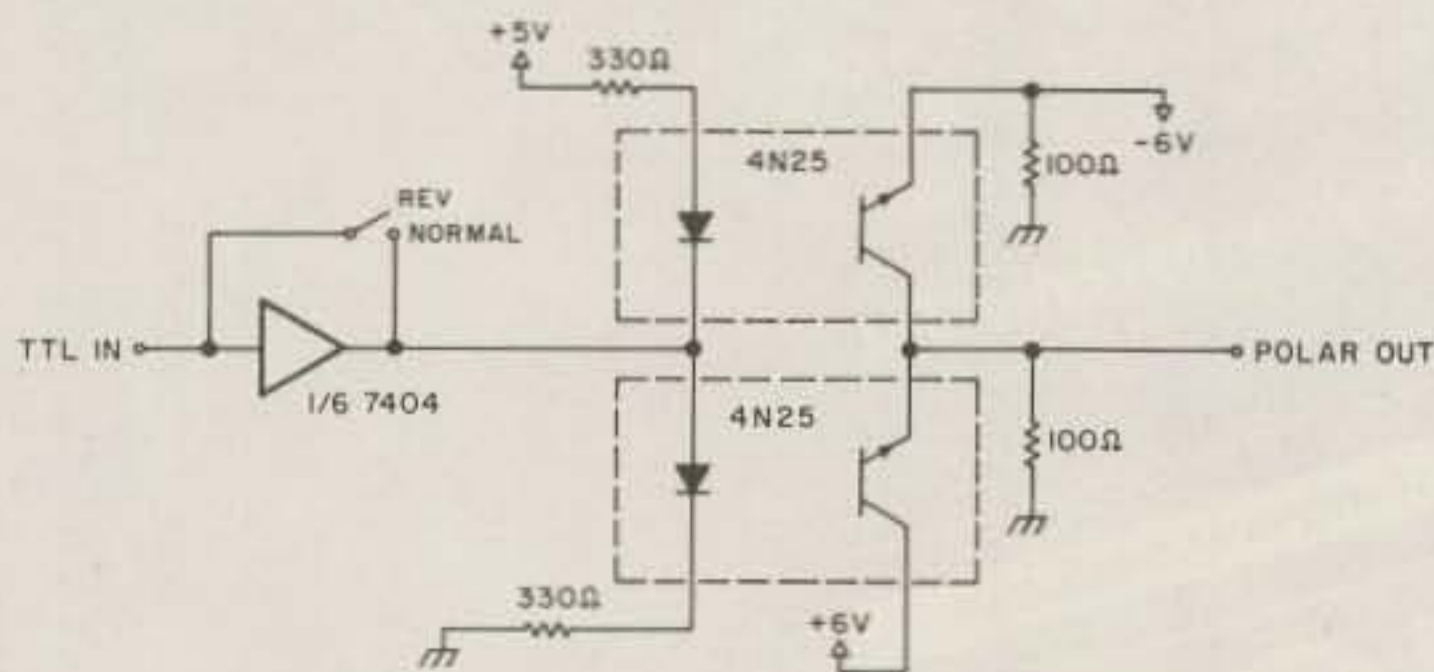


Fig. 1. TTL-to-polar conversion.

A computer may be programmed to do the same conversion, from one code to another and back again, and will do it just as well as a simple board, at many times the cost. But what you gain is some intelligence in the conversion. The computer can provide features such as message buffers, automatic identifiers, and other bells and whistles which make operating a real pleasure. Now, I don't think I would run out and buy a computer just to run RTTY, but once you have one you won't believe how many new uses you can find.

This leads us to another question: which computer? Well, from the RTTY point of view, I really don't think that matters much. My biases run toward the 6800 family, but that is because I have one and have written quite a bit of software for it. The TRS-80, by Radio Shack, is clearly one of the most popular microcomputers on the market, spawning accessory suppliers and even whole magazines (have you tried *80 Microcomputing* yet?). A typical question comes from John T. Gubernard K2LSX, of Bergenfield, New Jersey, who writes that he has a TRS-80 and is looking for ways to get on the air with it.

Guess what else the mail brought? One of our 73 advertisers, Vic Frump K8EXJ, passes along information about his Bit-Byter RTTY system for the TRS-80. This system is designed for either a Level I or Level II computer and has quite a list of features, including split-screen operation, with received information scrolled in the bottom two-thirds of the screen and the transmit buffer in the top third, automatic RTTY and CW identification, single-key CQ, RY, or QBF, and 60- or 100-wpm operation. The unit keys the loop, so interfacing to most systems should be straightforward. Interested? Drop Vic a line at UHF Sales & Service Co., Route 1, Box 52A, Evans WV 25241. Be sure to mention RTTY Loop when you write, OK?

Pictures on RTTY is always a good topic, but, unfortunately, one which has caused quite a bit of concern in these pages in months past. As I write this (in January), there still is no word on the ongoing saga of Teleprinter Art, Ltd. There are pictures out there, however, and you don't have to pay for them!

Russ Lawson K1MOU drops me a note that several active hams have reams of pictures they will gladly send to anyone, over the air. Ken WA4MNT, in St. James City, Florida, says that he has quite a few, and W. E. Symons K4IH passes along a similar list as long as your arm.

Most letters I get are questions or requests for this and that bit of information. I would like to acknowledge one this month that was just a nice note. I can remember back a few years, when I was an intern, how tight my time was and how precious every spare moment became. This schedule only gets worse the further into the system you go, through residency and Fellowship. That is why this note, from Joseph R. Salvatore, M.D., now a Fellow at Roger Williams General Hospital in Providence, Rhode Island, means so much. Joe was one of my interns a few years ago, and I lost track of him when he left the area to further his education. I don't know what his callsign is now, but I am sure that he does not have much time to operate. Thanks for reading the magazine, Joe, and best of luck.

Our sister publication, *Kilobaud Microcomputing*, has been giving quite a bit of space to communicating over telephone lines. These Computer Bulletin Board Systems (CBBS) now form a viable means of getting information across the country without worrying about propagation conditions. Users of 6800 systems might be interested in an article in the February, 1981, issue which details the method I use to hook up to the CBBS locally. By the way, if you want to leave me a message, you might try the Baltimore Micro-Mail Service, at (301)-655-0393, calling only between the hours of 10 am and 10 pm, eastern time, or the Prodigy system, at (301)-337-8825, available 24 hours a day. Both of these systems are ring-back, CP/M-based computers. To access, call the number, let the phone ring once, then hang up and dial again. The computer will answer when you call back in.

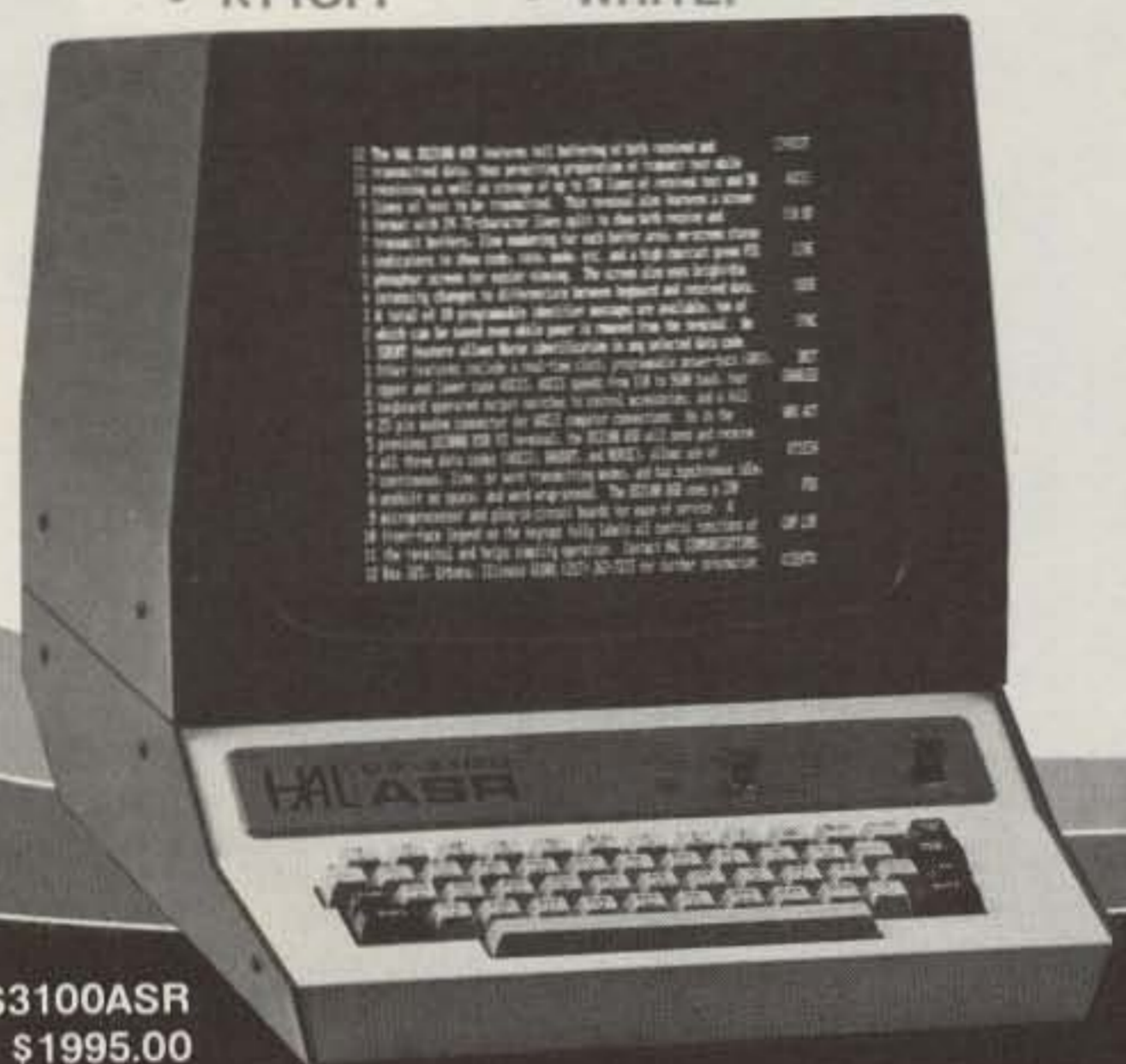
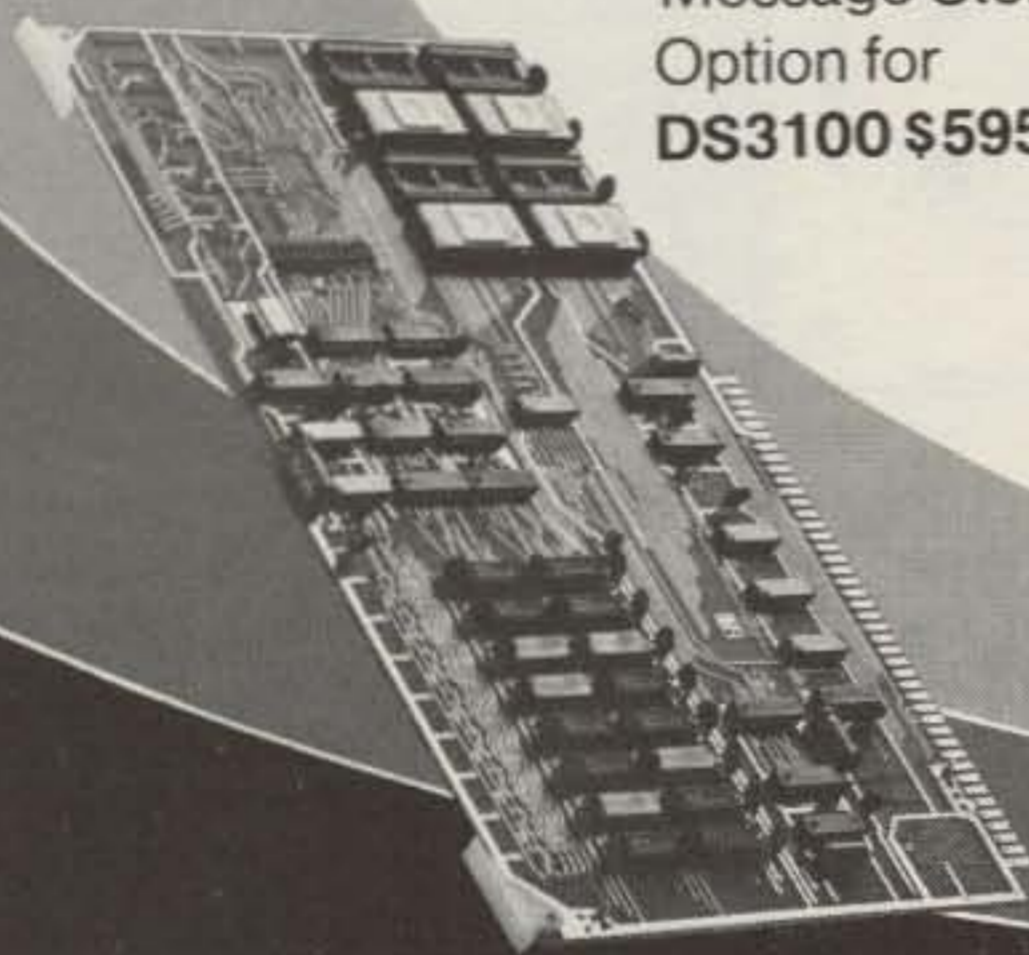
Going to look at another piece of equipment next month. What is it? You may not think you need it, but once you've bought one you wouldn't be without it. Curious? Don't miss next month's RTTY Loop!

NEW FROM HAL

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The Message Storage Option (MSO) adds mass storage to the DS3100 so that relatively long messages may now be stored and replayed at will. For example, the MSO-3100 will provide more than 32,000 characters of additional storage—approximately 450 lines for messages. Messages are stored in variable length files with user-assigned file names and pass-words for file protection if desired.

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**30 or 70 WATTS
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- SCR100 mounted in shielded housing
- Same as used on SCR1000
- Completely asmbld. w/F.T. caps. SO239 conn., AF GAIN POT, etc.

SCR450 UHF Receiver Bd. or Assy.

- Similar to SCR100, except with 12 Pole IF Fitr. & 8 Resonator Front End Fitr.!
- Discriminator & Deviation Mtr. Outputs
- **Totally New Advanced Design!**



SCAP Autopatch Board

- Provides all basic autopatch functions
- 3 Digit Access, 1 Aux. On/Off function, Audio AGC, Built-in Timers, etc.
- 0/1 Inhibit bd. also available.
- Write/call for details and a data sheet.

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- Used w/SCAP board to provide "Reverse Patch" and Land-Line Control of Repeater
- Includes land line "answering" circuitry



FL-6

FL-6 Rcvr. Front-End Preselector

- 6 Hi Q Resonators with Lo-Noise Transistor Amp (2M or 200MHz).
- Provides tremendous rejection of "out-of-band" signals w/out the usual loss! Can often be used instead of large, expensive cavity filters.
- Extremely helpful at sites with many nearby VHF transmitters to "filter-out" these "out-of-band" signals.

CTC100 Rptr. COR Timer/Control Bd.

- Complete solid state control for rptr. COR, "Hang" Timer, "Time-Out" Timer, TX Shutdown/Reset, etc.
- Includes Inputs & Outputs for panel controls & lamps

Repeater Tone & Control Bds.—For SCR1000/4000 & CTC1000/ID250 only

TRA-1 "Courtesy Tone Beeper" Board

- Puts out a tone beep apx. 1 sec. after RX sig. drops—thus allowing time for breakers
- Resets T.O. Timer after "beep"

TMR-1 "Kerchunker Killer" or "Time Out Warning Tone" Bd.

- For One of above 2 functions
- "Kerchunker Killer" provides adj. delay (0-10 sec.) for initial rptr. access. Auto-Reset at end of QSO.
- T.O. Warning Tone provides alerting "warble tone" apx. 10 sec. before "time out."

PSM-1 Repeater Power Supply Mod Kit

- For SCR-1000 or SCR-4000
- Replaces Darlington Pass Tr.—for improved reliability
- Includes new overvoltage "Crowbar" shutdown circuit.
- Complete kit, w/assembled PC board. \$19.50 + \$2.50 SH.

ID250 CW ID & Audio Mixer Board

- Adjustable ID tone, speed, level, timing cycle.
- 4 Input AF Mixer & Local Mic amp.
- COR input & xmtr. hold circuits.
- CMOS logic, PROM memory—250 bits/channel.
- Up to 4 different ID channels!
- Many other features Factory Programmed



SCT410 XMTR. ASSY.

SCT110 VHF Xmtr/Exciter Board

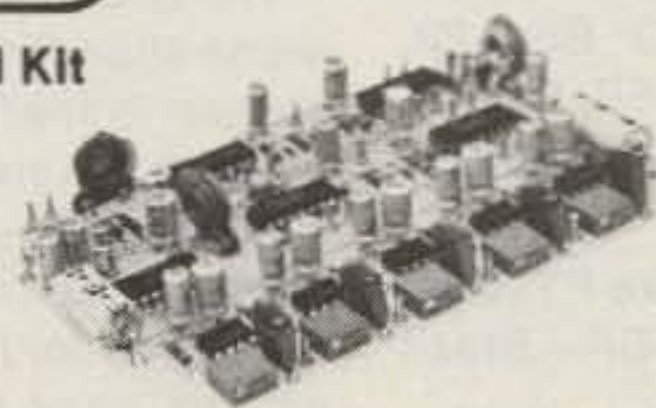
- 7 or 10 Wts. Output, 100% Duty Cycle!
- Infinite VSWR proof
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- New Design—specifically for continuous rptr. service
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- Spurious – 70 dB. Harmonics – 60 dB.
- With .0005% xtal
- BA-10 30 Wt. Amp board & Heat Sink, 3 sec. L.P. Filter & rel. pwr. sensor.

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- SCT110 mounted in shielded housing
- Same as used on SCR1000
- Completely asmbld. w/F.T. caps. SO239 conn.
- 7, 10 or 30 Wt. unit.

SCT410 UHF Transmitter Bd. or Assy.

- Similar to SCT110. 8-10 Wts.
- Avail. w/ or w/o OS-18 Super High Stability Crystal Osc./Oven.
- BA-40 30W. min. UHF Amp. Bd. & Heat Sink.



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Control Board

- 3 digit ON, 3 digit OFF control of a single repeater function. Or, (optional) 2 functions (2 digits ON/OFF each).
- Can be used to pull in a relay, trigger logic, etc.
- Typically used for Rptr. ON/OFF, HI/LO Pwr., P.L. ON/OFF, Patch Inhibit/Reset, etc.
- Stable, anti-falsing design. 5s. Limit on access.
- For Add'l Function(s)—Add a "Partial TTC" Board.

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LETTERS

AMATEUR RADIO DAY

About 40 amateurs live in this northwest area of Arkansas, around Rogers. We have secured through the Official Centennial Commission, Saturday, May 9, to be set aside as Amateur Radio Day, as part of the events during the summer. Please help us celebrate that day by working one of the Official Centennial Amateur Radio Stations. The K5BP call letters will be used on about 7,283 kHz LSB or 21,363 kHz USB from 1400 UTC to 2200 UTC. Send confirming QSL card with a #10 SASE to K5BP, Dept. 1881, General Delivery, Rogers AR 72756 to receive an Official Centennial Certificate.

Glenn E. Webster W5VIX
Rogers AR

DE PY2AA

We, from LABRE—Liga de Amadores Brasileiros de Radio Emissao—are glad to announce that there has been set up a beacon, here in Sao Paulo—SP—on the six-meter band, for propagation research purposes.

The beacon is on 50.055 MHz and has an output power of 25 Watts. The antenna is an omnidirectional ground plane which is about 25 feet above the ground level, on the top of the League building.

The format transmitted is a long dash, along with "de" and the call: — de PY2AA.

We would very much appreciate any kind of report; they can be sent directly to PY2AA—Beacon Project, PO Box 22, 01000—Sao Paulo—SP, Brazil.

We will keep you informed on all free local beacon activity.

Hugo Adelino da Silva PY2DSQ
Sao Paulo—SP—Brazil

AND WAYNE SAYS...

There seems to be quite a controversy over Dick Bash's publications, and the fire was recently fueled by Skip Tenney's editorial. If I remember correctly, you were quite enthusiastic

about Dick's publications. We find we are being put on the spot by some of our customers after seeing Skip's editorial, and I am trying to feel out some of the more prominent members of the amateur fraternity to determine what their thoughts are on this whole issue.

Warren L. Spindler K2IXN
Ham-Radio World, Inc.
Oriskany NY

Yes, Warren, I have some thoughts on the Bash cheat books. I am not aware of ever having been enthusiastic about them. Indeed, I have refused from the first to allow Bash to advertise in 73, for which we are paying with the loss of about \$1,000 per month. I'd say that we are putting our money where my mouth is.

The editorial in HR about the Bash books was read with entertainment by many. If you will look back in the April, May, and June, 1980, issues of HR (and some in HRH), you'll find that their Ham Radio Bookstore advertised and sold the book they are now being righteous about. I refused to carry ads for the book or to handle it in our Radio Bookshop.

As I understand it, HR was enthusiastic about the Bash books up until they got a call from the FCC. The FCC has been very uptight over the books and I have heard that they called Tenney of HR and put it on the line: If he wanted any more FCC information for his Half Right Reports, he should stop advertising for Bash. The ads stopped and the info to HRR continued.

The Bash books are not much worse than the old ARRL Q & A manual in that they strongly encourage the memorization of answers rather than the understanding of theory. I feel that this is bad for those who suck in on this easy way to their first license. This is why my license manuals emphasize learning the theory rather than memorizing answers. Memory quickly fails... and any change of questions quickly confuses applicants. If the theory is understood, not only is any test simple but the foundation for going

ahead to higher classes of license has been laid.

The memory route leaves the Novice with no real comprehension of radio theory, so he is then committed to ever more difficult memorization as he goes for the General and Advanced licenses. His ignorance will immediately be perceived by anyone he talks with over the air, making the use of his license less than fun. You can't fool people into thinking you really are a ham when you aren't. They see through the sham.

The really sad part of all this is that there is nothing complicated about understanding the theory. We've had kids four years old able to comprehend it and pass the test. Yes, it takes a bit of time and thinking. You know, it is incredible how much effort people will devote to not having to think! You might get the idea that it is painful to think instead of it being one of the most exciting of human experiences.

Now, to answer your question... if I were in your position, I would not sell the Bash books. —Wayne.

AN UNBIASED VIEW

Just finished reading Larry Kahaner's excellent article, "Who Really Invented Radio?," but found it to be a "floppy copy" of hundreds of other writings, with the exception of a few new names with numbers identifying the modern-day authority of early radio.

Like many others, I also agree that America's N. B. Stubblefield invented, manufactured, and demonstrated a wireless device that transmitted and received both music and voice before anyone on this planet, and, like L. H. Hortin, I am tired of explaining that today's radio, as we know it, is Stubblefield's "wireless telephone" transmitter/receiver, and not Signor Marconi's dot and dash performer, or even Tesla's electrostatic transmitter.

Furthermore, English scientific publications such as yours really invented the word "radio"—several years after Stubblefield's famous broadcast demonstrations—to describe any and all sources of energy that radiated and/or created heat. The truth of the matter is that Stubblefield's scientific "wire-

less telephone" terminology and achievements were lost to the world by the stroke of a writer's pen, confusing knowledgeable men of both that time and even now! Luckily, Murrayites such as Hortin, Johnson, and many others, who know the real story, still exist.

It would appear that those two radio shack jocks, Riley Ray and William Call (also known as W4LMF and KJ4W respectively), should have known that "wireless telephone" is radio, no matter how you look at it, feel it, broadcast it, or just plain hear it, before tattling Murray's local gossip to the world.

Troy Cory Stubblefield,
Grandson of N. B. Stubblefield,
and son of Oliver Stubblefield
Universal City CA

73 METHODS WORK

I've never written a letter to any magazine before, but I feel I must this time.

I have no technical background or training whatsoever that is electronics or radio-related. In fact, until 1979 I didn't even know how to use a soldering iron! Using your 73 code tapes and theory courses, I have progressed from Novice to Extra class since July of 1979 (just passed Extra class exams January 7, 1981). That's a period of a little over 1½ years, and there is no way I could have done it without the help of your code tapes and study guides.

I can't thank you enough for all that your organization has to offer. Your training and teaching aids are second to none. Keep up the good work and you'll make a lot of newcomers, like myself, very pleased.

Bob Burdick KA1DOS
Ayer MA

PEKING TRAVELS

I read your article in this January's 73 and I thought I should mention that I was in China in December, 1979, and at that time I saw several allband radios in the communes.

In Shanghai, at the Children's Palace (for bright kids), there was a room where the students were assembling transistor radio kits.

I stayed at the Peking Hotel in

Continued on page 123

The New Yaesu FT-902DM



What's so new about the 902?

- **WARC Bands Factory Installed!**
Your FT-902DM won't be "obsoleted" when the new bands become available.
- **Diode Ring Receiver Front End!**
The industry-standard dynamic range of the FT-901DM is now better than ever.
- **True Reading Frequency Counter!**
No need to recalibrate when changing bands or modes.
- **Curtis 8044 IC Keyer!**
Full dot and dash memory are now provided on the built-in keyer.

What's more, the FT-902DM retains these great features of the '901:

- * Variable IF Bandwidth
- * Built-in memory system
- * Audio peak CW filter
- * IF rejection tuning
- * SSB, CW, AM, FM and FSK
- * Digital plus analog readout
- * RF speech processor
- * Highly stable PLL local oscillator
- * Plug-in modular construction
- * AC and DC operation built in

The FT-902DM . . . designed to give you the competitive edge!

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REVIEW

KENWOOD TR-7800

I have operated a lot of different two-meter rigs in my short life, and I am picky. When I first saw the Kenwood TR-7800 two-meter FM transceiver at a show last year, I made several unkind remarks about the rig to my companions. "Ha!" I said. "Look at that ridiculous keyboard entry system. That won't work in the car!"

I now wipe the egg off my face and present my sincerest apologies to my friends, not to mention the poor tortured soul in the booth. This is one of the best two-meter rigs I have ever used! Kenwood has designed this rig to be at home in both base and mobile applications, which is no minor undertaking.

In a way, my first impression was right—the keyboard is not easy to use while driving. What I

missed was that it is rarely necessary to use that keyboard at all. This rig is equipped with an extremely flexible memory system, which allows 15 frequencies and their transmitter offsets to be stored in memory and recalled with the push of a button on the microphone. The memories are maintained even when the power switch is off.

Add four AA nicads and the rig will remember your favorite frequencies when there isn't a 12-volt power supply for miles around. No more peering at a washed-out display while fighting rush-hour traffic. No more calling a friend feverishly while your rig is on the wrong offset. Groping for the MHz switch or the 5-kHz button also have been mercifully banished from the two-meter experience. In short, this rig offers just about every-

thing the dedicated FMer could ask for—either in a mobile installation or as a base station.

Basic Performance

It's no use having all these sophisticated features if the basic performance isn't up to snuff. Before we go any further, let's examine the 7800's performance characteristics.

The 7800 is very compact, measuring only 6-7/8" wide, 2-1/2" high, and 8-1/16" deep. Electronic performance is excellent. Actually, the design of the receiver and transmitter sections of the 7800 is very similar to that of its older brother, the TR-7625. Many improvements have been made, but the basic design is a tried and proven one. There appears to be some additional filtering in the receiver to increase selectivity, and more reliable finals were used in the transmitter output stage.

Southern New Hampshire is not what could be considered an rf saturated area, so the fact that we never encountered any intermod problems doesn't mean too much. Still, all indications are that the 7800 should handle intermod at least as well as any other top-quality synthesized rig. Squelch action was very sensitive and sharp, more so than other popular rigs we have tested. The squelch control can be set barely above the noise threshold, and weak signals will open the squelch, but noise won't. Received audio is excellent, both through an external speaker and through the larger-than-usual built-in speaker. Since the built-in speaker is top firing, you won't have any problems if you mount the rig on a shelf or the transmission hump of a car.

Transmitter deviation was set perfectly, as was the output of the DTMP encoder. The 73 repeater uses a digital tone decoder, and if the tone levels on a pad are set too high, the decoder rejects them. The TR-7800 has one of the few pads we have seen that doesn't need some adjustment to work properly.

Transmitter output is rated at 25 Watts on high power. Our sample put out over 30 Watts throughout the entire 144-147-MHz range. Low-power output is internally adjustable and we set it at 2.5 Watts. The transmitter's final stage is protected against high swr by sampling reflected

power. As swr climbs, transmitter drive is reduced. I left the rig key-down with no load for over a minute, and the only thing that failed was my nerve. I figure that if anyone transmits for more than a minute without any antenna connected, it won't be Kenwood's fault if the finals blow!

Squelched receive current consumption was 0.4 A and maximum current required was 6 A in the high-power transmit mode. The rig draws about 3 mA even when the power switch is off to maintain the frequency and offset memories. Four AA nicad batteries can be installed inside the case to maintain the memories when the rig is completely disconnected from a power source. The nicads will maintain the memories for several days at a time and are automatically charged at 30 mA whenever the transceiver is on.

In short, the TR-7800 functions so well that its basic performance characteristics can safely be taken for granted. There is nothing temperamental about this rig, so you are free to enjoy its sophisticated bells and whistles. With no further ado, let's take a good look at those bells and whistles.

Frequency Agility

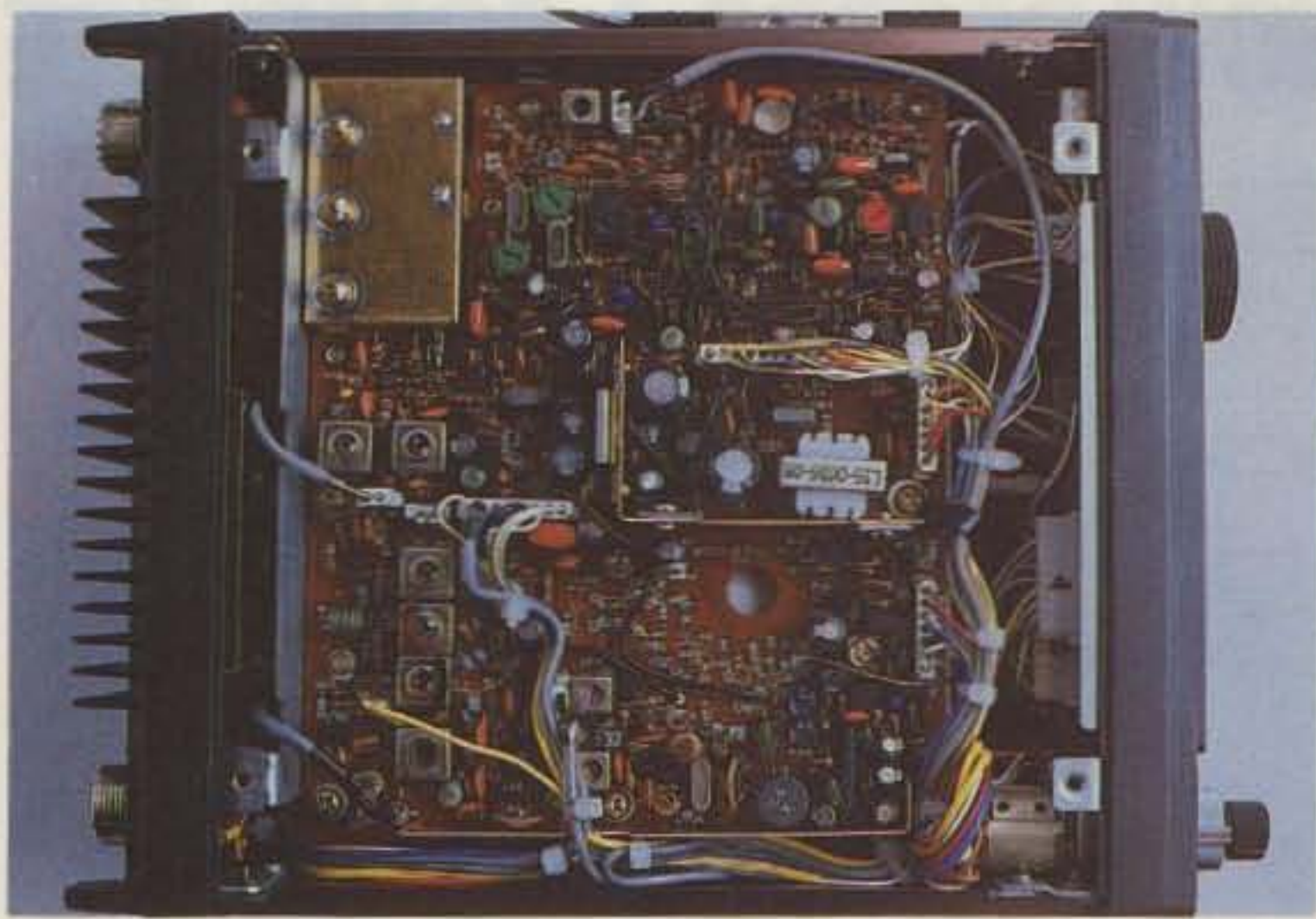
The front panel is fairly simple and the controls are easy to understand. There are several methods of selecting an operating frequency on the 7800. The first is by entering the last four digits of the desired frequency on the keypad. 146.52 MHz would be entered as 6520. If operation other than simplex is desired, the offset also is entered via the keypad.

The second method of frequency selection is to scan through the band using the up/down switches located on the microphone. The band can be scanned in 5- or 10-kHz steps, with an audio tone accompanying each step.

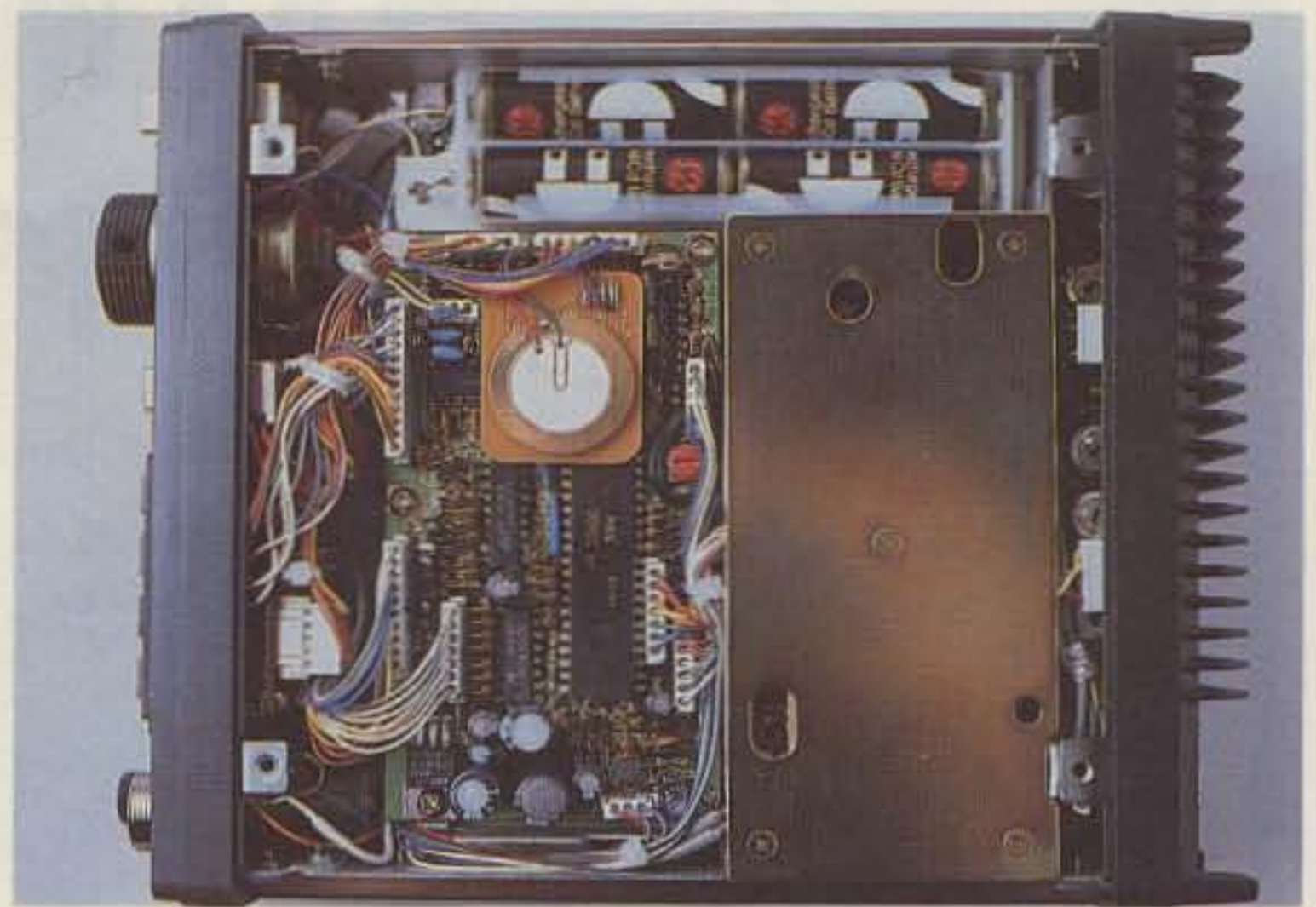
A third way to change frequencies is by depressing the SC button on the front panel. Don't ask me what SC means—I haven't a clue! What it *does* is automatically scan the band looking for signals. When it finds a signal, it pauses for about five seconds and then continues its scan. If you want the 7800 to come to a complete stop, you can press the transmit switch, the C button on the tone



TR-7800 (front view) with Bird Ham-Mate® Thruline® Wattmeter.



Top view of TR-7800.



Bottom view of TR-7800.

pad, or one of the scan buttons on the microphone.

Each time you change frequencies using one of the above methods, the 7800 reverts to the simplex mode. Let's suppose that you are operating on 146.76, with the transmitter offset set to -600 kHz. If you scan up to 146.85, the rig will revert to simplex, and you'll have to punch the negative-offset button again. This would be annoying if there weren't yet a fourth method of frequency selection. This fourth method of tuning is one of the features that makes the TR-7800 a truly outstanding two-meter rig, and it deserves close examination.

There are fifteen memories available to the 7800's operator and they hold the offset as well as the frequency. Memories 1 through 13 are programmed by entering the receive frequency and a standard offset (+, -, or simplex). Memories 0 and 14 allow the receive frequency and any transmit frequency to be entered separately, so you can operate on any repeater split. Memories are selectable from the scan switches on the microphone, the SC switch on the keypad, or rotary knob on the front of the rig. The large LED readout always displays the frequency of operation, and the smaller two-digit display tells which memory has been selected.

The memories really enhance my enjoyment of two-meter activities. The ability to scan through 15 memories from the microphone makes this rig as safe in mobile use as a crystal-controlled rig, yet it offers almost unlimited frequency options. Since the rig beeps every time it steps through a frequency, you can go from repeater to

repeater without even looking at the rig, much less touching it. The little keyboard also works fine, even with my large fingers, but the keyboard is a little too small to be used safely by the driver of a vehicle in motion.

The 15 memories also can be automatically scanned. When you use any rig in the band-scanning mode, it is always stopping on something that you don't want to hear. The 7800's memory scan feature allows you to be very selective about what you listen to.

More Features

I already can hear the screams of protest from all you old codgers who were weaned on big Motorola microphones. Yes, the microphone is small, but it seems to have been carefully designed. Even my massive paws handle it with ease. There is a very good reason for Kenwood's little microphone—stick-shift cars.

Ever try to jam 'er down into third with a big clunky microphone in your hand? Hard to do. You'll have no trouble shifting while holding on to the little Kenwood mike. Clearly, small microphones have arrived!

I have one complaint about the Kenwood microphone: It isn't equipped with a standard hang-up lug. It does have some kind of hook arrangement that is apparently popular in Japan, but since no mating hang-up clip is provided with the radio, you'll have to home-brew your own.

The instruction manual does a fairly good job of explaining how to connect and use the rig, and it contains a good schematic and block diagram. The manual would be a lot more effective if it made better use of the

English language. I would encourage Kenwood to have their manuals proofed and edited by a native speaker of English in the future! A separate service manual is also available, but it wasn't ordered in time for review.

Compulsive input checkers will be pleased with the momentary-contact "reverse" switch, which allows one to listen on the input frequency and transmit on the output frequency of a repeater. Priority channel operation is also available. When the priority Alert switch is depressed, the 7800 scans whatever frequency is programmed in channel 0 for activity every five seconds. If there is activity, the rig beeps to let you know. You can switch over to the priority channel by pushing the priority Operate switch. Handy, eh what!

Also on the front panel is a tone switch. Activation of this switch supplies power to a user-supplied CTCSS encoder. Connections are provided inside the rig for ground, post-filter audio input, and +8 V dc. The +8 V dc is supplied only during transmit. The setup is tailor-made for a Communications Specialists encoder, but something could be home-brewed to fit in the space fairly easily.

To those of you concerned that all of this flexibility may be unreliable, relax. I remember a radio (which shall remain nameless) that came out a few years ago offering most of the features of the TR-7800. This disaster was filled with acres of mechanical switches and TTL chips. Naturally, it ran extremely hot and was unreliable. The features of this rig and the TR-7800 may be similar, but the designs

are worlds apart. The 7800 uses a single microprocessor rather than discrete logic chips, and its schematic positively reeks of conservative design. It's not at all unreasonable to expect the TR-7800 to stand up to the rigors of daily use and abuse better than more conventional synthesized rigs.

There are a lot of other details that quickly endear the TR-7800 to the jaded two-meter operator. Ever scratched up a rig when you stack your two-meter rig on top of other equipment in the ham shack? Kenwood thoughtfully included four rubber feet that screw into the bottom of the rig. The slide-in mounting bracket included with the rig is one of the slickest acts in town.

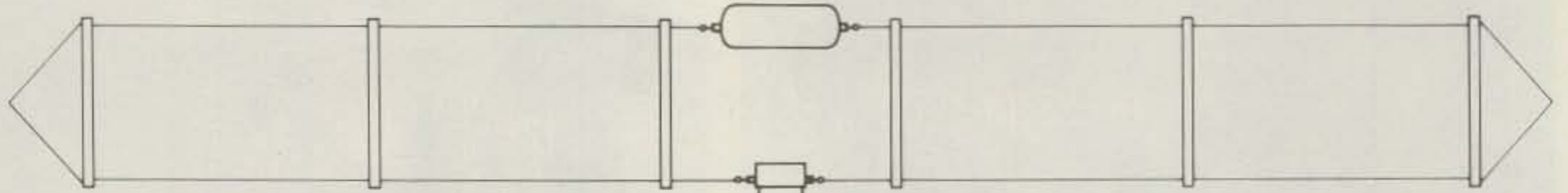
Many rigs have a front-panel layout that makes them difficult to operate in the dark. The knobs and switches on the TR-7800 are carefully shaped and placed for ease of use.

The microphone would need five pins to connect the ground, audio, scanning, and PTT lines to the rig, but the TR-7800 has six pins in its mike connector, leaving a spare for the inventive ham. One possible application that immediately comes to mind is the power connection for a touchtone™ mike or an auto-dialer. Just connect 12 volts to the spare terminal in the mike connector and you're in business!

Conclusion

The TR-7800 is one of the most carefully thought out rigs I have ever used. Unlike many other synthesized rigs, the fancy features don't substitute for good performance. This rig's basic characteristics are beyond reproach, and I could explain

B & W NOW OFFERS A COMPLETE

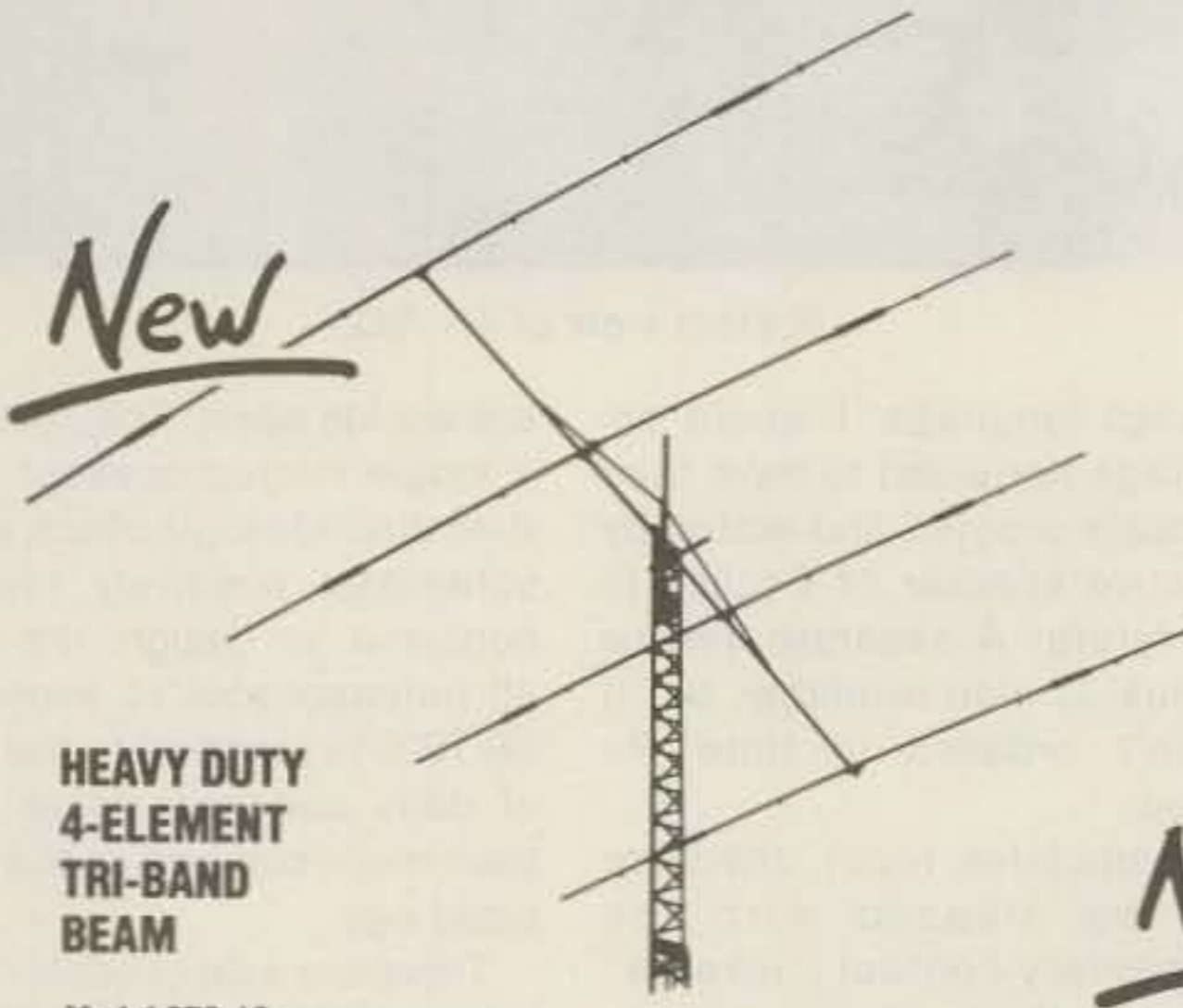


NEW CONCEPT NOW FAMOUS BROAD BAND FOLDED DIPOLE

Model 370-15

Covers 3.5-30 MHz including the new 12, 17 and 30 meter bands. Only 90 feet long! Can be used as a sloping or flat top antenna. Supplied completely assembled with high tensile strength steel copper clad wire, 50 ft. RG-8 coax cable and PL259 connector. Will handle 2.5 KW-5 KW PEP.

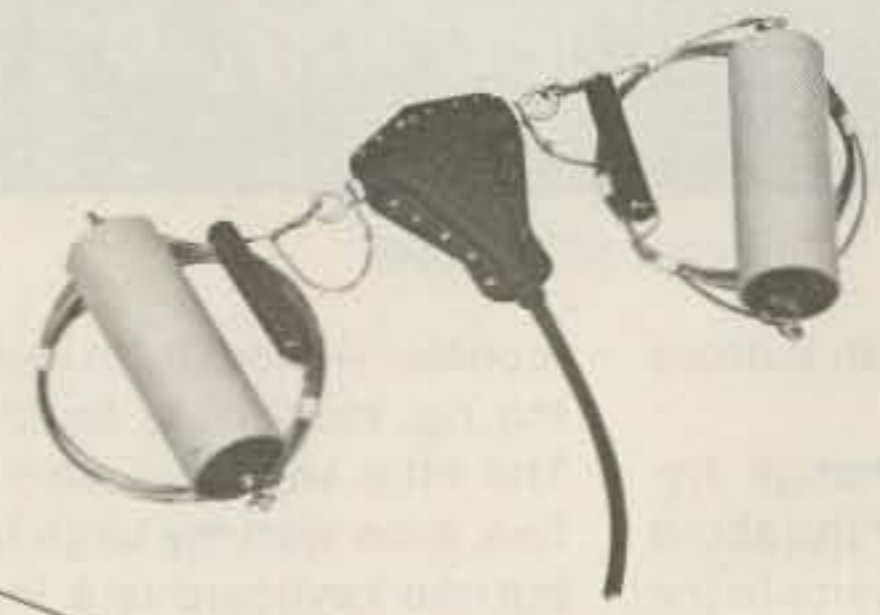
New



HEAVY DUTY 4-ELEMENT TRI-BAND BEAM

Model 370-16

Four working elements on each band in 10, 15 and 20 meters. The 24 foot boom permits optimum spacing for maximum forward gain and front-to-back ratio. All traps are precision tuned. Rugged reliability assures ability to withstand winds up to hurricane strength.



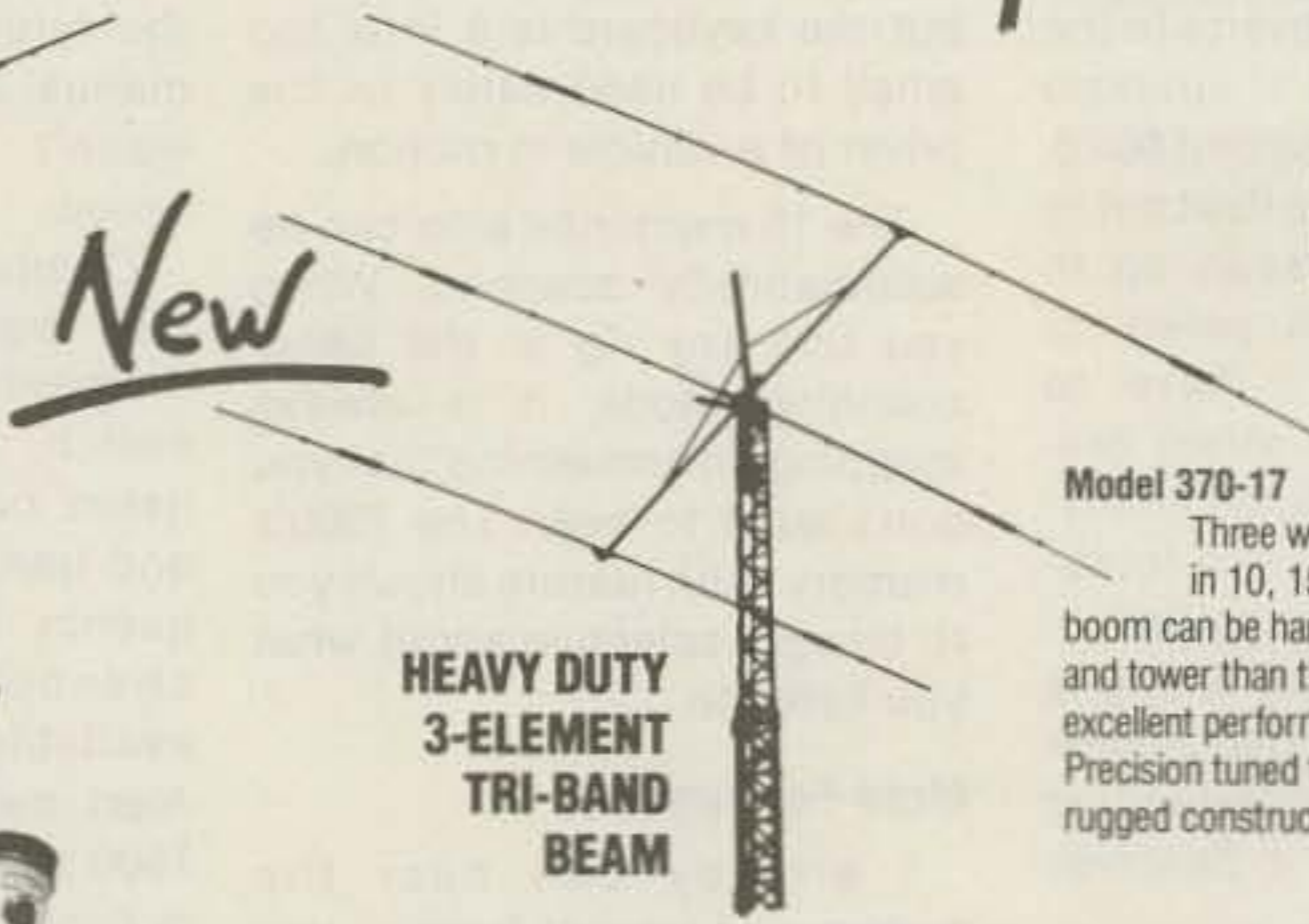
Model 370-11
FIVE BAND TRAP ANTENNA
80, 40, 20, 15 and 10 meters
1,000 Watts
2,000 Watts PEP
All Band Antenna
One Feed Line

Model 370-12
Same as above, in kit form.

Model 370-13
FOUR BAND ANTENNA
40, 20, 15 and 10 meters
1,000 Watts
2,000 Watts PEP

Model 370-14
Same as above, in kit form.

New



HEAVY DUTY 3-ELEMENT TRI-BAND BEAM

Model 370-17

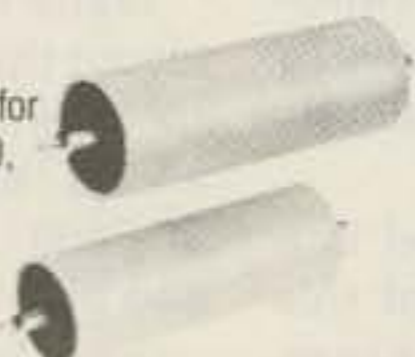
Three working elements on each band in 10, 15 and 20 meters. The 16 foot boom can be handled by a lighter duty rotor and tower than the TB4HA but still provides excellent performance characteristics. Precision tuned traps are combined with rugged construction.

ANTENNA TRAPS

Weatherproof. Strain test over 600 lbs. Power-1000 watts-2000 watts PEP. Supplied with complete instructions for antenna wire lengths.

Model 370-1

5 Band Antenna Traps for coverage of 80, 40, 20, 15 and 10 meters in one antenna.



Model 370-2

4 Band Antenna Traps for coverage of 40, 20, 15 and 10 meters in one antenna.

Model 370-5

END INSULATOR
• Space Age Glass Polymer Material
• 1000 lb. Pull Test
• Size 4"L x 1-1/4"D



Model 370-9
PL-259 Connector for use with RG-8 Coax Cable. Mates with SO-239 Connectors. UHF Type.



Model 370-8
50 ft. RG 8 Type coax cable.



Models 370-6, 370-7
ANTENNA WIRE
No. 14 AWG (17/22)
370-6, 70' coil—370-7, 140' coil



Model 370-10

PORTABLE WHIP ANTENNA
Tunes the 2, 6, 10, 15, 20 and 40-meter amateur bands, as well as all 40 channels of the 27 MHz CB band. When properly adjusted to the operating frequency, VSWR is 1.1:1. Complete with base loading coils, coaxial feed line, and counterpoise. Power rating is 360 watts CW and SSB.

COAXIAL ANTENNA CHANGEOVER RELAY

Model 377

Power Rating 1000 watts CW (2000 watts SSB)
VSWR Less than 1.15:1 DC to 150 MHz
Power Requirements 0.015 Ampere 48 to 130 volts AC
Connectors UHF Type SO-239



ANTENNA TUNERS

AT-140

Matches auto antenna to your C.B. rig.



Model AT-200

Matches auto antenna to your 2m Rig.



Model CC50
Standard

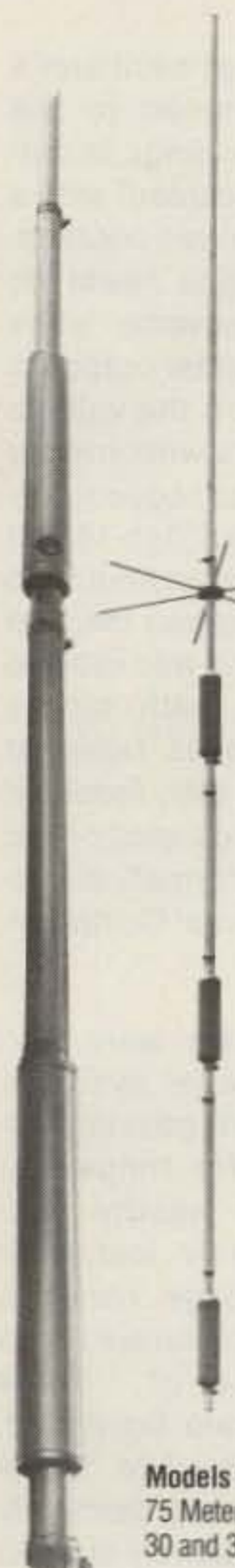
DIPOLE CENTER CONNECTORS

Model CC51
Military Type

FOR COAXIAL-CABLE FEED

Waterproof, mechanically strong connection between a coaxial feed line and the center of a dipole antenna.

ANTENNA PRODUCT LINE



New

VERTICAL ANTENNAS

Model 370-30

Four band trap vertical for operation 40, 20, 15 and 10 meter band. 2000 PEP. Does not require counterpoise radials when using a standard eight foot ground rod (not supplied). VSWR not more than 1.5:1 at resonance. Includes slimline traps for use as a "flag pole". Overall length is 21 feet.

Model 370-31

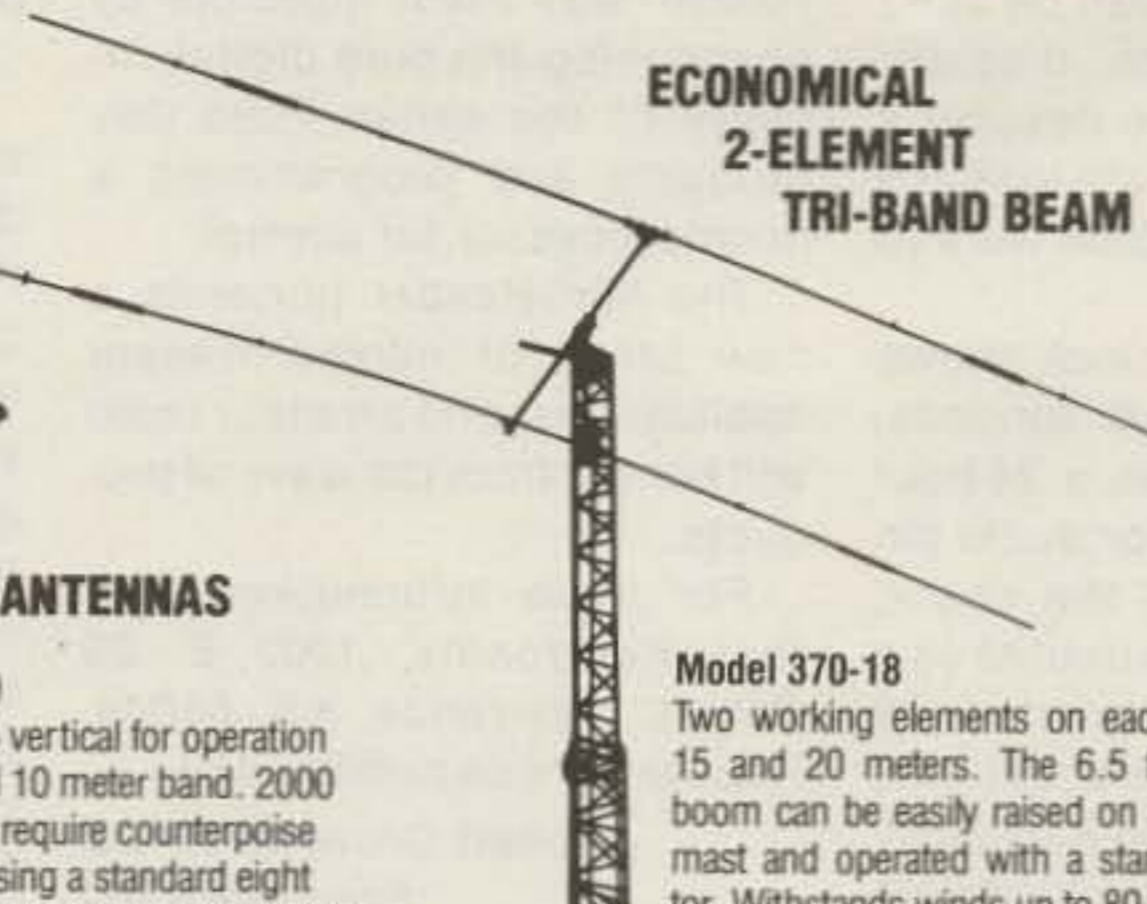
RADIAL KIT-ACCESSORY

For 370-30 and 370-32 Verticals on 10-80 meters. All necessary wire and hardware is included for two ground-plane radials for 10-80 meter band.

Model 370-32

Outstanding performance with this omnidirectional, low radiation angle, trap vertical antenna. Requires small installation space for either roof or ground-level. Hardware is included. Traps are precision set at the factory for maximum radiation efficiency on each band with low VSWR. Heavy duty construction withstands winds up to 100 mph.

Models 370-33 & 370-34
75 Meter ADD-ON Kit for models 370-30 and 370-32 antennas.



ECONOMICAL 2-ELEMENT TRI-BAND BEAM

Model 370-18

Two working elements on each band in 10, 15 and 20 meters. The 6.5 foot aluminum boom can be easily raised on an inexpensive mast and operated with a standard TV rotator. Withstands winds up to 80 mph.

COAX SWITCHES

Power 1 KW-2 KW PEP
Impedance 50-75 ohms
VSWR 1.2:1 up to 150 MHz

- Model 593** Single Pole 3 Position with grounding of all unused positions
Dimensions 1-3/4" high, 5" wide, 3" deep
Wall or desk
- Model 594** 2 Pole 2 Position
Dimensions 1-3/4" high, 5" wide, 3" deep
Wall or desk
- Model 595** Single Pole 6 Position with grounding of all unused positions
Dimensions 8-1/2" x 3-1/2" x 2"
- Model 375** Single Pole 6 position with grounding of all unused positions
Axial mounted connectors.
- Model 590** Single pole 5 position, non-grounding type switch. Axial mounted connectors.
- Model 590G** Single Pole 5 position with grounding of all unused positions. Axial mounted connectors.
- Model 592** Single Pole 2 position switch, non-grounding. Axial mounted connectors.

TRANSMITTING BALUNS

Power 2.5KW-5KW PEP
Connectors SO-239

Type	Standard Impedance Ratios	Freq. Range
BC-1	50 ohms bal to 50 ohms unbal	1.8-30 MHz
BC-2	50 ohms bal to 200 ohms unbal	1.8-30 MHz
BC-3	50 ohms bal to 300 ohms unbal	3.5-30 MHz
BC-4	50 ohms bal to 600 ohms unbal	3.5-30 MHz

RECEIVING BALUNS

Type	STANDARD IMPEDANCE RATIOS	Freq. Range
RC-780	50 ohms bal to 50 ohms unbal	3.5-30 MHz
RC-781	70 ohms bal to 50 ohms unbal	3.5-30 MHz
RC-782	150 ohms bal to 50 ohms unbal	3.5-30 MHz
RC-783	200 ohms bal to 50 ohms unbal	3.5-30 MHz
RC-784	300 ohms bal to 50 ohms unbal	3.5-30 MHz
RC-785	600 ohms bal to 50 ohms unbal	3.5-30 MHz
RC-790	50 ohms bal to 70 ohms unbal	3.5-30 MHz
RC-791	70 ohms bal to 70 ohms unbal	3.5-30 MHz
RC-792	150 ohms bal to 70 ohms unbal	3.5-30 MHz
RC-793	200 ohms bal to 70 ohms unbal	3.5-30 MHz
RC-794	300 ohms bal to 70 ohms unbal	3.5-30 MHz
RC-796	600 ohms bal to 70 ohms unbal	3.5-30 MHz

BALUNS

Commercial & Industrial Types

MODELS AVAILABLE

B&W MODEL NO.	INPUT IMPEDANCE (unbalanced)	OUTPUT IMPEDANCE (balanced)	POWER CAPACITY
HFT-1K/50U/700B	50 ohms	700 ohms	11KW Average 2KW PEP
HFT-1K/50U/600B		600 ohms	
HFT-1K/50U/300B		300 ohms	
HFT-1K/50U/200B		200 ohms	
HFT-1K/70U/As Above	70 ohms	as above	5KW Average 10KW PEP
HFT-5K/50U/700B	50 ohms	700 ohms	
HFT-5K/50U/600B		600 ohms	
HFT-5K/50U/300B		300 ohms	
HFT-5K/50U/200B		200 ohms	
HFT-5K/70U/As Above	70 ohms	as above	

RADIO FREQUENCY FILTERS

Model Number	Intended Use	Power Capacity (Watts)	Impedance (Ohms)
423	6 Meter	100	50
427	Amateur Radio	1000	50
424	Amateur Radio	100	50
425	TVI Filter	1000	50
426		1000	70
422-15	Amateur 15 Meter	100	50
431-15	Radio Harmonic	1000	50
421-20	Amateur 20 Meter	100	50
430-20	Radio Harmonic	1000	50
420-40	Amateur 40 meter	100	50
429-40	Radio Harmonic	1000	50
419-80	Amateur 80 Meter	100	50
428-80	Radio Harmonic	1000	50
422-2	Amateur 2 Meter Bandpass Filter	350	50

- Model 376** Single Pole 5 position with grounding of all unused positions. Sixth switch position grounds all outputs. Radial mounted connectors.
- Model 550A** Single Pole 5 position switch. Radial mounted connector.
- Model 551A** 2 Pole 2 position. Radial mounted connectors
- Model 550A-2** Single Pole 2 position switch. Radial mounted connectors

R. F. COAXIAL SWITCHES WITH BNC CONNECTORS

- Model 596** Single Pole 3 position with grounding of all unused positions
Dimensions 1-3/4" high, 5" wide, 3" deep
Wall or desk
- Model 597** Single Pole 6 position with grounding of all unused positions
Dimensions 8-1/2" x 3-1/2" x 2"
Mount Wall or desk



BARKER & WILLIAMSON
10 CANAL STREET
BRISTOL, PA 19007



PROFESSIONAL QUALITY SINCE 1932

every function to another ham in less than three minutes. I rarely see a piece of equipment that doesn't have some peculiar flaw that really aggravates me. The 7800 is one of the few that doesn't. If you are about to exchange some of your hard-earned dollars for a two-meter rig, the Kenwood TR-7800 deserves your serious consideration.

For more information, contact *Trio-Kenwood Communications, Inc.*, 1111 West Walnut, Compton CA 90220.

Paul Grupp KA1LR
73 Staff

KANTRONICS MINI-READER

The age of functional miniaturization is upon us. Kantronics, well established for their reputation in amateur license training tapes and accessories, has released an ultra-compact version of their famous Field Day RTTY/Morse reader.

The Mini-Reader still possesses all of the features of its larger predecessor, but has been reduced to the approximate size of a standard calculator. Measuring only 5-3/4" W x 3-5/8" H x 1-1/4"D, the Mini-Reader features 10 brilliant fluorescent characters. The display moves from right to left, Times-Square style, as the message writes across the full range of alphanumeric characters.

The primary mode is its RTTY/CW reading capability. The Mini-Reader will follow the mark signal at 60, 66, 75, and 100 wpm—any shift. A sharp audio bandpass filter rejects co-channel interference and heterodynes, assuring accurate copy. For CW reception, the Morse function will automatically track 3-80 wpm, self-adjusting

to speed. Two of the characters may be used to display the Morse speed.

The Mini-Reader can be used as a code-practice display, assisting the user to develop a perfect fist. If your "v"s look like "e e e t" you have some work to do!

A built-in digital clock shows hours, minutes, and seconds, and may be used as a 24-hour timer as well. And for audio circuit design around the shack, the Mini-Reader can double as a frequency counter from dc to 79 kHz! Computer buffs will find the 100- and 300-baud ASCII a little fast to read, but isolated data sets can be stored and displayed.

We decided to give the Mini-Reader a thorough workout by coupling it to a Kenwood R-1000 general-coverage receiver and seeing how it would perform throughout the shortwave bands. One of the most pleasing observations was made right at the start: no RFI! The Mini-Reader switching circuitry was totally inaudible in the adjacent receiver, meaning that the days of RFI from RTTY demodulators have been relegated to the past, and they won't be missed!

In actual use, the Mini-Reader is simply affixed to an appropriate ac adapter (12 V dc at 240 mA) and plugged into the speaker or earphone jack of the receiver or transceiver. Front-panel push-button selection allows the user to select the functions of his choice.

We found the brilliant fluorescent characters even easier to read than the LEDs of the larger and more expensive Field Day model. And even happier, the price of the Mini-Reader is \$150 less than the Field Day II SWL

model—\$314.95!

We were told by Kantronics that the small size of the Mini-Reader was made possible by abandoning the pure digital circuitry of the earlier Field Day products and programming a microprocessor for control.

The Mini-Reader portends a new breed of microprocessor applications, and amateur radio will benefit from the wave of products.

For more information, contact *Kantronics*, 1202 E. 23 Street, Lawrence KS 66044. Reader Service number 479.

Robert Grove WA4PYQ
Brasstown NC

THE UNIVERSAL COMMUNICATIONS 2300-MHZ DOWNCONVERTER KITS

Coffee cans, snow scooters, and stop-sign-shaped PC boards in every direction. That was the general situation when a group of friends and I recently purchased a number of the 2100-MHz downconverter kits from Universal Communications. These MDS, or pay-TV, converter kits were advertised in 73, and they seemed like an ideal way to try the rapidly growing frontier of microwave TV. We were not sure exactly what we were getting into, but the enticement of unique movies was definitely an incentive!

I won't elaborate on our phone-order difficulties, but it soon became apparent that we were in a pileup with the rest of the U.S. in trying to place our order. Fortunately, we got through on the third day of trying. The downconverter kits arrived COD three days later. Fast! The Universal Communications kit consists of the PC board, all associated board parts, a short length of hardline coax which is used for the antenna, and very good instructions/information on microwave techniques.

Construction began (immediately!) by winding three rf chokes on supplied resistors, then mounting all the components on the PC board. The board was then tack-soldered onto the back (bottom) of a one-pound coffee can, with the hardline coax routed through a small hole into a whip antenna. This arrangement provided an approximate 11-dB gain over the basic whip, and perfectly mated the PC board to the coffee can. This one particular trademark,

we later learned, is what sets Universal Communications' boards apart from its competitors'.

Finally, the local oscillator's stripline was trimmed to the desired frequency range (a cutting chart was included) and a coax output cable was connected. (This single line feeds dc voltage to the converter while also feeding converter output to the TV set. Varying the voltage remote-controls downconverter tuning.) All six of us sequentially used a borrowed 0-to-16-volt power supply for checkout, and five converters worked the first time. The sixth unit was cleared soon thereafter, with simple soldering techniques being at fault. Each of us then modified existing 12-volt regulated power supplies using information supplied in the Universal Communications packet.

A day later, we were into studying microwave systems, components, and gain-improving techniques for fringe-area setups. Several nearby residents mysteriously lost their shiny, new garbage can lids around this time, then we found a local source of "snow scooters" and gain flourished. The "snow scooter," or "snow coaster," is an approximately three-foot, parabolic-shaped dish which, when fitted with struts to support the coffee-can setup, provides approximately 18 dB of gain—and relatively good picture reception compared to the basic coffee-can or garbage-can-lid setup. Our personal observations revealed that previous pictures with substantial snow were improved to almost snow-free quality, and each additional improvement of approximately one dB made further substantially noticeable improvements.

Gain improvement at these microwave frequencies, however, is slow in happening: A larger dish helps; a higher-gain rf amplifier also helps. (Universal Communications also sells these transistors for \$15, and they are definitely worth it, unless one can wrangle a very high-gain/low-noise 50- or 75-dollar equivalent.) We also found that adding extra lengths of parallel conductors to the Universal Communications PC board capacitors and using low-noise microwave diodes provid-



Kantronics' Mini-Reader.

A superb frequency counter is frequently not counted—just because it doesn't have a high price-tag.



The truth is, our 8000B 1 Gigahertz is an excellent counter. In fact, it's preferred by many engineers, technicians, and electronic enthusiasts. Not a single competitor on the market today can surpass our price/performance ratio.

And we've deliberately kept our prices down. First, we've refused to join everybody else in their high mark ups. Instead of "charge what the market will bear," for us it's "charge a fair price." Second, we sell what we manufacture, directly to you. So extra costs of extra steps are automatically eliminated. Third, we have to build a lot of frequency counters to meet the demand. Because we do sell so many, we don't have to charge a high price to make a profit.

And about quality . . . Sabtronics frequency counters always have the most innovative features available. For example, our 8000B 1 Gigahertz Frequency Counter has a 10 Megahertz precision crystal timebase. But most important, the 8000B, using the most advanced LSI circuitry, has a guaranteed sensitivity of 30 millivolts up to 1 Gigahertz, with 20 millivolts typical. The three-stage differential amplifier IC makes this possible. Altogether, the 8000B uses only 6 IC's, making the chance of failure virtually nonexistent.

Three selectable gate times provide the measurement speed you need — and greater resolution. The resolution is further enhanced by our counter's 9-digit display.

Like the 8000B, Sabtronics' 8610B is a high-quality precision frequency counter. It features only 4 IC's, and offers a frequency range up to 600 Megahertz.

The cases of both counters are high strength impact-resistant ABS plastic. Elegant but very rugged. Sabtronics doesn't believe in skimping on the high quality construction that brings excellent performance. But we're not about to charge a high price just because we could get it!

Send in the coupon and order your new frequency counter now. Credit card holders may call.

BRIEF SPECIFICATIONS:

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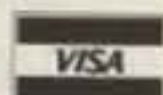
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Shortwave listening? Why not! While SWLing may not be a part of amateur radio, there's no denying the very close relationship between the two hobbies. While CBing may have usurped SWLing as the main gateway to ham radio, thousands still get their first taste of hobby radio by listening to the international shortwave giants on a portable radio. In any event, it's a well-known fact that many hams are closet SWLs. As a matter of fact, more than one prominent DXer has been known to guard his top shortwave QSLs as jealously as many of his most-prized ham pasteboards.

So, whether the closest you get to shortwave listening is fighting the BBC World Service on 40, or if you regularly scan 41, 19, and 13 meters more often than 40, 20, and 15, the world of SWLing is something we should all know a little more about.

ELEMENT 1—CROSSWORD PUZZLE (Illustration 1)

- | | | | |
|---------------|--------------------------------------|-------------|--|
| Across | | 22 | VOA's Delano transmitter's state (abbr.) |
| 1 | Belonging to a famous Soviet station | 23 | Time station |
| 8 | Typical shortwave mode (abbr.) | 24 | High antenna location |
| 9 | Announced | 27 | Receiver (abbr.) |
| 10 | Skyhook (abbr.) | 28 | British radio organization—not BBC (abbr.) |
| 12 | Shortwave "boundaries" (abbr.) | 29 | Greek (abbr.) |
| 13 | Signal skipping zone (abbr.) | 30 | 23 across' state (abbr.) |
| 14 | Not me, but _____ | 31 | VOA's IS—"_____ Doodle" |
| 15 | SWL's bible (abbr.) | 32 | Amateur roundtable (abbr.) |
| 17 | Signal attenuation | | |
| 20 | DX signals usually travel over this | Down | |
| 21 | Radio interference (abbr.) | 1 | U.S. propaganda station |
| | | 2 | Morning (abbr.) |

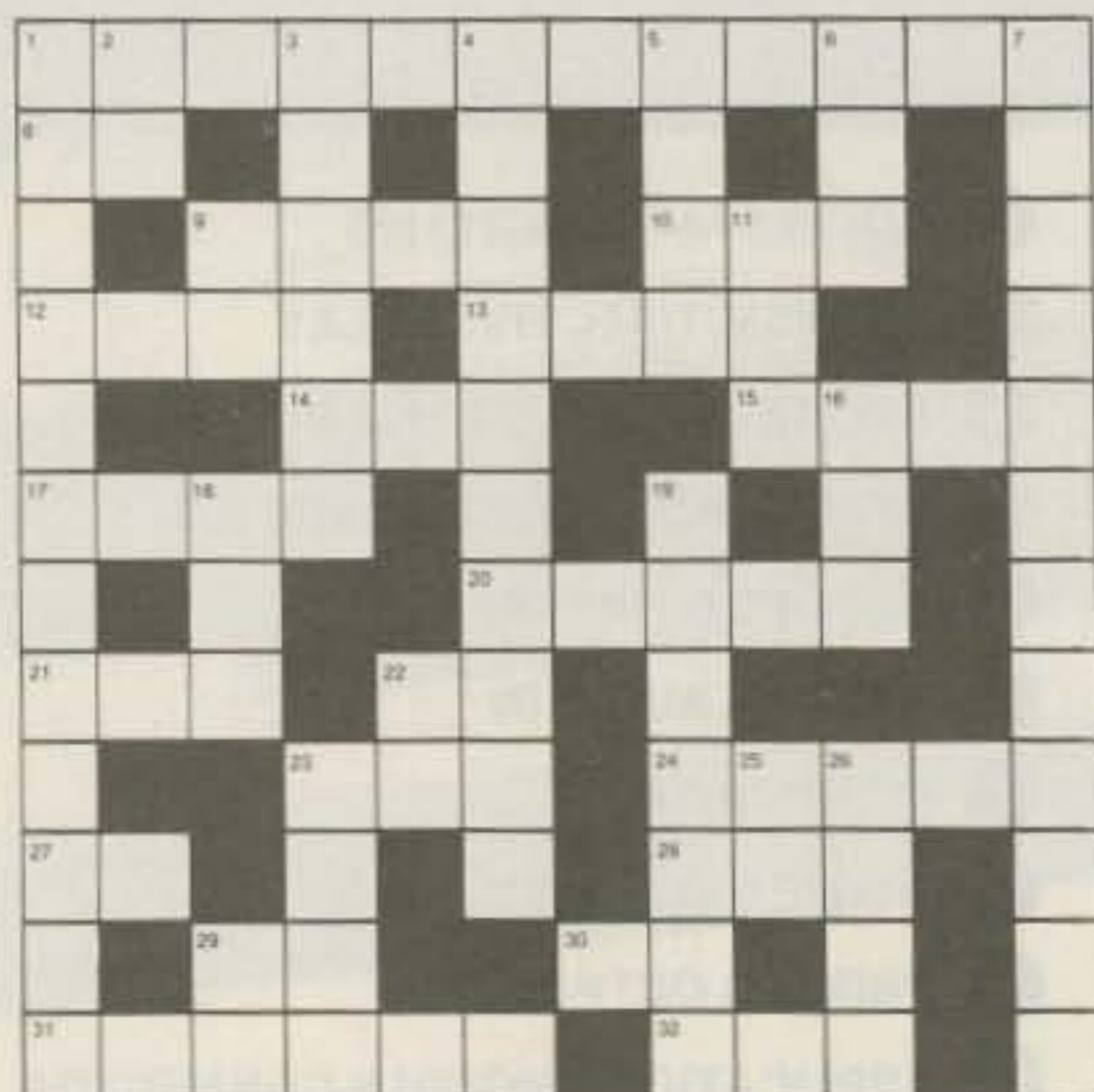


Illustration 1.

- | | | | |
|----|----------------------------------|----|------------------------------------|
| 3 | Belonging to RAI | 18 | Telegraphic regret |
| 4 | Below shortwave | 19 | Broadcast outlet (abbr.) |
| 5 | Former clandestine island | 22 | Radiotelegraphic code (abbr.) |
| 6 | Tenth month (abbr.) | 23 | Logging stations can be hard _____ |
| 7 | HCJB's continent | 25 | Old boy (abbr.) |
| 9 | Sudanese prefix | 26 | To desire QSL |
| 11 | Immediately | 29 | Morse "good night" |
| 16 | Return postage requested (abbr.) | | |

ELEMENT 2—MATCHING

While not "shortwave" in a strict technical sense, listening to distant broadcast-band stations is an activity stretching back over 60 years. Here, match the call of the station to its QTH. All stations listed run 50 kW and operate 24 hours a day. All have been licensed since the earliest days of broadcasting.

Column A

- 1) KDKA
- 2) WOR
- 3) WWL
- 4) KGO
- 5) KSL
- 6) KNX
- 7) WBT
- 8) WJR
- 9) WSB
- 10) WGN
- 11) WLW
- 12) WSM
- 13) KOB
- 14) KOA
- 15) KYW
- 16) WHO
- 17) WBZ
- 18) KXL
- 19) KGA
- 20) WHAM

Column B

- A) Atlanta GA
- B) Nashville TN
- C) Portland OR
- D) Denver CO
- E) Spokane WA
- F) San Francisco CA
- G) Des Moines IA
- H) Rochester NY
- I) Los Angeles CA
- J) Pittsburgh PA
- K) Ann Arbor MI
- L) Philadelphia PA
- M) Salt Lake City UT
- N) Cincinnati OH
- O) Albuquerque NM
- P) New Orleans LA
- Q) Boston MA
- R) Detroit MI
- S) New York NY
- T) Chicago IL
- U) Charlotte NC

ELEMENT 3—SCRAMBLED WORDS

Unscramble these words dealing with shortwave listening:

- | | | | |
|------------|------------|-----------|-------------|
| titleslui | catsodrab | plisrotac | tandlicense |
| dabn | tisecmod | gropam | letnis |
| sucim | losegiuri | tarlveni | gaugelan |
| tenrenvomg | granpopada | renegein | servosae |
| breactila | nefgoir | arlye | tactis |

ELEMENT 4—TRUE-FALSE

- | | True | False |
|---|-------|-------|
| 1) Israel radio has broadcast in the slow-scan television mode. | _____ | _____ |
| 2) Radio Moscow regularly broadcasts on 40-meters a show about amateur radio. | _____ | _____ |
| 3) Private interests aren't allowed to operate shortwave broadcast stations in the U.S. | _____ | _____ |
| 4) Utility stations are owned by public utilities such as power and water companies. | _____ | _____ |
| 5) The planet Jupiter can be heard daily on 18, 22, and 27 MHz. | _____ | _____ |

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- **REMOVABLE HEAD:** The control head may be located as much as 15 feet away from the main unit using the optional connecting cable. **COMPARE!**

- **PL TONE OSCILLATOR BUILT IN:** Frequency is adjustable to access PL repeaters.
- **MICROPHONE VOLUME/FREQ. CONTROL:** Both functions may be adjusted from either the microphone or front panel.
- **NON-STANDARD OFFSETS:** Three accessory offsets can be obtained for CAP/MARS or unusual repeater splits. CAP and Air Force MARS splits are **BUILT IN!** **COMPARE!**
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The MFJ-494 Keyboard Keyer.

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Continued on page 122

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If the drag factor is not considered when OSCAR calculations are performed, long-range orbital projections will be in error. For example, by the end of 1979, OSCAR 8 was more than 20 minutes ahead of some published schedules. The nature of orbital mechanics is such that extra drag on a satellite causes it to move into a lower orbit, resulting in a shorter orbital period. Thus, the satellite arrives above a given Earthbound location earlier than predicted.

Using data supplied to us by Dr. Thomas A. Clark W3IWI of AMSAT, the equatorial crossing tables shown here were generated with the aid of a TRS-80™ microcomputer. The tables take into account the effects of atmospheric drag and should be in error by a few seconds at most.

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.

At press time, OSCAR 7 was scheduled to be in Mode A on odd numbered days of the year and in Mode B on even numbered days. Monday is QRP day on OSCAR 7, while Wednesdays are set aside for experiments and are not available for use.

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 8 is in Mode A on Mondays and Thursdays, Mode J on Saturdays and Sundays, and both modes simultaneously on Tuesdays and Fridays. As with OSCAR 7, Wednesdays are reserved for experiments.

OSCAR 7 ORBITAL INFORMATION FOR APRIL

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
29169	1	0032:20	85.4
29182	2	0126:35	99.8
29194	3	0025:53	83.9
29207	4	0120:08	97.5
29219	5	0019:26	82.3
29232	6	0113:41	95.9
29244	7	0012:59	80.7
29257	8	0107:14	94.3
29269	9	0006:32	79.2
29282	10	0100:47	92.8
29294	11	0000:05	77.6
29307	12	0054:20	91.2
29320	13	0148:35	104.8
29332	14	0047:53	89.6
29345	15	0142:08	103.2
29357	16	0041:26	88.1
29370	17	0135:41	101.6
29382	18	0034:59	86.5
29395	19	0129:14	100.1
29407	20	0028:32	84.9
29420	21	0122:47	98.5
29432	22	0022:05	83.4
29445	23	0116:20	96.9
29457	24	0015:38	81.8
29470	25	0109:53	95.4
29482	26	0009:11	80.2
29495	27	0103:26	93.8
29507	28	0002:44	78.7
29520	29	0056:59	92.2
29533	30	0151:14	105.8

OSCAR 8 ORBITAL INFORMATION FOR APRIL

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
15658	1	0122:17	78.8
15672	2	0127:03	88.8
15686	3	0131:50	81.2
15700	4	0136:36	82.4
15714	5	0141:22	83.7
15727	6	0002:57	59.1
15741	7	0007:43	68.3
15755	8	0012:29	61.5
15769	9	0017:15	62.7
15783	10	0022:01	63.9
15797	11	0026:48	65.1
15811	12	0031:34	66.3
15825	13	0036:20	67.5
15839	14	0041:06	68.7
15853	15	0045:52	69.9
15867	16	0050:38	71.2
15881	17	0055:24	72.4
15895	18	0100:10	73.6
15909	19	0104:56	74.8
15923	20	0109:42	76.0
15937	21	0114:28	77.2
15951	22	0119:14	78.4
15965	23	0124:00	79.6
15979	24	0128:46	80.8
15993	25	0133:32	82.0
16007	26	0138:18	83.2
16021	27	0143:03	84.4
16034	28	0004:37	59.9
16048	29	0009:23	61.1
16062	30	0014:09	62.3

OSCAR 7 ORBITAL INFORMATION FOR MAY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
29545	1	0050:32	98.7
29558	2	0144:47	104.3
29570	3	0044:05	89.1
29583	4	0138:19	102.7
29595	5	0037:38	87.5
29608	6	0131:52	101.1
29620	7	0031:11	86.0
29633	8	0125:25	99.6
29645	9	0024:44	84.4
29658	10	0118:58	98.0
29670	11	0018:17	82.8
29683	12	0112:31	96.4
29695	13	0011:50	81.3
29708	14	0106:04	94.9
29720	15	0005:23	79.7
29733	16	0059:37	93.3
29746	17	0153:52	106.9
29758	18	0053:10	91.7
29771	19	0147:25	105.3
29783	20	0046:43	90.2
29796	21	0140:58	103.7
29808	22	0040:16	88.6
29821	23	0134:31	102.2
29833	24	0033:49	87.0
29846	25	0128:04	100.6
29858	26	0027:22	85.4
29871	27	0121:36	99.0
29883	28	0026:55	83.9
29896	29	0115:09	97.5
29908	30	0014:27	82.3
29921	31	0108:42	95.9

OSCAR 8 ORBITAL INFORMATION FOR MAY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
16076	1	0018:55	63.5
16090	2	0023:41	64.7
16104	3	0028:26	65.9
16118	4	0033:12	67.1
16132	5	0037:58	68.3
16146	6	0042:43	69.5
16160	7	0047:29	70.7
16174	8	0052:15	71.9
16188	9	0057:00	73.1
16202	10	0101:46	74.3
16216	11	0106:31	75.5
16230	12	0111:17	76.7
16244	13	0116:02	77.9
16258	14	0120:48	79.2
16272	15	0125:33	80.4
16286	16	0130:19	81.6
16300	17	0135:04	82.8
16314	18	0139:50	84.0
16327	19	0001:23	59.4
16341	20	0006:09	60.6
16355	21	0010:54	61.8
16369	22	0015:39	63.0
16383	23	0020:25	64.2
16397	24	0025:10	65.4
16411	25	0029:55	66.6
16425	26	0034:41	67.8
16439	27	0039:26	69.0
16453	28	0044:11	70.2
16467	29	0048:56	71.4
16481	30	0053:41	72.6
16495	31	0058:27	73.8



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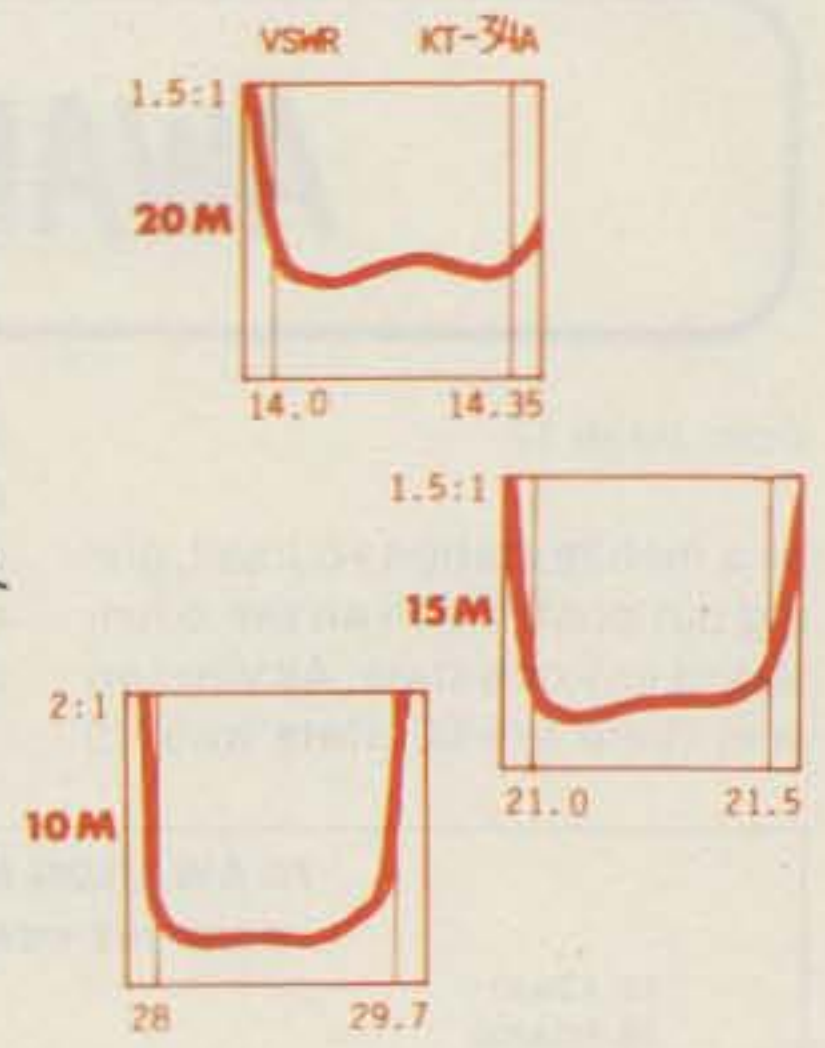
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KLM's KT-34A . . . Broadbanded, efficient, compact!

Thanks for your interest in our KT-34A. We're glad to have tickled your curiosity. The KT-34A is a very special antenna, representing the first significant step forward for tribander design in 20 or more years. It is made for the amateur and the equipment of today, and advanced enough to meet the challenges of the future.

What makes the KT-34A so different from a conventional tribander? Basically, the traps, coils, and capacitors have been discarded in favor of lossless linear-loading and Hi-Q air capacitors, all composed of aluminum tubing! These allow the KT-34A to handle 4KW PEP at an unusually high level of efficiency. The linear loading also makes full 1/4-wave elements possible on 10 and 15 meters, and brings 20 meters much closer to the desirable 1/4-wave than any conventional tribander (the sketch below shows the remarkable metamorphosis of the KT-34A design).

Two driven elements are employed to make the KT-34A unusually **broadbanded** (a concept applied to most KLM antennas). VSWR and performance remain nearly constant across each of the three bands (see the VSWR charts). A KLM balun is supplied to allow direct feed from your 50 ohm coax.

Structurally, the KT-34A is built tough. No boom support is required. All the aluminum, including the boom, is strong weather resistant 6063-T832 alloy. All the hardware is stainless steel except for the mounting U-bolts. Virtually indestructible Lexan insulators support the elements and insulate them from the boom. Rotation is possible by most any ham rotor. Wind balance and wind survival are excellent. Boom length is only 16 feet.

To meet your future needs, the KT-34A is easily expandable. The KT-34XA Upgrade Kit, which adds two new elements and doubles the boom length, produces substantial increases in performance. Your KT-34A cannot become obsolete!

A great deal of thought and care has gone into the design of this antenna. It's not just another "me too" tribander, but one developed from modern techniques, materials and engineering. We hope you will give it a try. We know you won't be disappointed

KT-34A SPECIFICATIONS

Frequencies of operation:

- 14.0-14.350 MHz
- 21.0-21.450
- 28-29.750

Gain: 7 dBd \pm .3 dB across each band

F/S: 30 dB

F/B: 20 dB

Feed impedance: 50 ohms with balun supplied

Power rating: 4KW PEP

Boom: 16 ft. x 3" O.D.

Mast: for 2" O.D. (standard)

Element length: 24 ft. average

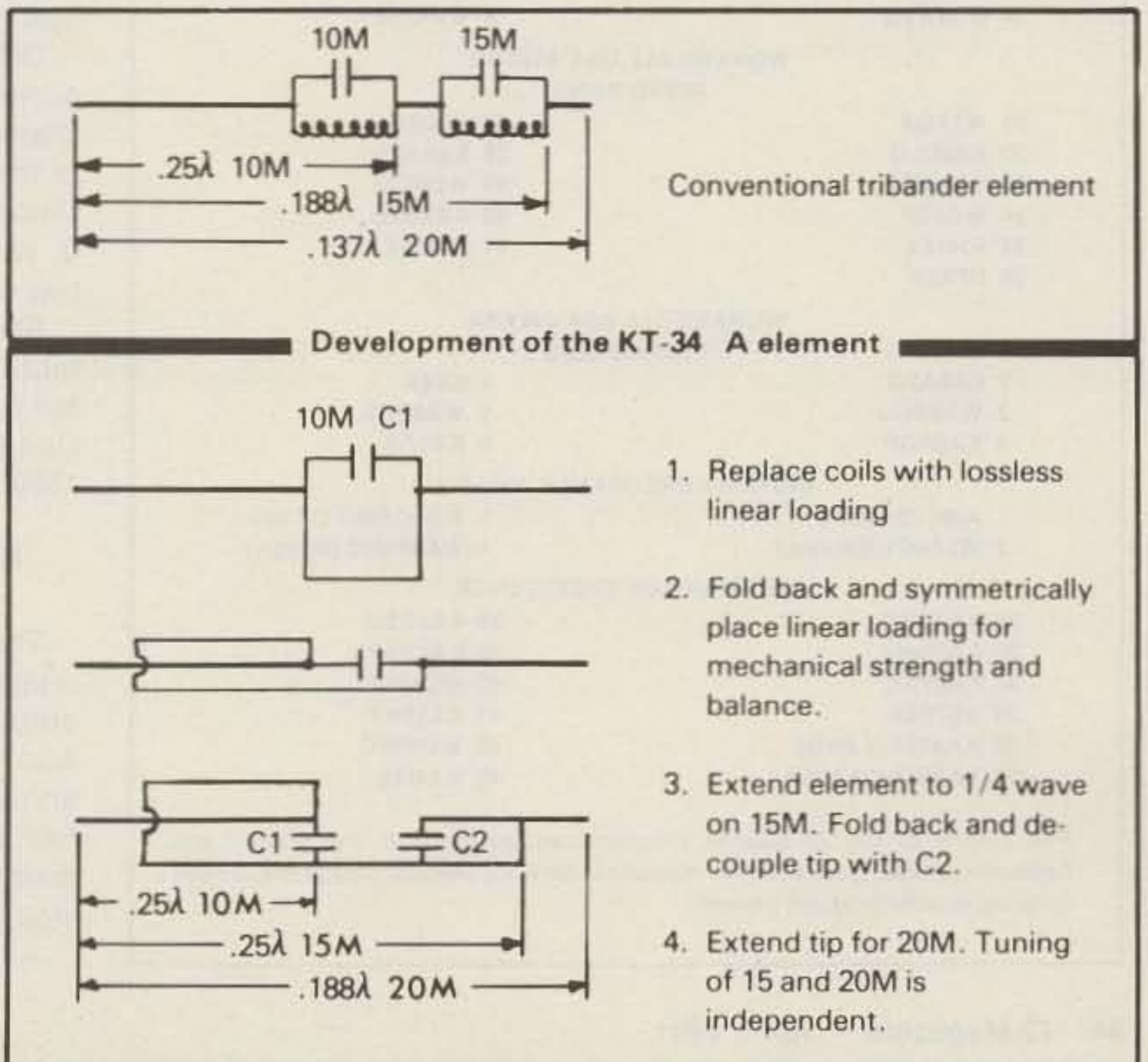
Turning radius: 16 ft.

Wind area: 6 sq. ft.

Wind survival: 100 MPH

Suitable Rotors: TR-44, Ham "M", HD-73, KR-400, etc.

Price: \$389.95



AWARDS

from page 12

be a mobile station yourself, giving out contacts in all the counties of any one state. As you can see, there are 50 state awards

for each category listed above. A potential of 150 individual awards if you mastered them all! Whew! You may work any band or mode.

As with the other awards, do

73 AWARDS PROGRAM

WORK THE WORLD AWARD

72 K2AIO	74 9V1UK
73 N7AKQ	75 VK2VUQ

NORTH AMERICAN CONTINENT AWARD

109 K2AIO	112 VK2VUQ
110 N7AKQ	113 WD8KXT
111 9V1UK	

SOUTH AMERICAN CONTINENT AWARD

98 K2AIO	101 WB2FFY
99 N7AKQ	102 VK2VUQ
100 9V1UK	

EUROPEAN CONTINENT AWARD

125 K2AIO	128 VK2VUQ
126 N7AKQ	129 N3BCZ
127 9V1UK	130 WD8KXT

OCEANIC CONTINENT AWARD

81 K2AIO	83 9V1UK
82 N7AKQ	84 VK2VUQ

AFRICAN CONTINENT AWARD

84 K2AIO	87 9V1UK
85 N7AKQ	88 VK2VUQ
86 WD4LYA	

ASIAN CONTINENT AWARD

79 K2AIO	82 VK2VUQ
80 N7AKQ	83 WB2FFY
81 9V1UK	

73 DX COUNTRY CLUB AWARD

2 x SSB

51 9V1UK	53 VK2VUQ
52 OE1UHB	

DX CAPITALS OF THE WORLD

10 OE1UHB	11 WB9UIA
-----------	-----------

10 METER DX DECADE AWARD

1 WB4WRE/M	5 DA2AL
2 AC3Q	6 WB4TZA
3 W5TJQ	7 WD5JRG
4 WD0AVG	8 WA4ZLZ

WORKED ALL USA AWARD MIXED BAND

31 W1AGA	37 K7DBV
32 KA2CLQ	38 KA4JQS
33 KA4BNQ	39 WD8IDD
34 W4DDP	40 KA2GZE
35 AH6AX	41 KA6IYE
36 DF6ZP	

WORKED ALL USA AWARD 75/80 METERS

1 KA0AZQ	4 KS4B
2 WD0BOS	5 WB9UKS
3 KA5AOP	6 KB5FN

DISTRICT ENDURANCE AWARD

1 AJ8L (50 min.)	3 WB6CDM/7 (12 min.)
2 WL7ACY (55 min.)	4 WA3PMI/7 (36 min.)

Q5 AWARD OF EXCELLENCE

32 KA7GKO	38 KA3CBC
33 KA2GMJ	39 KA7HPP
34 KA0FXC	40 WD4PLF
35 VE7DZR	41 KA1FKX
36 KA8GIX (7 MHz)	42 WD9IWC
37 KA8GIX (21 MHz)	43 KA6IYE

Full details of the 73 Awards Program can be found in the August and September, 1980, issues of this magazine. Why not become part of the fastest growing awards program around!

not send QSL cards! Have your contacts verified by at least two amateurs and forward this list and a \$1.00 award fee to Ray Teeter N2RT, RD 2, Canaan Heights, Locke NY 13092.

BONANZA AWARD

The Bonanza award is probably the most demanding of all the awards being offered by Ray.

To qualify, applicants must work the same mobile in the various counties of a single state. There are three categories in which to apply. Class A—working the same mobile in all counties of a single state; Class B—working the same mobile in 2/3 of the counties within a single state; and Class C—working the same mobile in at least 1/3 of the counties of a single state.

Both the applicant and the mobile contact will get awards for their efforts. To apply, prepare your list of contact dates and times, band and mode of operation, county and state of operation, and last and most important, the mobile contacted in each case.

Have your list of contacts verified by at least two amateurs or a local radio club secretary. Send a \$1.00 award fee and your application to: Ray Teeter N2RT, RD 2, Canaan Heights, Locke NY 13092.

UNION COUNTY AWARD

Here is an historical award being offered by Ray which requires the applicant to work Union counties of the United States.

Offered in three award categories, applicants must, for Class A, work 18 Union counties of the USA; for Class B, work 12 Union counties; and for Class C, work at least 6 Union counties of the USA.

Send your list of verified contacts along with a \$1.00 award fee to Ray Teeter N2RT, RD 2, Canaan Heights, Locke NY 13092.

ARMSTRONG PIONEER AWARD

The Major Armstrong Memorial Amateur Radio Club has instituted the Armstrong Pioneer Award, an honor to be bestowed annually on the amateur who has, in the opinion of the voting members, done outstanding service for an amateur community.

Any amateur operator or

group of amateurs may nominate a ham whom they feel meets the criteria listed below. Nominations opened November, 1979, and will be accepted for as long as the award program exists. Members of the Major Armstrong Memorial ARC will review each year's nominations every spring, determining by vote the amateur who, in the spirit of Major Edwin H. Armstrong, inventor of Frequency Modulation, has contributed the most to amateur radio through pioneering efforts.

The following criteria should be observed when considering an amateur for nomination: (1) the nominee should be a licensed amateur or group of amateurs; (2) the nominee should have made a significant contribution to ham radio by experimentation and development in new or little-used bands or modes (examples: development of equipment for SSTV, OSCAR, RTTY, EME; revival of neglected modes like facsimile; technical developments that help populate little-used bands, etc.); or (3) the nominee should have made a significant contribution to ham radio by promoting the use of such bands or modes (examples: efforts to keep 10 meters during sunspot minima via nets, clubs, beacons, etc.; efforts to increase activity on 1296 MHz and microwave bands; efforts to keep AM or other obsolete modes alive via nets, contests, etc.; efforts to promote the concept of amateur radio in countries where it is not permitted, etc.).

The examples are only that; the committee hopes the ham fraternity will respond with news of any kind of amateur radio pioneering.

Talk about this award nomination at your next club meeting. Send your statement about the nominee you select to: Major Armstrong Memorial Amateur Radio Club, Inc., PO Box 1234, Englewood Cliffs NJ 07632.

THE REVEREND JOHN FLYNN MEMORIAL AWARD

This award has been instigated by the Alice Springs Community College Radio Club of Australia. It was founded in memory of Reverend John Flynn, who pioneered the Australian Inland Mission, the Royal Flying Doc-

Continued on page 120

LOOKING WEST

Bill Pasternak WA6ITF
c/o The Westlink Radio Network
Suite 718
7046 Hollywood Blvd.
Hollywood CA 90028

THE SIX-METER READER REACTION DEPARTMENT:

Though it's taken some time, we are now really getting input and ideas concerning amateur radio's repopulation of the six-meter band. One of the most interesting letters received came from Lew Collins W1GXT, and it reads:

I read your September, 1980, column, Looking West, with much interest since I have been working on the development of a six-meter bandplan for a number of years. In addition, I have been a user of the band during all those years, and thus feel I am qualified to offer some insights into the six-meter problem that are not available to a passive observer such as you. I am hopeful that the comments that I am offering, which may on the surface sound a bit negative, will be received by you in the constructive spirit in which they are intended.

In my opinion, *three* factors led to the demise of six meters as you remember it: 1) The growth of two-meter FM/repeater operation, 2) The ever-present TVI problem on six, and 3) The decrease in solar activity. Probably item 1), as correctly observed in your article, was the major factor. I claim that the bulk of six-meter activity was of the low-power, rag-chewing local nature that you remember, with a little DX sprinkled in for excitement. The six-meter station with a pair of 4-400s and six-over-six yagis was the exception, rather than the rule.

TVI has always been a serious problem for the six-meter operator, particularly in those areas with channel 2 (Boston, New York, Los Angeles, etc.). The consumer electronic equipment of the 70s not only exists in unprecedented quantity, but the interference rejection properties in general are poorer as manufacturers strive to remain competitive. Many six-meter operators who went QRT because of

TVI discovered they could have as good or better local communication without the TVI hassles by getting on the local two-meter repeater. Unknown to you, the diehards with the big rigs and big antennas sat quietly by waiting for the DX openings of 1979-80. Just read a few issues of K5ZMS's newsletter if you don't believe me!

I must take exception with your statement that none of the existing input-output spacings is workable. (Otherwise, why would so many different standards flourish?) I could list numerous counter examples to your claim, but perhaps the most striking is the repeater located on the WCAU-TV tower in Philadelphia which uses 120-kHz input-output separation! This repeater has wide-area coverage and hundreds of users.

The basic parameter in designing a duplex transmission system, such as an amateur

"... I believe you do not take the amateur radio control enthusiasts seriously enough... they will not QSY without a fight. I would like to see you propose a plan based on FCC regulations as they now exist... so that it could be put into effect sooner rather than later."

repeater, is *not* the number of kilohertz separation between the transmitter and receiver frequencies, but rather the percentage separation. Thus, if we are to adopt 220-MHz standards for use on six meters, the optimum input-output separation is: $1.6/223.5 = 0.0072$, which works out to be 380 kHz at 53 MHz. Interesting enough, North Shore RF Technology, who pioneered the notch-type duplexer for the amateur market, produced a six-meter duplexer for 400-kHz spacing.

The 220-kHz separation used in southern California and the 200-kHz value used in eastern New England were both derived the same way, but starting with the now universal 600-kHz separation used on two meters. $0.600/147.0 = 0.0041$, which gives 216 kHz at 53 MHz.

There is another side to this input-output separation issue which you totally neglected in

your article. While it is true that the greater the input-output separation, the easier it is to make a repeater work, that is not necessarily true for the *system* consisting of *one* repeater plus a *number* of mobile users. Specifically, many of the amateurs who operate six-meter FM use high-quality transceivers which were originally manufactured for the land-mobile market by Motorola, General Electric, RCA, etc. These are not the old vacuum-tube boat anchors you remember from your early days of amateur FM, but are frequently solid-state or hybrid designs offering the state-of-the-art in mobile transceiver performance.

In order to produce a quality transceiver, the front-end as well as the transmitter exciter stages are fairly narrowband to minimize spurious output and responses. Consequently, there is a definite upper limit imposed upon a repeater's input-output separation by the user's radio, assuming that the user desires to have the capability of simplex as well as repeater operation. (It is my observation that most six-meter FMers desire to maintain

a simplex capability. In fact, one of the major advantages of six over two is that the simplex working range is greater. That is why I originally got on six meters.)

I must also point out that you have made an error in using and interpreting Carson's Rule. Carson's Rule *does not* say that the bandwidth of an FM signal is infinite, although an *exact* mathematical analysis of an FM signal does lead to that conclusion. What Carson's Rule *does* say is that an FM signal does not have *appreciable* sideband energy outside of the band $B = 2f + 2W$. All Carson's Rule says is that an FM signal occupies more bandwidth than does AM; practically speaking, both have finite bandwidth.

The issue of whether the repeater or user transmitter should be closer to TV channel 2 is a bit more complex than you

have indicated. Although I happen to agree with your position on this matter, others have argued loud and long for the other way around.

Unfortunately, I believe you do not take the amateur radio control enthusiasts seriously enough, and if you have not heard from them by now, it is merely because they have not read your proposal. In my experience, they view 53.1, 53.2, 53.3, 53.4, and 53.5 MHz as their private domain, and they will not QSY without a fight. Space does not permit going into this complex issue here.

There have been numerous attempts over the past ten years to move the national simplex channel from 52.525 MHz to something else, such as 52.520, with no success. There are hundreds (maybe thousands) of six-meter FMers in the less densely populated areas who operate 52.525 MHz exclusively, and, consequently, there is a great deal of resistance to change. I believe that any realistic bandplan will have to accommodate this long-established frequency, even if it doesn't make sense logically.

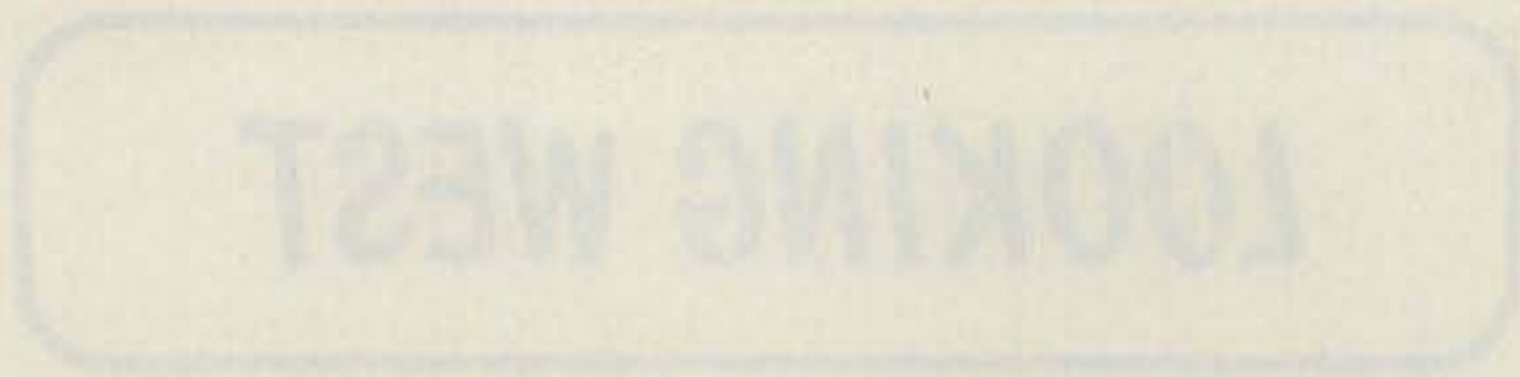
Your proposed use of 50.00 to 50.25 MHz is slightly at variance with accepted practice there, and needs slight revision. SMIRK, the Central States VHF Society, and other well-known VHF DX groups should be consulted on this point.

In summary, I am in complete support of your appeal for a national six-meter bandplan. However, I believe your proposal has some major flaws which must be corrected if it is to gain acceptance. Otherwise, we will just progress from having N different six-meter plans to having N + 1 such plans. In addition, I would like to see you propose a plan based on the FCC regulations *as they now exist*, so that it could be put into effect sooner rather than later.

Keep up the good work.

Best regards,
Lewis D. Collins W1GXT

As you can see, Lew spent quite a bit of time in preparing his commentary. There is much with which I agree, and points on which I disagree. The important thing is that he took the time to write. Next month, I'll answer Lew's letter. In the meantime, keep your thinking caps on.



The History of Ham Radio

— part XIII

Reprinted from QCC News, a publication of the Chicago Area Chapter of the QCWA.

On the lighter side of amateur radio, during the long winter nights, there evolved within the fraternity a new phase of activity. It had its inception in the many curious, humorous, and indescribable stories under the pen name of

The Old Man

who now, through the lapse of time, has become a hal-

lowed legend. The legend is now permanently memorialized in the Wouff Hong Story.

According to research, the ever-present references to the fabulous wouff hong came about like this: In the days when amateur radio was in swaddling clothes, way back in about 1914, there emerged a personality known as the Old Man.

As reality would have it,

this individual was, as all amateurs were and are to this day, afflicted with the sad but ever-present problem of raucous disturbances, be they man-made, nature-made, or even fabricated right within the shack of the beholder. This perpetual problem was known in the days of yore as "Rotten QRM." But to go on with the research.

Plagued in the very early

days of wireless communication with such interference, driving sane but determined listeners (wishing to remain that way) to distraction, especially when the headphones were securely clamped over both ears, listening intently for what the Morse dots and dashes were meant to convey, there emerged the following effusive but clear and loud verbiage into print [the Old Man exclaiming]:

"Fellows, [all excited and boiling over] fellows, this QRM business is getting my nanny—here it is midnight—I have smoked myself into a state of funk—the floor is covered with burnt matches—I am losing a perfectly good temper—there is no sign this will not continue all night long... How long do the radio bugs sit up at night anyway?—What are we going to do about

8 QST January, 1917

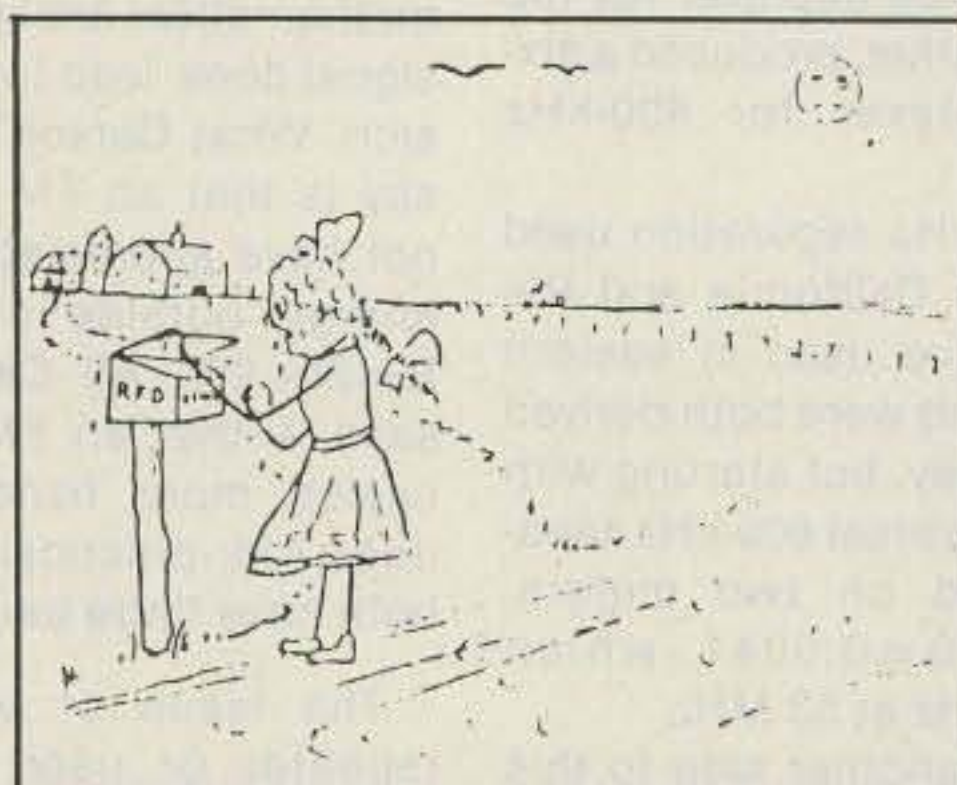
Rotten QRM

By "The Old Man."

Say, fellows, here's the old man again. This time he's all excited and boiling over. In fact he's so wild about some "Rotten" subject that he has fallen back to some queer dialect and shouts about "wouff hong's", "rettysnitches", and some disorder known to the trade as "ugerumf". What do all these mean? Better read the article and see. —Editor.



Smoked himself into a state of funk.



Poor girl in Ill. who hasn't heard from her fellow in 24 hours.



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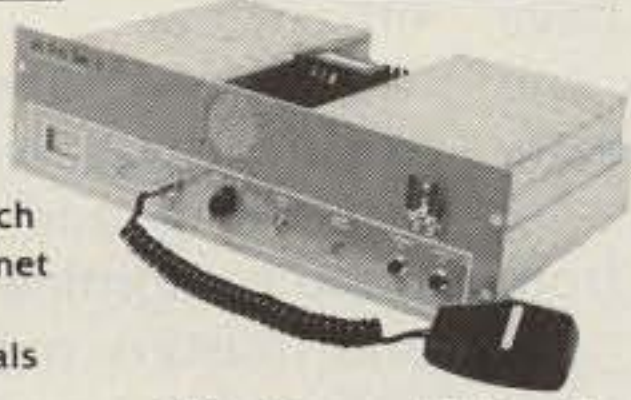
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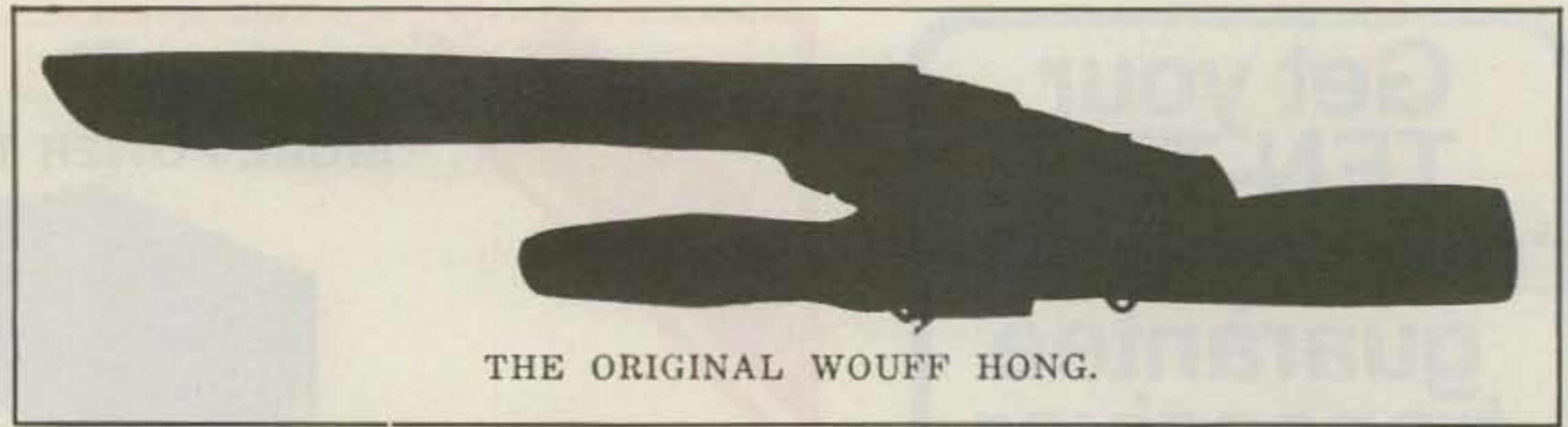
this business?—When we heard some commercial station say QRM we had to look it up on the chart to see what it meant. . . Later we began talking to the fellow over on the other side of town, and then was born our amateur QRM.

"But when we have a fellow who has not written to his girl for a full twenty-four hours, and who positively must get the message to her over in Illinois, it becomes a serious matter to have someone else getting gay with the ether, especially when the latter has no conception of the existence of the word 'brevity.' The trouble is, the young squirts don't stop to think. Willy with his sputtering spark coil discharge sends out this hogwash—now listen to this . . .

"'Yes yes jst wyd glucky wait a mt muddy wouff hong bliftsky monkey motor.' We assume from this message that Glucky is being asked to wait a minute while Bliftsky seeks a wouff hong with which to wallop a monkey the next time the latter faces towards the motor. I do not think I know just exactly what a wouff hong is. Probably some piece of apparatus used in the southern states to beat monkeys with.

"It is this form of uninteresting 'conversation' which clutters up the air with QRM. Of what moment is it to the rest of the world that this fellow Bliftsky is going to smear somebody's monkey with a wouff hong? When anybody relapses into such a mental slop as to want to operate with a thing named a wouff hong, he ought to keep his trouble to himself and not compel all of us respectable amateurs to listen to his drool. To slave and slobber a lot of foolish twaddle like this when that poor girl in Illinois has not had a letter since yesterday is plain wicked.

"Or just cast a lingering



THE ORIGINAL WOUFF HONG.

look at this:

"'Biirgrmph bru rotary ge ge ugerumf om with my set rettysnitch spitty tone hit in potimus?' Now what do you suppose the poor gink was trying to say when he unreeled that? You have to guess a lot in wireless, and how would you guess this? Something is wrong with this fellow's biirgrmph, his rotary also has a bad case of the ugerumf and somebody around the place must have spit on his rettysnitch, because his tone was so rotten it hit him on his potimus. Sounds bad to me. Why will some people send such personal matter by wireless when the whole country can overhear? It isn't decent, and it makes the QRM more rotten than ever, and just think of the way it makes a perfectly good logbook appear.

"I spent the better part of an hour trying to make out what ailed the poor fellow's biirgrmph, but had to give it up. What we ought to do is to organize an Anti-QRM Association. Then let us elect for Chairman the worst plug-ugly we can find in these U.S.A. Then let us chip in a little money and hire a clerk with a bad disposition who will write letters threatening the life of everybody whom the members report as causing needless QRM. Let us rise, fellow bugs—down with the fellow with the scratchy spark coil—down with the fellow, the unspeakable skunk who calls somebody and sends a long relay message repeating each word three times when the station to which he is sending is sending one



THE OLD MAN

WELL! WELL! WELL! LOOK WHO'S HERE. A picture of THE OLD MAN. It came in the mail, just like all his stories.

thing at a time himself.

"There, by heck, I have that stuff off my back and chest. Now you over there in Illinois, get this call—let everybody stand back from now on—I'm tired and sleepy and cross—and I don't care who I QRM, until

I get that pin cleared off . . ."

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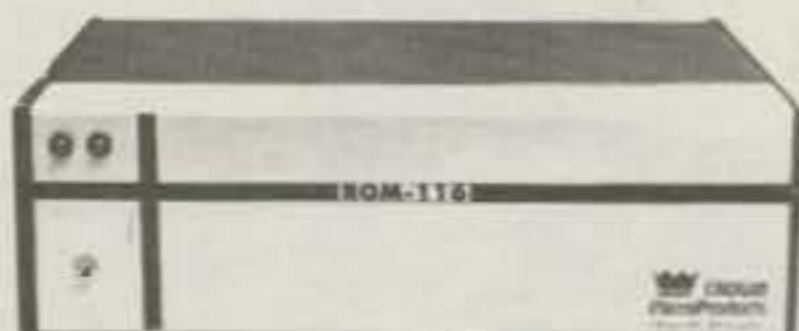
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Pots are used for speed, volume, tone, and weight because they are more human oriented than keystroke sequences and they remember your settings.

A meter gives continuous readout of buffer memory and speed. Two characters before full, the meter lights up red and the sidetone changes pitch.

PROGRAMMABLE, AUTOMATIC MESSAGES

Four automatic messages and two programmable message memories (A and B) are provided. Messages A and B can be a total of 30 characters. B starts where A ends.

When recalled, each message takes only one character of the buffer. They may be chained and/or repeated via the buffer.

"Well," you say, "that sure is not much memory." But it's more than it seems because of the built-in automatic messages.

For example, type your call into message A. Then by pressing the CQ button you send CQ CQ DE (message A). Press twice to send twice, etc.

The other automatic messages work the same way: CQ TEST DE (message A), DE (message A), QRZ (message A).

Special keys for KN, SK, BT, AS, AA, and AR.

TEXT BUFFER

The 50 character text buffer sends smooth perfect code even if you "hunt and peck."

Since each automatic or programmable message takes only one buffer character, this gives a far larger effective buffer.

You can preload a message into the buffer. Then when you are ready to transmit press the control key.

You can hold the buffer by pressing the shift key and space bar.

With the buffer in hold, you can send a comment with an external paddle as a keyer. To resume sending buffer, press the control key.

Simply backspace to delete errors.

RTTY: BAUDOT, ASCII

5 level Baudot is transmitted at 60 WPM. RTTY and CW ID are provided via message A.

Carriage return, line feed, and "LTRS" are sent automatically on the first space after 63 characters on a line. After 70 characters the function is initiated without a space. This gives unbroken words at the receiving end and frees you from sending the carriage return.

All up and down shift is done automatically. A downshift occurs on every space to quickly clear any garbles in reception.

The buffer, programmable and automatic messages, backspace delete and PTT control (keys your rig) are included.

The ASCII mode includes all the features of baudot. Transmission speed is 110 baud. Both upper and lower case are generated.

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The availability of low-cost speech synthesizer technology has opened many doors for the sightless

amateur. The introduction of a "talking calculator" several years ago was the first and most affordable

example of synthesized speech instruments which are useful to the visually-handicapped amateur.

Through the courtesy of the manufacturer, Telesensory Systems, Inc., of Palo Alto, California, the heart (or, more appropriately, the voicebox) of the Speech Plus Calculator recently has been made available at a reasonable price. Since that time, several efforts have been made to interface this module to available amateur equipment. Most have been relatively complicated, requiring from 10 to 30 or more IC packages.

Thanks to the forethought of the designers, a simple and very easy to duplicate interface is possible, eliminating a major barrier to more widespread use of synthesized speech in digital equipment. The model C-700 frequency counter, manufactured by DSI Instruments of San Diego, California, is based upon the LSI Computer Systems LS 7031 counter IC, which is ideal for this application. Other test equipment may be connected to the synthesizer module in a similar manner. The only

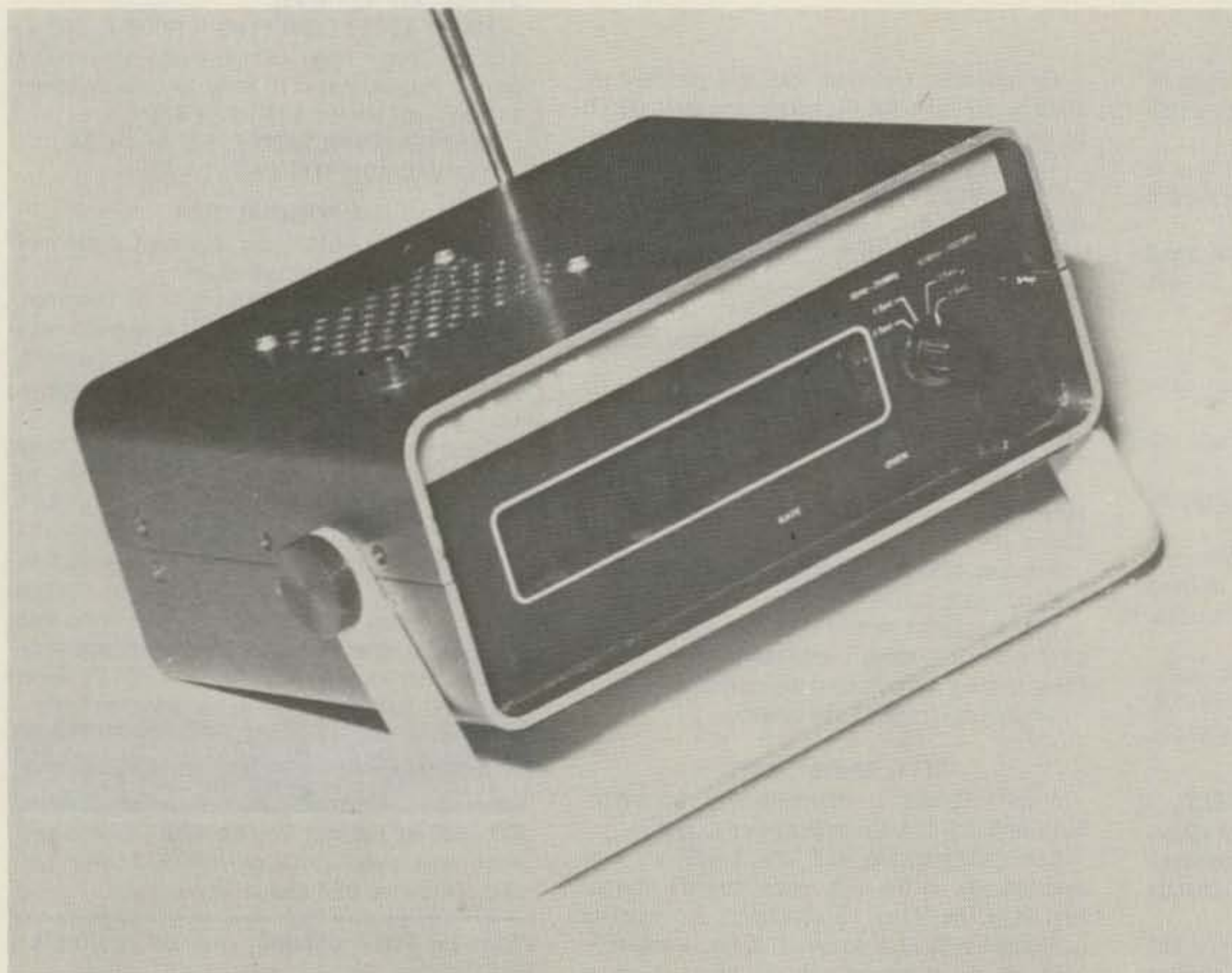


Photo A. There is little evidence that this DSI Model C-700 frequency counter has a voice of its own. The push-button in the left-hand corner of the cabinet top triggers an 8-digit readout. Volume and audio-visual controls are on rear panel.

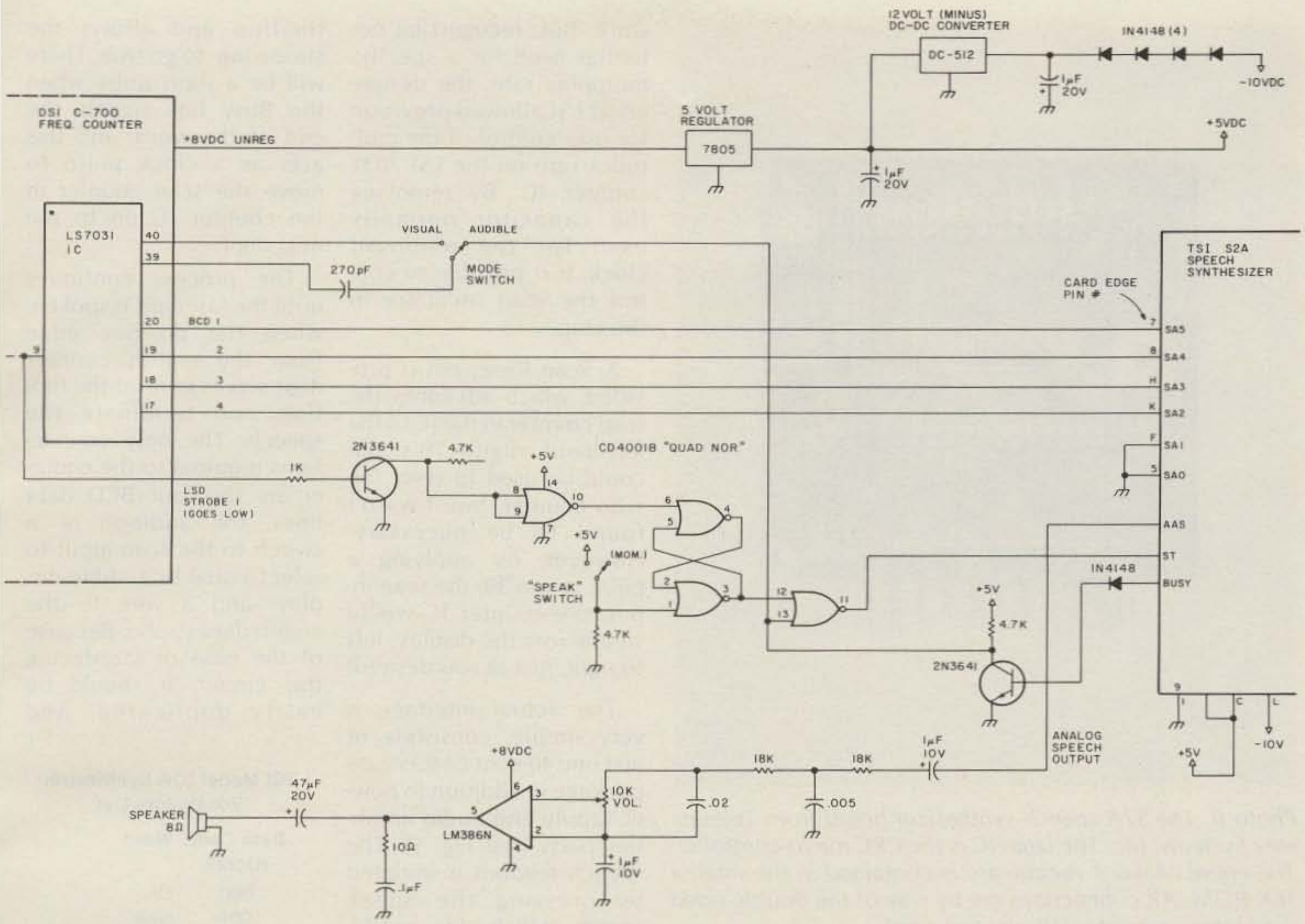


Fig. 1. Talking Counter schematic.

requirement is access to the display multiplexer clock circuit, as will be explained later.

The Telesensory Systems (TSI) model S2A synthesizer module was selected for the Talking Counter. This module provides all ten numerals, plus a few common math and calculator-type words in its 24-word vocabulary (see Table 1). Larger, 64-word models are available, but their higher cost and added features weren't necessary for this application.

The TSI module is easily interfaced to TTL levels using a negative bias voltage which can be easily obtained by use of a small and inexpensive dc/dc converter in systems where a source of minus voltage is not available. In a year of playing with the synthesizer

module, it has proven to be quite rugged and resistant to handling and breadboard accidents. So, perish the thought of ruining a \$95 board!

TSI provides application notes which offer suggestions on appropriate filtering to eliminate excessive noise and hiss from the digitized audio signal. Since a non-standard audio amplifier was used in the prototype, some changes were made. The filter shown on the schematic is recommended by TSI for the common LM386 audio amplifier IC. Some conditioning is required to make the "Busy" line TTL compatible, but all inputs can be driven directly by TTL or CMOS circuitry.

To make speech, the appropriate BCD code is set up on the S2A input and

the Start line is pulsed. Speech will begin on the negative edge of the strobe signal. Also, once speech has begun, the S2A will signal this by means of the Busy line. This pin will go active when the module is "talking," returning to the off state when finished. By simple gating, it is easy to make the speech board say complete words, without "stuttering" or interrupting itself.

In order to make a typical digital display "speak," it will be necessary to start at the left-hand side and step across the display from left to right, "saying" each digit along the way. Some designs choose to latch every digit or to try to get in sync while the display is operating. Neither approach is easy, and neither is necessary, because of

what started out as a short-cut for the chip designer.

With a limited number of pins on an IC, it is impractical to dedicate an individual set of digit and segment pins to each digit in a multi-digit display. So, nearly every display designer relies on multiplexed displays, where four common BCD data lines are shared by all digits. Then, each individual digit is turned-on or "strobed" when its data is valid. Since the digit strobes occur pretty often (usually every millisecond or so), persistence of vision makes it appear that each display is lit up all the time. The multiplexing clock runs fast, to avoid flicker, but isn't critical.

It is so non-critical that the chip designer often relies on a simple RC time delay to make the oscillator

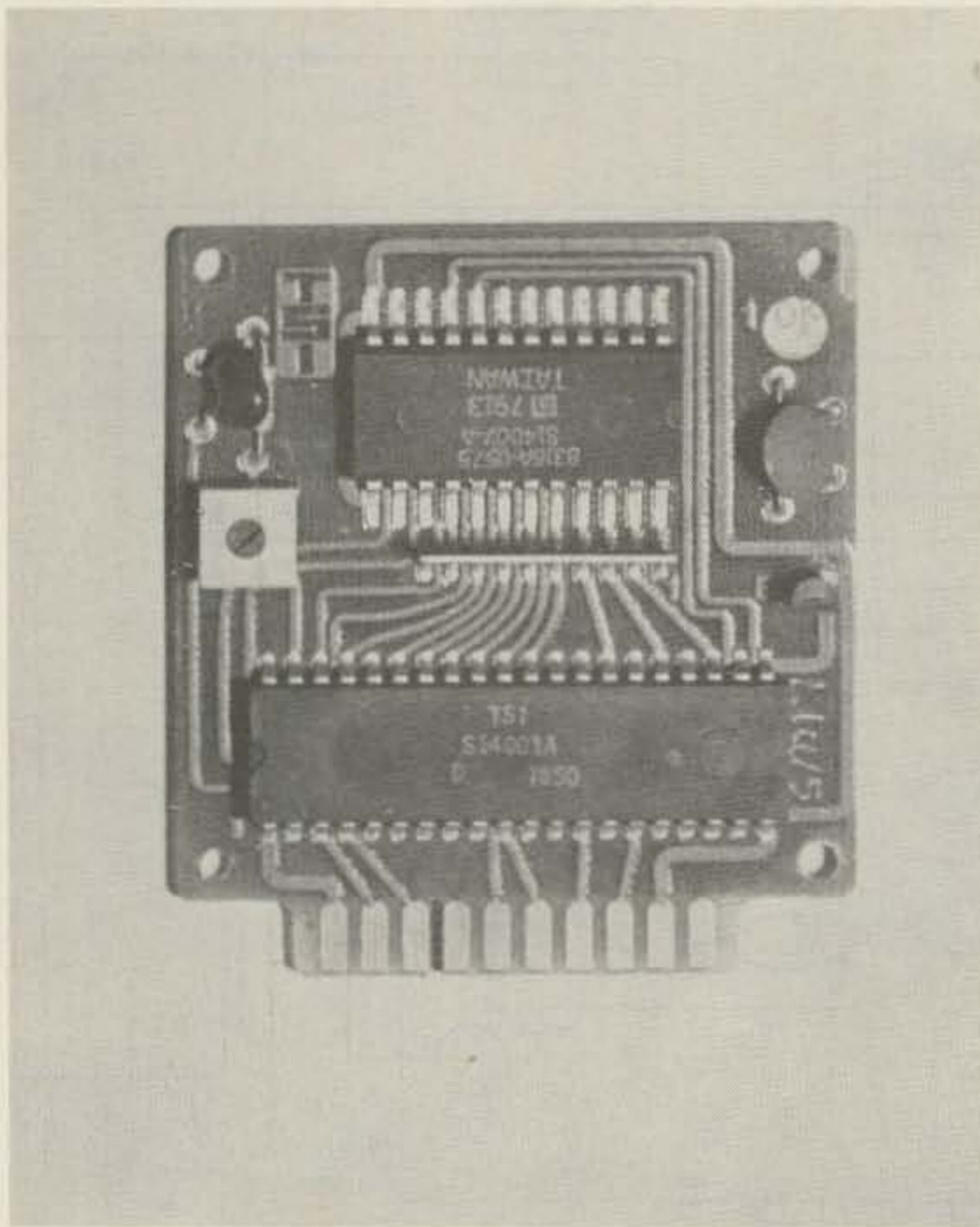


Photo B. The S2A speech synthesizer board from Telesensory Systems, Inc. The large IC is the CRC micro-controller. The entire 24-word vocabulary is contained in the smaller 16K ROM. All connections are by way of the double-sided card edge connector (10 pins per side).

work. But, recognizing potential need for a specific multiplex rate, the designers at LSI allowed provision for user control of the multiplex rate on the LSI 7031 counter IC. By removing the capacitor normally used for the on-board clock, it is possible to control the scan oscillator in the chip.

A Scan Reset pin is provided, which advances the scan counter in the IC to the left-hand digit. This pin could be used to reset the scan counter, but it wasn't found to be necessary. However, by applying a pulse to pin 39, the scan input, the counter IC would step across the display, left to right, just as was desired!

The actual interface is very simple, consisting of just one 40-cent CMOS gate package in addition to power supply and audio amplifier parts (see Fig. 1). The speech readout is initiated by pressing the Speak switch, which sets an R-S

flip-flop and allows the strobe line to go true. There will be a short pulse when the Busy line signals the end of the word, and this acts as a clock pulse to move the scan counter in the counter IC on to the next digit.

The process continues until the last digit is spoken, when the positive edge from the eighth counter digit serves to reset the flip-flop and terminate the speech. The only connections required to the counter are the four BCD data lines, the addition of a switch to the scan input to select visual or audible display, and a wire to the eighth digit strobe. Because of the ease of interfacing this circuit, it should be easily duplicated, and

TSI Model S2A Synthesizer Vocabulary List

Data Code (Octal)	Word
000	Oh
001	One
002	Two
003	Three
004	Four
005	Five
006	Six
007	Seven
010	Eight
011	Nine
012	Times-Minus
013	Equals
014	Percent
015	Not used
016	Low
017	Over
020	Root
021	Em
022	Times
023	Point
024	Overflow
025	Minus
026	Plus
027	Clear
030	Swap

Table 1. The "voice" of the S2A is that of Dr. Forrest Mozer, inventor of the speech-generation algorithm used by the LSI controller. The speech synthesizer is a static-sensitive device and normal MOS handling precautions should be observed.

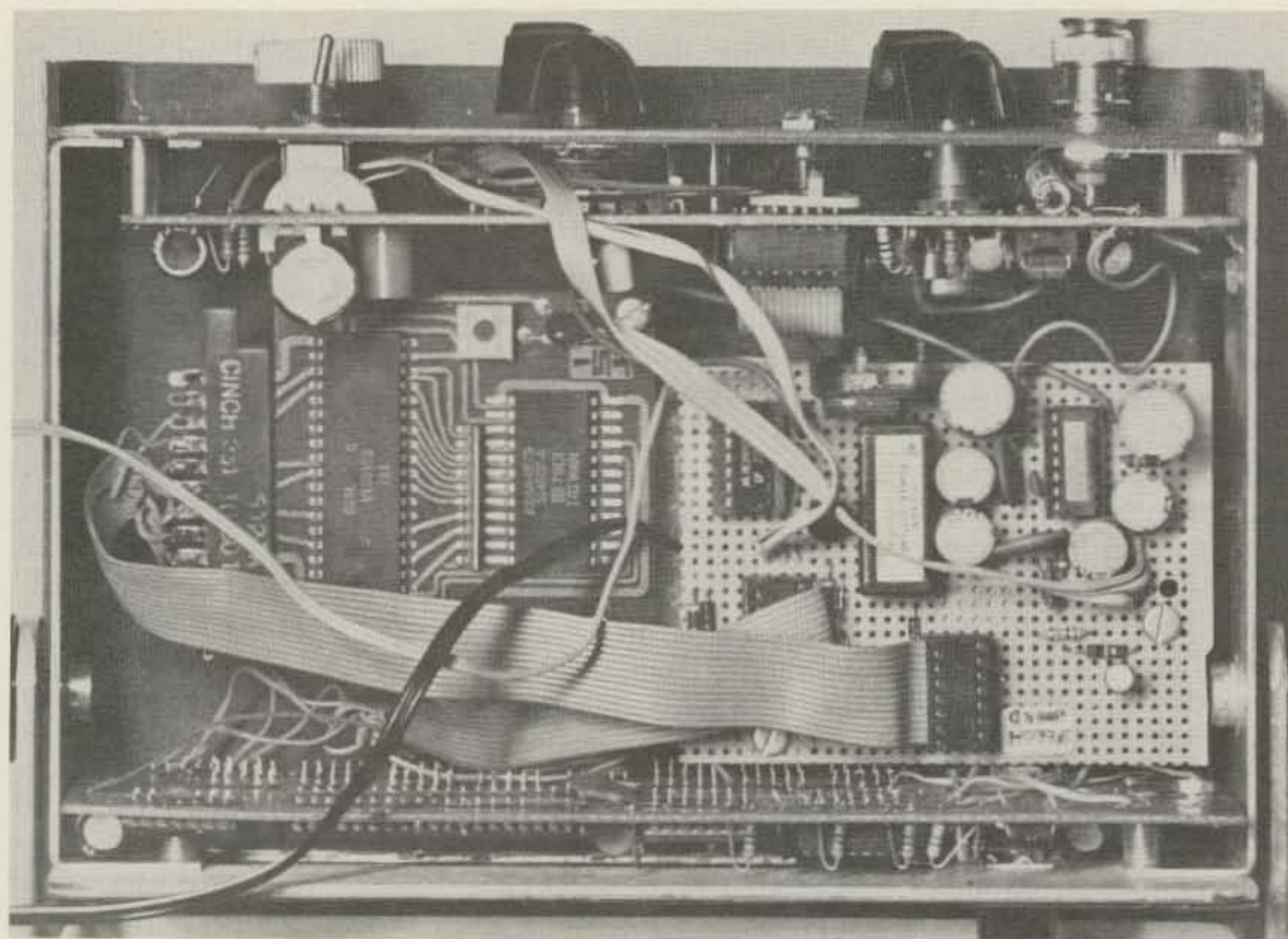


Photo C. Inside the counter. The speech board is visible on the left and the power supply and amplifier-interface circuit board are on the right. Note DIP-plug connections to counter mainframe. Large module at right is dc/dc converter that generates -10 volts for synthesizer. Speaker is mounted to top cover.



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possibly adaptable to other equipment.

A glance at the databook reveals that several popular A/D chips commonly used in digital multimeters and some clock ICs provide similar access to the multiplex scan clock. In fact, just about any device with a multiplexed display would be a good candidate for an artificial voice implant!

Construction is non-critical, and inside the metal DSI case, no problems with rf have been encountered. Removal of the lead-acid battery pack provided plenty of space for the TSI module and the interface/amplifier board. Connections are merely tack-soldered to the counter PC board, with plug-in DIP cables to the added board. Power can easily be robbed from the counter, with a 7805 regulator and the dc/dc converter

used to power the synthesizer. Minus 10 volts is needed, but since a minus 12-volt converter was available, a few diodes were used to drop the voltage a bit. Some experimentation may be needed to fine tune the audio filtering for a specific amplifier-speaker configuration. Use of a good-sized speaker helps intelligibility, as does tweaking the clock pot on the S2A board.

Further enhancements could include leading-zero suppression and automatic "point" insertion for locating the decimal. But the added complexity and circuitry required may offset any possible advantage. After a few minutes use, one becomes quite adept at reading frequencies, and frills aren't missed while enjoying the "Cylon-like" sound of the counter!

One idea worth exploring, though, is to separate the "talker" by itself, making it easier to use one synthesizer on several instruments. But in a few years, advances in speech technology will decrease costs enough that one won't mind having a dedicated voicebox in every instrument. In fact, applications for artificial-speech devices are by no means limited to aids for the handicapped.

It is quite handy to check frequency without crawling underneath a dash-mounted radio, or to be able to get a frequency report right from the repeater's mouth. At least one repeater uses the TSI modules for ID and telemetry, and more applications for this versatile and affordable module just await the experimenter's imagination!

A Talking Counter is a valuable tool for the blind ham or technician. The marriage of the DSI counter and the TSI synthesizer is a natural and, hopefully, will open the door for more useful and inexpensive applications of modern artificial speech synthesis techniques. ■

References

1. Model S2A speech synthesizer is available from Telesensory Systems, Inc., 3408 Hillview Ave., PO Box 10099, Palo Alto CA 94304.
2. Information on the LS 7031 counter IC is available from LSI Computer Systems, Inc., 1235 Walt Whitman Rd., Melville NY 11746.
3. The DC-512 dc/dc converter is available for \$9.95 each from The Megavision Corporation, PO Box 122, Columbus NE 68601.

In the Stack

— R/Cers, don't be grounded by control channel congestion! Put your ship on six!

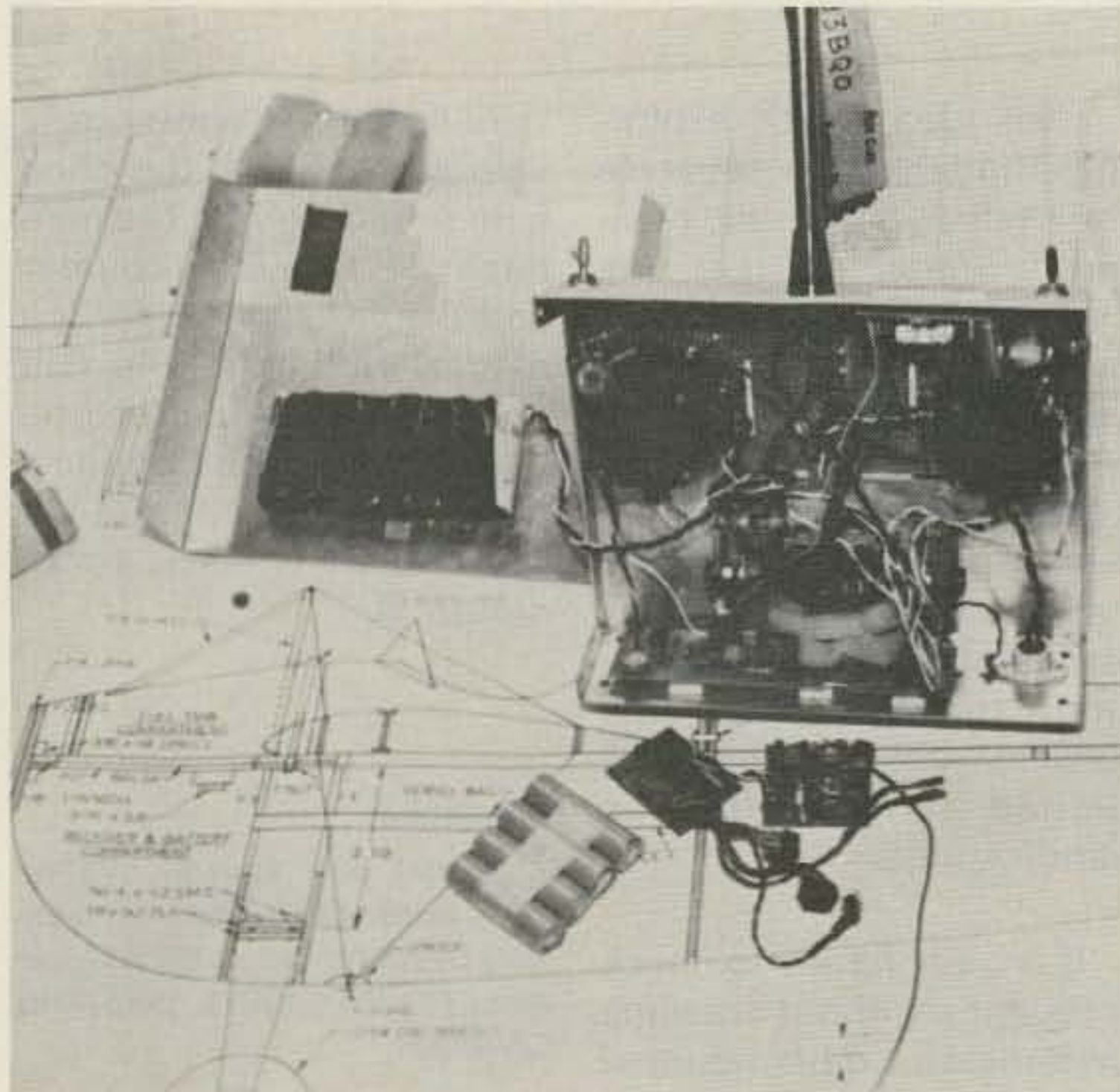


Photo A. Transmitter case open with encoder board at bottom and battery-charging jack at right. Four penlight cells of the flight pack are at left, with the decoder at center and receiver at right. Eight-cell transmitter pack at upper left is held to the rear panel of the case with silicone rubber. Switches at the top of the transmitter case are sixth- and seventh-channel controls. They are for dropping bombs or parachutes, operating retractable landing gear, or anything that does not need to be proportionally controlled.

The model airplane contest is under way. Over a hundred pilots and their planes are gathered in the open meadow. At the pilots' briefing, your radio control frequency is announced as being the most crowded. This means that instead of selecting the time to fly when conditions are best, you must wait to be called to the flight line to fly. Only one R/C rig can be in operation at one time, or the resulting interference will cause the model to crash.

With ten or more pilots on the same frequency as you, the rotation of the roster means a long wait between flights, and being hurried when your name is called. The additional pressure of being on a crowded frequency on top of the usual "first flight nerves" is unsettling and will not help your scores. There ought to be a better way!

For hams, there is a bet-

ter way. While there are only seven channels for R/C operation in the 72-MHz band for non-hams, there are five channels from 50.100 to 50.500 MHz in the six-meter band. While these are not exclusively for R/C operation, the ARRL and most ham groups throughout the world have agreed to reserve them for radio-control purposes. At a typical contest, there may be four or five hams flying, so the crowding on any particular frequency will be very light. Now, instead of having to wait to be called up to fly, you can pick the best time and choose the right conditions, not being bound by the frequency roster.

While there are several factory-built radios on the six-meter band, most hams prefer to put together a kit. The best known of these is from Heathkit®, and this brand is always well represented at the flying field.

Ace R/C, Inc., of Higginsville, Missouri, and Royal Electronics of Denver, Colorado, also make radio kits for the six-meter band. While all three firms offer some flexibility in the choice of styles in components, Ace seemed to have the widest variety of gear at lower prices than the others.

Since most R/C rigs operate on the same basic principle, the choice of gear comes down to the specific use to which the rig will be put. For small three-foot-wingspan models flown in small spaces such as school yards, the smallest and lightest rig is best. For quarter-scale monsters weighing twenty-five pounds and spanning nine or ten feet, the size and weight of the rig don't mean a thing. It takes very powerful servos powered by large capacity batteries to move the ailerons or elevator on these biggies.

The radio in the photos is the seven-channel kit from Ace R/C, with the transmitter housed in a Royal Electronics case. In operation, the rig controls the plane like this: The pilot's thumbs rest on the two control sticks on the transmitter. Each stick moves both forward and back as well as from side to side. The right stick controls the ailerons (left/right) and the elevator (forward/back). The left stick controls the rudder (left/right) and the motor speed (forward/back). The remaining controls are operated from switches and levers on the front and top of the case—bomb-drop, landing-gear retract, and wing flaps.

Each stick moves a potentiometer which varies the width of a digital pulse that becomes part of a pulse train. The pulse train has a clock pulse and seven data pulses, one for each control. The transmit carrier is turned on and off by

the pulse width (A1 emission) set by the pulse train. In the aircraft, demodulated pulses come from the receiver, which is of standard superhet design, to the decoder board. Here, the clock pulse enables the circuitry to route the first pulse after the clock to the elevator, the next pulse to the ailerons, and so on, until all seven data pulses are distributed to the proper servos.

A servo is an electronically-controlled electric motor. It moves an arm that is mechanically connected to whatever control on the plane you wish to control. When the data pulse enters the servo, it is compared to an on-board pulse-generator output which is controlled by a pot, physically positioned by the servo output arm. The on-board pulse is determined by where the arm is currently, while the data pulse from the ground indicates where the pilot wants the arm to be positioned. A difference between these two pulses produces an error, which causes the servo motor to rotate in the proper direction to move the arm/pot combination to reduce the error. At zero error, the motor stops and the servo idles, waiting for a new position indication to be sent up from the ground via the pulse train. While the transmission method is digital pulse, the net effect on the plane is smooth control, since the pulse-recurrence frequency is high enough to preclude stepping of the controls.

In actual use, all this highbrow theory is not important to the pilot and his plane. As the pilot thinks "let's do an axial right roll," his thumb moves the transmitter's right stick to the right, and as the plane half-rolls to inverted, he pushes the stick forward for down elevator, holding the nose up as the second half of the

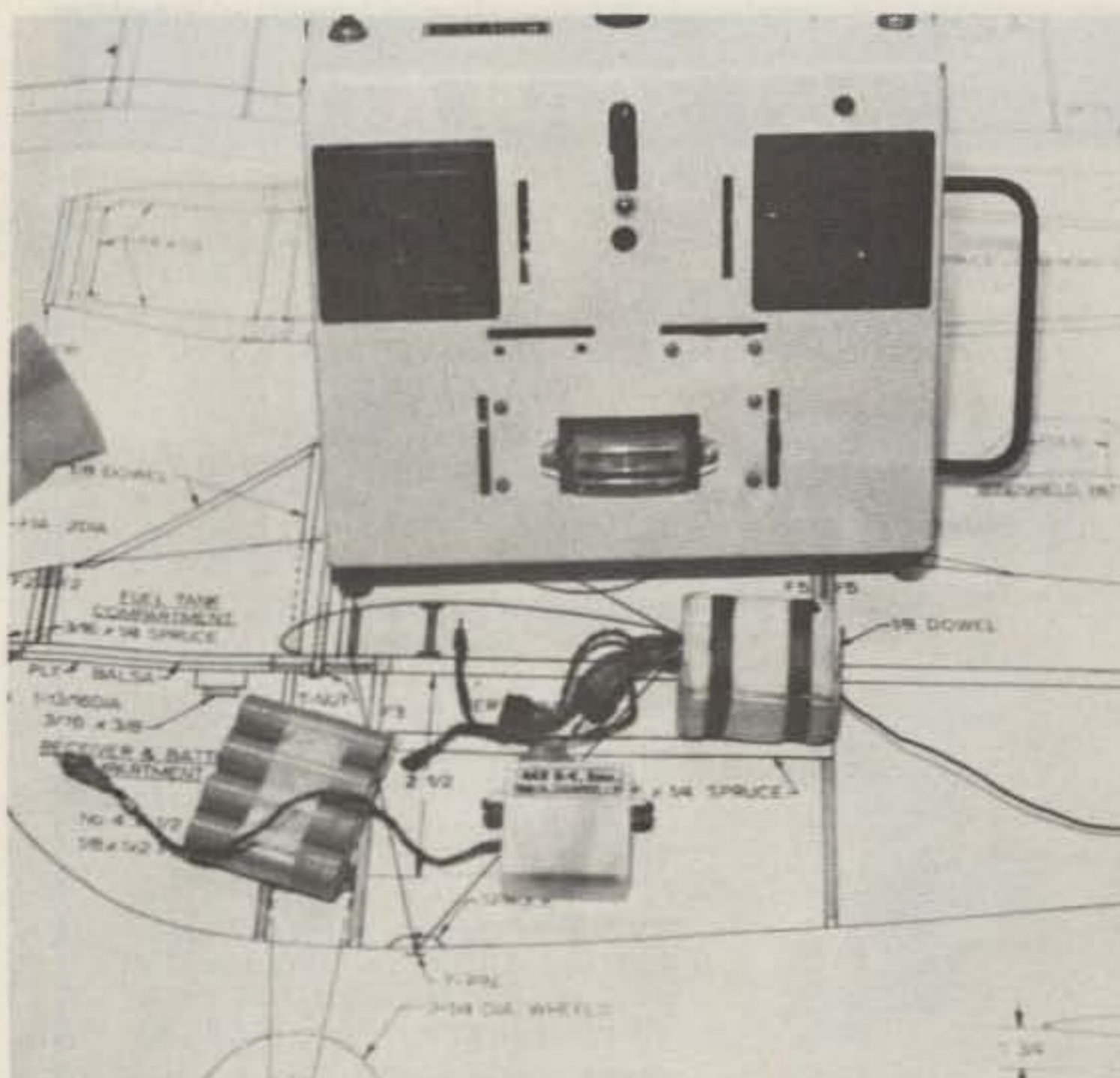


Photo B. The system buttoned up and ready to install in the aircraft. A 6PDT switch (not shown) turns the airborne unit on and off. The receiver/decoder case is covered with thin foam rubber for protection. The servo at lower center is one of four in the basic system.

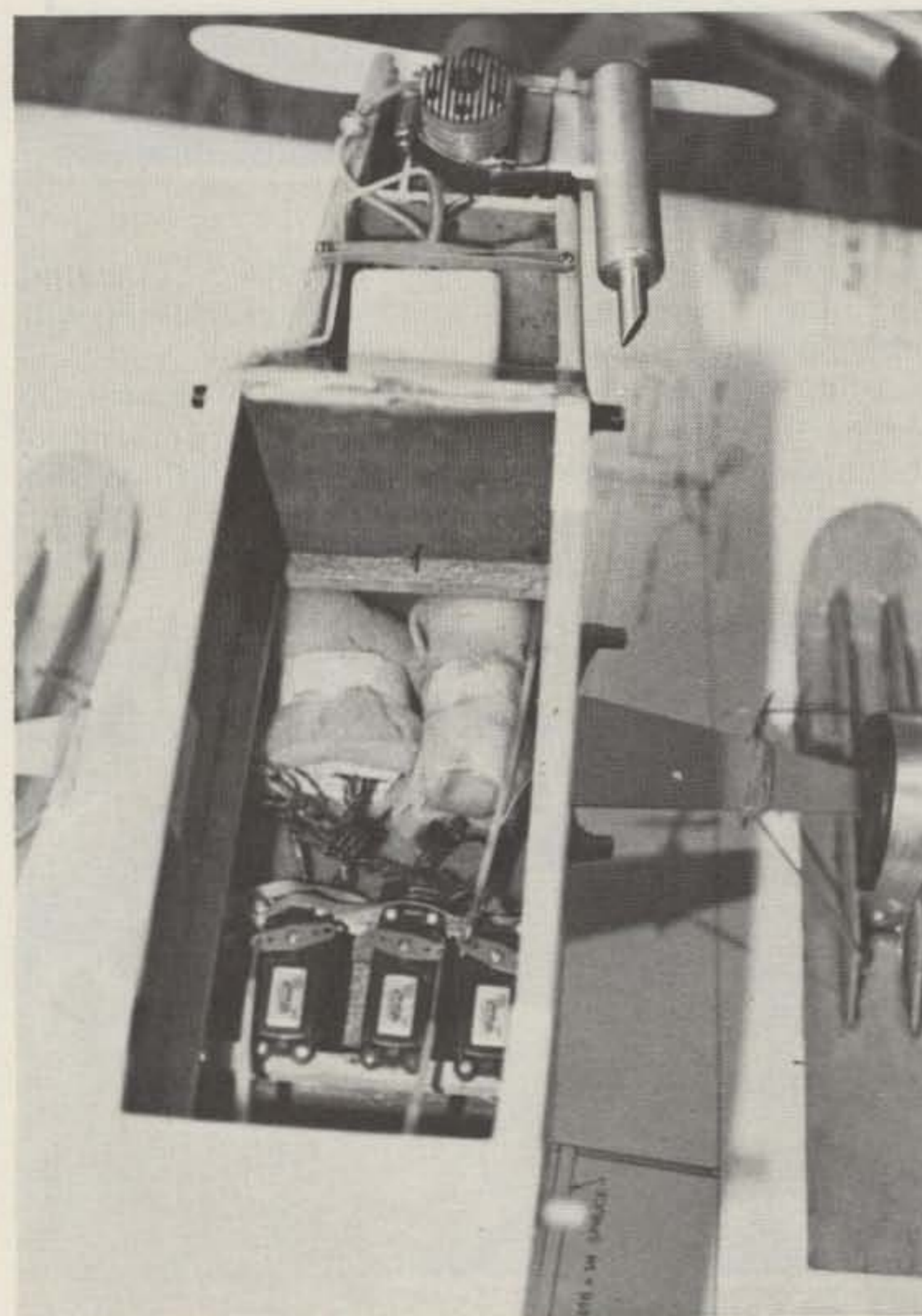


Photo C. The radio room of a typical powered aircraft. Receiver/decoder and battery are both wrapped in one-inch foam to dampen vibration from the engine. The three servos control rudder, elevator, and motor speed.

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roll is completed. The system allows the pilot to make the plane behave realistically, as if under the guidance of a miniature pilot. It allows the pilot to fly famous historical aircraft in the same way that the full-

size aircraft were operated, and to try new designs with no personal risk.

The instructions for building the kit are laid out in the same fashion that Heathkit uses. Each step is checked off, with nothing

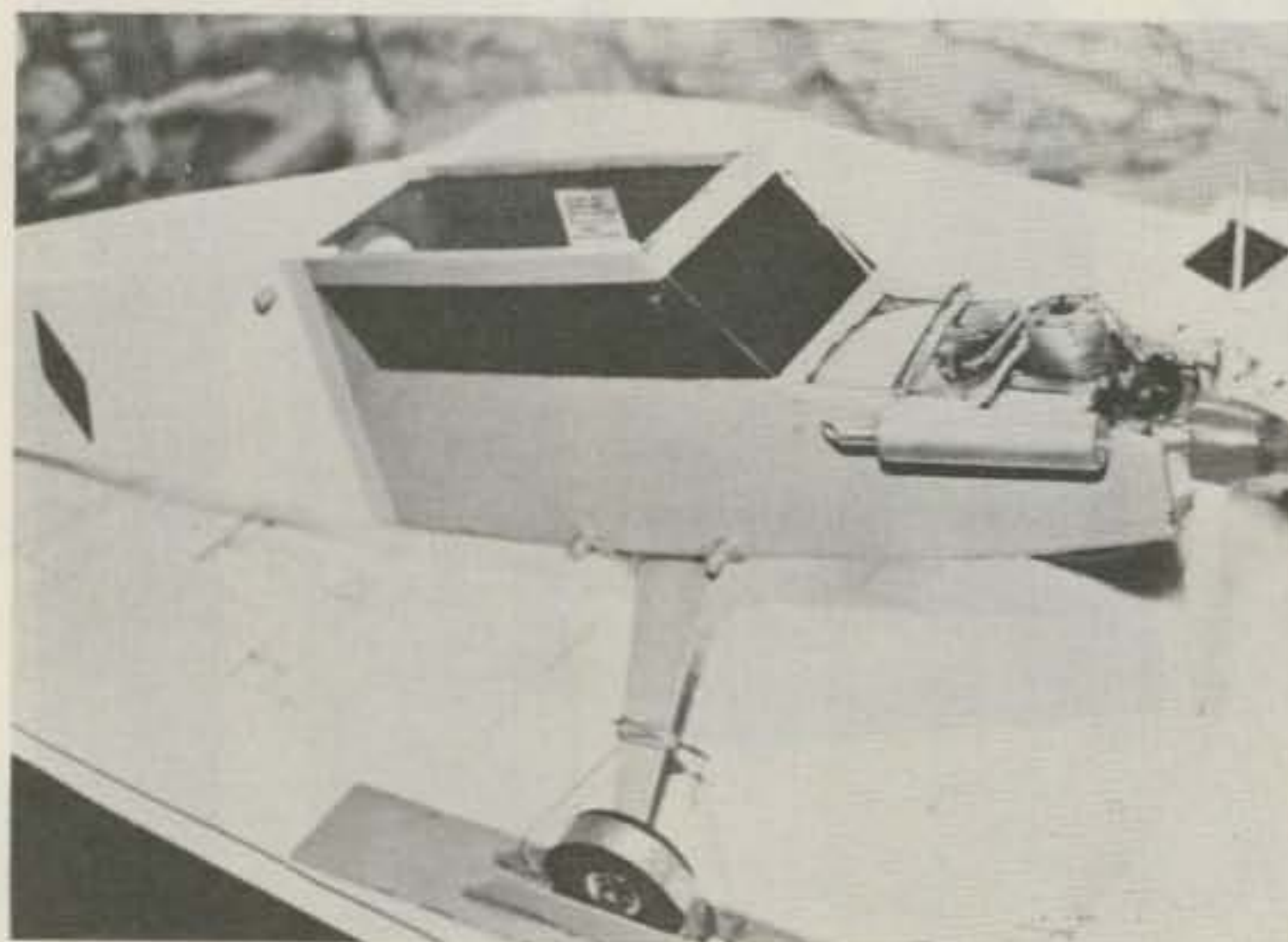


Photo D. The aircraft minus its wing. Power is a .40-cubic-inch engine with 10-inch diameter propeller. The fuel tank (just behind the engine) carries 13 ounces of model engine fuel. The skis are required for operation in that "flakey sunshine" so common to winter in the northeast.

left to chance. The many illustrations make parts placement easy. While the whole system is complex, the sequence of assembly and attention to the smallest detail make it one of the easiest kits to build.

Unlike most amateur gear, this radio operates in a very hostile environment. In powered planes, the engine is a single-cylinder unit and not very well balanced. This 20,000-rpm massager will loosen a poor solder joint in short order. Any metal-to-metal contact produces static noise which can jam the incoming data stream to the receiver. If severe enough, the noise will effectively lengthen the pulses, making the servos all run to one extreme, which could result in a spiral dive into the ground.

Nicad batteries in the transmitter and airborne system have their own requirements of care and feeding and dislike vibration as much as the circuitry does. By using heat-shrink tubing over connector/wire junctions, taping batteries together solidly, and wrapping the receiver and battery pack in foam rubber, the effects of vibration will be greatly lessened.

Ongoing maintenance is the only way to keep the radio from having trouble. To help with this, a monitoring system was built into the transmitter to check on vital voltages. At the top right corner of the transmitter case, a small LED is mounted in a grommet. The LED will not light on less than 8.9 volts and is wired across the string of eight AA cells, which are 9.6 volts at full charge. When the LED goes out, very little time remains for the pilot to land the plane, or gravity will do it for him.

The transmitter encoder uses about 6.0 volts from the battery. A bad cell would not put out the LED, but may tear up the pulse

train at the encoder board. For this reason, the meter at the lower center of the transmitter case monitors encoder current and is much easier to see than the LED in full daylight.

Tests of the airborne battery are made using a Heathkit expanded-scale voltmeter, Model GD-1188. It costs about \$17.00 and reads the battery under simulated load. Using a mating plug, the meter is connected to the battery through the charging jack at the on-off switch. This tests the cells, all the wiring, and the switch itself, so items most likely to cause trouble are tested as a unit. This is the last check made before the plane is closed up for the day's flying.

The model airplane version of Murphy's Law states that your radio will become inoperative only on the day before the big contest. With a factory-built rig, the only option is to return the radio for service and miss the fun. With kits, all the prints and schematics are on hand, and by knowing how the radio went together originally, the chances of beating Murphy and fixing the problem are very good.

No matter what type of plane your rig ends up controlling—be it a highly-detailed scale fighter or a simple glider—there is no feeling quite like the one you get from flying a plane and radio that you built yourself. And come contest day, when it's time to hand in your transmitter at the impound desk, it will feel great to be able to say to the official that your rig is the custom job on six meters. ■

R/C Kit Manufacturers

Ace R/C, Inc.
Box 511E
Higginsville MO 64037
Royal Electronics, Inc.
3535 South Irving St.
Englewood CO 80110
Heath Co.
Benton Harbor MI 49022

All the News that Fits

—make your club newspaper a winner!

Wouldn't it be neat if...! It would be a great idea to have our own...! What great editorials I could write...!

Have you had these ideas in your mind lately, only to be stymied by the logistics involved? Do you have newsprint in your veins? Were you captivated, as a child, by the miniature print set you received from Santa Claus? (I never did get the knack of setting the type correctly with my super duper mini-print shop.) Have you mentioned the idea of having your own newspaper at a club meeting only to open the floodgates to who, what, where, why, and, more to the point, how?

Let's investigate the possibilities.

Why have a club newspaper? Amateur radio is communication. Most news is spread via the radio on club nets. So why have a newspaper? The same argument could be applied to television news. Most of us watch the up-to-the-minute local and international news on our favorite TV channel, but many of us also grope

in the early dawn to fish out the newspaper from the bushes to read what we heard about the night before. Newspapers give substance to the news. We can learn more when we read (and reread). When the facts are clearly stated in black and white, then we learn at leisure.

We read newspapers to find out what's happening, to catch up on what we missed, and to learn more details about the events we're interested in—to be in the know.

Club newspapers do all this and more. More, because it's a local paper giving tidbits of information about people we know and things we ourselves are involved with. The club newspaper is a uniting factor, keeping everyone up to date and making members more active. Even inactive members feel more a part of the club when they read their club newspaper.

Although club activities are important to club members, most things are not national news to be printed in QST or other amateur journals. So, members have a

chance to see their name in print, to be congratulated in upgrading or to be congratulated (or consoled) on their recent marriage, or birth of a new baby or grandchild, or anniversary—things that are important to us as people. (Much to the amazement of many, hams are people, too!) The club newspaper unites members on a social basis.

A ham is more likely to communicate about his latest antenna than to mention on the air that he is a newlywed or that the new baby is keeping him up nights. Getting to know one another on a social basis as well as on the air is a good way of keeping a club active and growing. We feel more like friends than just radio comrades.

Club newspapers are more than just club newspapers. That's right, club newspapers are publicity or public relations for amateur radio. The best public relations are not necessarily the biggest, flashiest commercials with catchy tunes behind them. The best public relations is everyday personal contact.

Ask a doctor or dentist what his best source of advertising is. He will probably tell you he doesn't advertise, that his patients are referred from other patients (word of mouth). Even with regard to a movie or a show or a restaurant, we tend to value our friends' opinions and recommendations. Their personal comments will sway us. If Tom said the restaurant had terrific food, Dick might try it. If he doesn't like the food, he'll think Tom has terrible taste.

But he tries it; he looks into it because his friend suggested it. With hundreds of thousands of amateurs around, amateur radio has its best publicity potential in its own people. This tells us all to be amateur radio conscious. Mention it in conversations; wear "I Am a Ham" T-shirts. T-shirt slogans are the rage. Everyone wears them. How about "Ride the Radio Waves with Amateur Radio"? Think of something creative and wear it! Wear your handheld radio on your belt. (Don't forget the ham radio belt buckle.) When people ask you if you're a police-

man, say, "No. This is amateur radio." Pull out a copy of your club newsletter and hand it to them.

You see, your club newsletter makes amateur radio a more tangible thing. People can look at it, read it, and perhaps become curious about "these crazy people." (I have wondered in the past if it is a requirement that a person be crazy to become a ham.) One way or another, the whole world is crazy, so we're all susceptible to the magic of amateur radio. All amateur radio needs is exposure.

Take extra copies of your newsletter with you in your car and pass them around. Leave them in your employee cafeteria for others to see. Give beginning amateur radio books and kits for Christmas presents. Start a ham station where you work. In amateur radio publicity, it's the little things that count. If everyone does a little, amateur radio will have a lot.

In our investigation of "why" an amateur radio club newsletter, we have delved into the "what." A club newspaper can be anything from a one-page edition to a twelve-page paper (or more).

Where does the money come from? Most clubs are their own publishers and take the funds from the club treasury. Usually, the treasury is supplied from club dues, hamfests that were held, or even raffle money. It is evident that in most clubs the treasury is not an unlimited source of supply.

Cost is a relevant factor in the type of newspaper your club will have—the kind of paper, printing, number of pages, etc. One big expense is postage. Check to see if your club qualifies for nonprofit bulk mailing privileges with the post office. However, going first class does have its advantages. The main advantage is that the member re-

ceives the newspaper within a respectable amount of time. I have received bulk mail as much as two weeks after the proposed event even though the senders felt they mailed it early.

Most club newspapers that I have seen use one 15-cent stamp and sometimes have double issues with 28 cents in stamps. If standard 8½" × 11" paper with a sub weight of 20 is used, one stamp will cover six sheets (12 pages) if no envelope is used. Just fold over the newsletter and address the bottom half of the last page and staple. Or five sheets (10 pages) can be sent in a standard size envelope with one stamp. (Warning: The post office is always changing its rates and rules, so keep abreast of the latest with your local post office.)

A club newsletter, first of all, contains club news: the date, time, and place of the next meeting and a description of the program for the meeting. Lists of activities such as foxhunting, Field Day, radio calibrating day, club picnic, a Christmas party, or anything that the club is currently involved in, can be put into the club paper.

Next, include congratulations to the members on upgrading and any personal notes that you can dig up during the month. Then, depending on the amount of space left, you can fill in with amateur-related articles such as: comments on amateur radio news at large, regulations, FCC changes, antennas, etc. Anything and everything that the editor and members can think of can be put in the club newsletter, except politics. The club newspaper is a written account of club activities and members' interests.

Who? is always the 64-thousand-dollar question. Be assured, if you bring up the idea, you will be the first one considered for the job of editor. Experience is

useful in any case, but not a real consideration. The real consideration is the willingness to do the job. Some clubs just make it the responsibility of one of the officers, such as a vice-president, for a one-year term. Somehow it's not so bad to know that you only have to do 11 issues. (You get one issue off for summer vacation.)

No matter who is the editor or responsible person for the newsletter, he/she will need the cooperation of the whole club. There is nothing more frustrating for an editor than to be at deadline and not have the necessary information. An editor is not an investigative reporter who has to sift through all the scuttlebutt and info to find the true facts. An editor reports the news as given to him.

Where does all this news come from? *The members!* If someone is a little too modest to report an upgrade such as passing the Extra exam when all he was trying for was his Novice license, then one of his friends should report it. It is up to the members to keep the newsletter interesting. Too many members think, "Oh, they'll hear about it." Or, "That's not important enough." *Anything* concerning the members is of interest in a club newspaper.

It is the responsibility of the editor to correlate all of the various items and to lay out the material on the pages. The editor cannot manufacture news. Since this is a volunteer, non-paying, do-it-in-your-free-time-when-you-could-be-DXing job, the editor does not have the time to search out stories. The more people who contribute to the newsletter, the more of a club newspaper it is, instead of just a one-man show.

One thing I have found: Don't just ask in general for people to contribute information or articles. An editor must impose upon his

friends. "I heard about your new antenna, Bill. Would you please write something up on it? Anything at all, Bill, that you want to tell us about your new antenna." You must ask directly on a specific topic. The more people you ask, the better your chances are of getting any copy back in return. Many members are surprised that you are even interested in their projects and are happy to comply with your request. (Maybe not happy, but they grit their teeth and do it.)

An editor's job is to plan. After relevant club news, any other articles or info of interest to amateur radio in general can be included, depending upon the amount of space available. This is why it's so important to have a specific deadline. When the deadline comes, the editor gathers all the information submitted to him during the past month and figures out how much space different articles need and what looks good where.

Don't despair. It's not really hard and the more you do it, the easier it becomes. But let me repeat—there is nothing more frustrating for an editor than to be at deadline and not to have the information needed. A joy of an editor's life is having too much material! Then he can plan what will go into the next issue and be that much ahead of the game.

It's just too easy to let the other guy do it. If a newspaper is to be successful, the members must cooperate. The beauty of it is that the members really don't have to do very much. Each gives a little and the news comes flowing in. Letters to the editor are always interesting. Members can send in their public service reports such as calling in traffic accidents and other related public service info. The local ARES EC can submit material to the editor about

ARES activities or even just give pep talks via the newsletter. But the vehicle of the newsletter must be used or it will die or atrophy. If the members don't care enough to send in the material, after a while the editor will feel that he is wasting his time.

The form in which the material for the newsletter is sent depends upon the individual club. The varying factors are many. Some editors (or a club typist) type up the entire newsletter and send it to the printer. Others give out specifications on, for example, margins and ask that the individuals hand in the material already typed. The editor then pastes up the various articles, using rubber cement. Many editors are just happy to receive the material and ask only that the handwriting be legible!

Keep in mind credit lines. It's wrong just to copy someone else's work word for word and pass it on as your own. If it's copyrighted, then write to the party involved to get permission to reprint. This is very simple to do and most people are glad to give a nonprofit organization cooperation. If your source is another newsletter, just be sure to give a credit line to the author of the article and the newsletter in which you found it. The Golden Rule is certainly applicable in this situation.

One great source of extra information (filler) is the National Aeronautics and Space Administration's publication, *Tech Briefs*. This is a collection of the various research and development projects carried on by NASA. *Tech Briefs* applies space technology to Earth problems. It's an impressive publication, sent out quarterly. There is usually something of interest to hams in the publication. When I wrote for permission to reprint, the reply, from Louis Mogavero, Director, Tech-

nology Utilization Office, was:

"NASA *Tech Briefs*, once published, are considered to be in the public domain. They may be reprinted by anyone, without permission from NASA."

If you're interested in receiving a copy, just write to: Director, Technology Utilization Office, PO Box 8757, Baltimore/Washington International Airport MD 21240.

Another good source that gives permission for reprinting is *HR Report*. *HR Report* is an up-to-the-minute newsletter published weekly, reporting happenings in amateur radio across the country. It makes great filler copy. All they ask is that a proper credit line be given. If you're interested in receiving it, write: *HR Report*, Greenville NH 03048.

Worldradio News is an amateur newspaper published monthly concerning radio news in the world. They say, "*Worldradio* is an international conversation. You are invited to take part. Our newspaper is written by its readers.

"Our goal is to be a valuable resource of ideas and experiences beneficial to the amateur radio community. We publicize and support the efforts of those who bring the flame of vitality into this avocation."

Editors of club newspapers may exchange their newsletter for a copy of *Worldradio News*. They also automatically grant permission to reprint. If you're interested, write: *Worldradio, Inc.*, 2120 28th Street, Sacramento CA 95818.

Another interesting untapped source of information is your own collection of amateur radio contacts. Along with my QSL cards to foreign lands, I enclose a note with a copy of the newsletter, asking for stories about amateur radio in their countries or just information on themselves. Everything considered, I've got-

ten terrific response. I always send them a copy of the newsletter with their story, written in their own words, with their byline. This is a good way for amateurs to create international goodwill. Not only that, it's educational for us to learn about how others in the world operate and live. Communication between people is the only hope for world peace.

How to get your paper printed is a goodie as far as problems go. The best thing is to find a ham who is also a printer, and use your power of persuasion to have him print up the newsletter. If you have the president of a large company like Xerox® in your club, persuade him to volunteer, and you're in like Flynn!

Lee Knirko W9MOL is editor of *QCC News*, the publication of the Chicago Area Chapter of the Quarter Century Wireless Association; also, he was president of the Amateur Radio News Service. Lee suggests:

"There are generally three ways to produce a paper. Offset press, photo process (Xerox or other electrostatic copier), and duplicator. Each has its advantages and disadvantages, including the cost per page. Generally, though, clubs usually use what is available. Particularly when it is free or cheap! Finding a ham printer using offset is the best of all worlds because of the flexibility and low cost per page, particularly if a fairly large quantity is printed, say over 200-300 copies. If fewer than, say, 25 copies are distributed, offset is expensive and one of the other methods is more favorable."

Xerox is a popular process used with club newspapers. Lee says:

"Many, but not all, tricks available to offset reproduction can be done with Xerox. You can reduce (8-1/2" x 11 from 11" x 14" is the most favorable), print two sides,

and automatically collate. The quality is not as good as offset, particularly for photos (screening helps), large black areas, or material previously Xeroxed. We now pay about \$75 an issue for 250 copies including photos and other graphics at my local ham printer."

Club finances, of course, influence the number of pages and type of printing done for the newsletter. There is only one way to find out the best method for you and your club: trial and error (which also is known as "Research and Development"). As Lee W9MOL says, "Bear in mind that reproduction quality is *not* the most important element in a club paper. If the *content* is there for *your readers*, they won't care how it's reproduced."

One nice thing about editing a club paper is that you get very few complaints. (I wonder why...?)

Eeks!! What do I say? You simply report the news in your own words. Everyone has his own style of writing. Keep in mind to have the five Ws—who, what, where, why, and when; you won't go too far wrong. Lee W9MOL has more advice:

"Before starting on an issue, you need to make a list of everything you might put into your paper. Then you need to type the material or get someone else to type it for you. You then pick and choose, expand or contract, to fit space needs. The first sentence is the 'grabber' designed to catch the readers' attention so they'll read on. Get some sample newsletters and study them for help in developing your own style."

Also have a standby dictionary. It's amazing how simple words don't "look" right when you know it's going to be printed hundreds of times. See if you can coerce someone to proofread for you. When you're familiar with the content and

writing, it's very hard to find your own mistakes until after it's printed. Then every error sticks out like a sore thumb.

Another help for editors is the Amateur Radio News Service: a volunteer organization dedicated to helping anyone involved with PR work or newspapers. Once a month, ideas are pooled from editors and PR people from all over the country and are printed in the *Bulletin*. They also have a booklet that is sent to new members entitled *The Club Paper*, which goes into detail as to the mechanical aspects of printing. If you're interested, write to Fran Norrick WB9WPS, Secretary, ARNS, Route 6, Box 239, Kankakee IL 60901.

Be an administrative editor. This is your chance to be an executive! As Lee says, "Consider the administrative editor who persuades his or her club's officers and members to submit

good material, finds someone who likes to draw cartoons, recruits some volunteer typists, locates a ham printer, organizes a circulation committee, and oversees to see that they have the finest paper for the club."

The more reporters you can assign, the more columnists you can draft, the more fun your newsletter can be for the club members.

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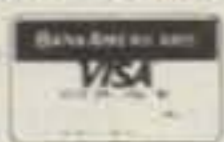
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My Infernal Tower

— tales of a flying fiasco

Up! The higher the better! My Novice antenna was barely high enough to walk under. The next one wasn't much above the roof. Higher! Tie sawmill scraps together with coat-hangers. Guy them to the fence and the woodshed with baling wire. Get that droopy dipole up there!

Good enough? No. Crooked as a dog's leg, and ugly besides. And with all the effort, it isn't as high as the electric wires to the east. And there is still 200 feet of rock to the west. Signals coming in all the way from Hawaii are not tough enough to penetrate much rock. Maybe there isn't such a thing as "good enough." Maybe "good enough" is just an illusion.

A man came to my store and traded a nice TV antenna and mast for some used duffel bags. Before the sun went down, that hardware was all standing on end. TV reception was better, even if the programs weren't. The FM station from fifty miles over the mountains came in perfectly. We could listen to beautiful music. And I had a taller skyhook. That was the real motive.

W7KJM lent me an inverted vee and an NCX-3. I tied a dead padlock to a length of nylon line and slung it over the TV antenna

and hauled up that loaner. Aha! Forty meters is mine!

But even the top of the thing is lower than the high-lines. *Nothing* would do but a tower. But towers seem to start at a month's wages. And they have no upper limit. Besides, it seemed sinful to spend anything on a hobby as long as I still owed on the homestead mortgage. ("Mort" is Latin for "dead." "Gage" is Latin for "pay-'til-you-are.")

The Final Solution

Anyway, one fine day we made a last back-breaking payment and the mortgage company sent us our title. And a few days after that an ad appeared:

COLOR TV \$75. Waterbed \$100. 30' aluminum twoer [sic] \$90. Trash-trailer \$250. 537-XXXX

Now, a "twoer" thirty feet long might be a boat—but not for \$90. Then, again, it might be a tower. It was a long-distance call, but I dialed during daylight.

"Popopopopop. Popopop. Popopopopopo pop," etc. "B-r-r-r-r-r-r-r-r. B-r-r-r-r-r-r-r-r," etc.

"Raunchy Realty. Betty speaking. May I help you?"

"You advertised a tower for ninety dollars?"

"Yes, sir. Would you like to look at it?"

"Yes, ma'am. Could you tell me...?"

"Yes, sir. We'll have it all cleaned out and the lights on by tomorrow noon."

"Lights?"

"Naturally."

"On a thirty-foot tower?"

"Tower?"

"Yes, ma'am. Tower. Maybe I have a wrong number. Excuse me."

I hung up and dialed again.

"Raunchy Realty. Betty speaking."

"Uh, this is me again. Is somebody in the office selling a tower?"

"Wait. I don't know. Uh, I thought you wanted to rent that garage for ninety dollars. Fred. Ff-rr-ee-dd! Somebody wants a tower."

"Tower? Oh, yeah," I heard in the background, along with a typewriter. "George has one he wants to get rid of. It's that pile of scrap iron in the alley."

It was fifty miles away. We were there very shortly. George was not there but his tower was. It looked so pitiful lying in three pieces by the garbage cans. It didn't look like it would even reach the eaves, much less the high-lines. I picked up a section in each hand. It was not aluminum, but steel. Even so, it didn't weigh much. I had really expected something much, much heavier. On the other hand, the sections seemed

stiff enough, braced that way.

Well, this was what I came for. George showed up and I paid him with money I had borrowed on my credit card. We went home, and the thing laid out behind the house for an unconscionably long time.

The most obvious thing to do was to dig a big hole next to the peak of the roof, stand the bottom section in it, and fill the excavation with wet cement. I could bolt on the other sections after the concrete cured and brace it to the house.

No. That was the only direction we could ever hope to build onto our house.

By-n-by, I traded a fairly good swivel chair (that only needed a little welding and only had a small rip in the cushion) for three unequal lengths of nearly straight one-inch pipe with only a little surface rust. They would not fit into the tower legs. After two hours of hard filing, they were still a smidgen too big. I took them to the welder. He told me what it would cost to turn them down on his lathe. Too much. Inspiration struck. I took the pipes to the hardware store. For a buck, the nice man threaded the first four inches on each one. That reduced the diameter a little and they fit into the tower legs just fine.

I dug a hole and calculated the amount of concrete to fill it up. Fifty bucks?! No way!

I bought ten bucks worth of instant-mix concrete and gathered about a ton of rocks. I joined the pipes to the bottom of a tower section and stood it up in the bottom of the hole and plumbed it with a carpenter's level. The carpenter was using some other tool at the time and didn't mind a bit.

By choosing the rocks carefully, there was not a lot of space between them. A layer of rocks and a pour of soupy cement poked down with a stick; another layer of chunks and more liquid stone. The pre-mix and the stones and the hole came out remarkably even. I smoothed it off immediately and again an hour later. At sundown, I carved a date in it and covered it with dirt so it wouldn't dry

out before it had a chance to cure. (Contrary to common belief, concrete does not harden by drying out. It actually combines with the water and becomes a different sort of substance.)

There stood my stub of a tower for a long time. It began to look like the situation described in Luke 14:28-30. I climbed up, balancing the second section on end, and tried to fit it on top of the first. Maybe it can be done. Maybe a suicidal maniac will accomplish such a thing, someday. I won't try it again. Ever.

Success By Committee

W7KJM promised me a crew for an antenna-raising party if I would put the whole thing together. So, I got all the bolts, insulators, guy wire, and turnbuckles I thought I needed. I set the guy anchor posts deep in the ground and tamped buckets of rocks around them. I

took that lonesome section off its makeshift base and put the whole tower together and attached the guys.

Exactly at the appointed hour, Ed, Ray, Paddy, Bob, Randy, and Dick drove up in a convoy.

One minute later they were all driving away again. The tower was up and guyed. They barely stopped for the sandwiches and Kool-Aid my wife brought out to the "party." They wouldn't accept pay or thanks.

"That's what ham buddies are for, Glenn."

That was quite a while back. I admire the tower every day. (What else is it good for? I don't have an antenna to put on it.) I climb it sometimes for the superb view from the top. I made a brace for the base because those three pipes go eye-high out of the ground before the tower even begins.

Today I bought nine feet of 1 1/4-inch pipe for a mast. It was a foot too long to go into the tower from the side. No way was I going to carry it up to the top and try to stuff it into the socket from above. At the price I paid, I sure didn't want to saw off a foot of it. Finally, I dug a hole in the ground and shoved the mast into the tower *from below ground*.

It is night. As I write this, my tower and mast rise way above the electric wires. Maybe I will have an antenna soon. There's this guy down in Phoenix with a 20m beam for sale. If he'll just wait until the garage-man finishes putting a new motor in my pickup, I'll borrow some money on my credit card again and go buy it. It's only a five-hundred-mile round trip, and I want to take my children to visit their grandparents, anyway. ■

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Apples: Five Bits or Eight

— tired of "Space Invaders"? Then turn your Apple II on to RTTY!

Carl Jensen WB6MEP
9842 Palais Road
Anaheim CA 92804

If you have run out of things to do with your Apple II lately, you might

like to try this project. It will get you operating on 5-bit RTTY and, with a little rewiring, 8-bit ASCII also. For 8-bit ASCII, you will have to rewrite the program. The Apple II interface in Fig. 1 is built around the COM 2502 UART. The AY5-1013 is an exact replacement and may be used. The system can be used with any SSB or FM transceiver.

bit 5 high, it puts the next character to be transmitted on data-bus bits 0 through 4 and sets bit 6 high also. Bit 6 high is \overline{TDS} and enters the character into the UART at TD1 through TD5. The UART then clocks the character out serially at TSO. One start bit and two stop bits are added by the UART.

Enabling \overline{RDE} and \overline{SWE} puts the received data and status bits on the data bus. When not enabled, these outputs are at a high impedance and will not disturb Apple operation. IC6 is the 16 × clock generator. Provision is made for either 60- or 100-wpm operation.

Fig. 2 is the demodulator. Receiver audio is fed into J1 from your receiver headphone jack. The speaker is handy for listening to incoming signals. The audio bandpass filter is not necessary but can help with QRM and QRN. Also, the output of the filter can be fed to a scope for use as a tuning indicator of sorts. More on this later. I used an Autek filter. You can use any kind of filter you wish, or none at all. During FSK, when the demodulator senses a 2295-Hz tone, it puts out a high level at J2. When a 2125-Hz

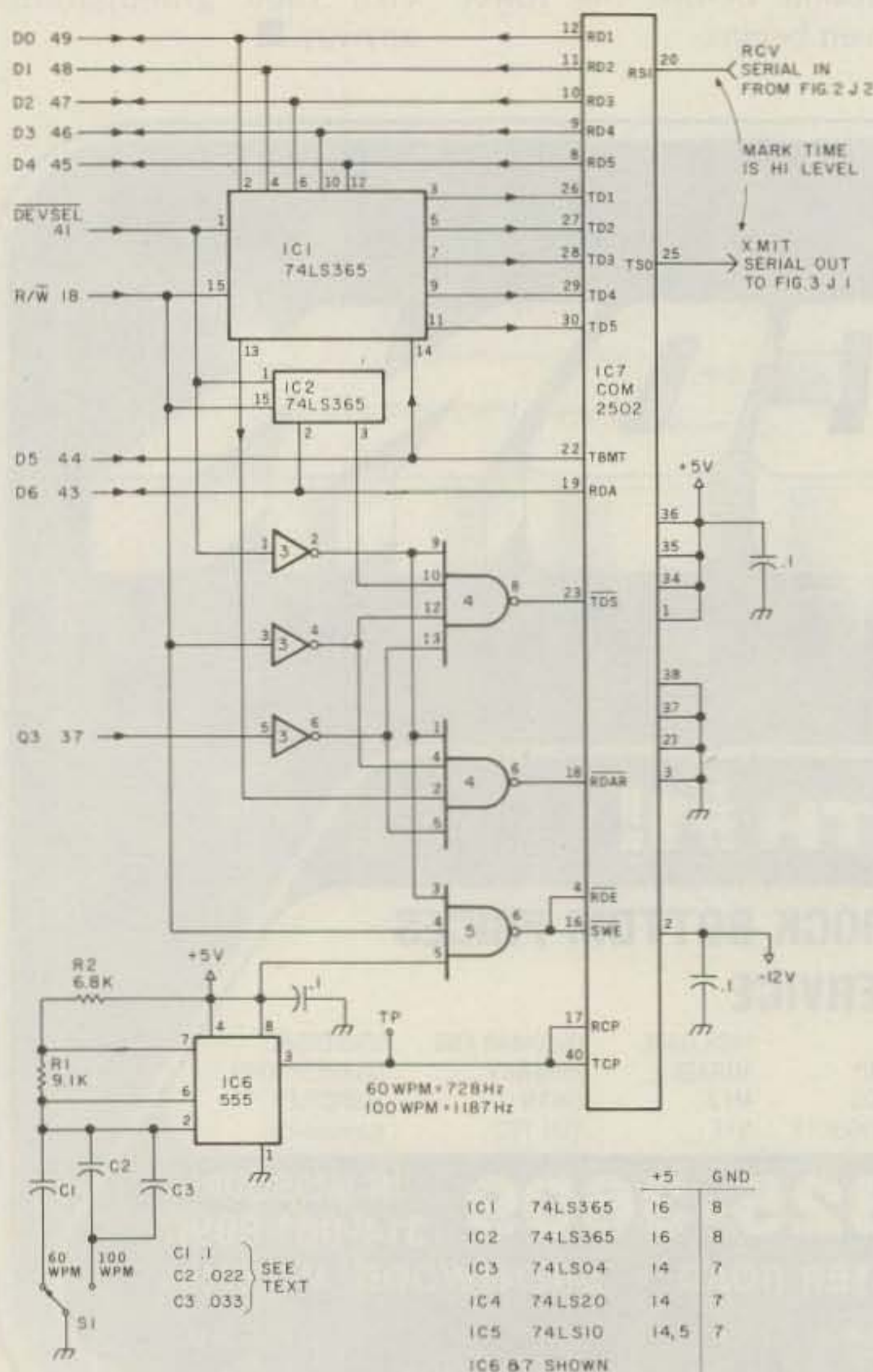
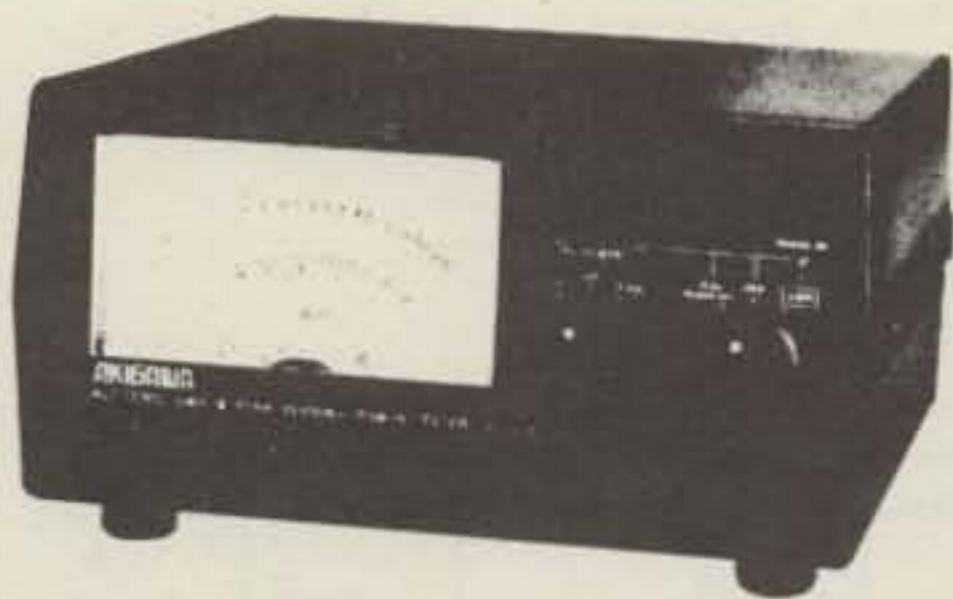
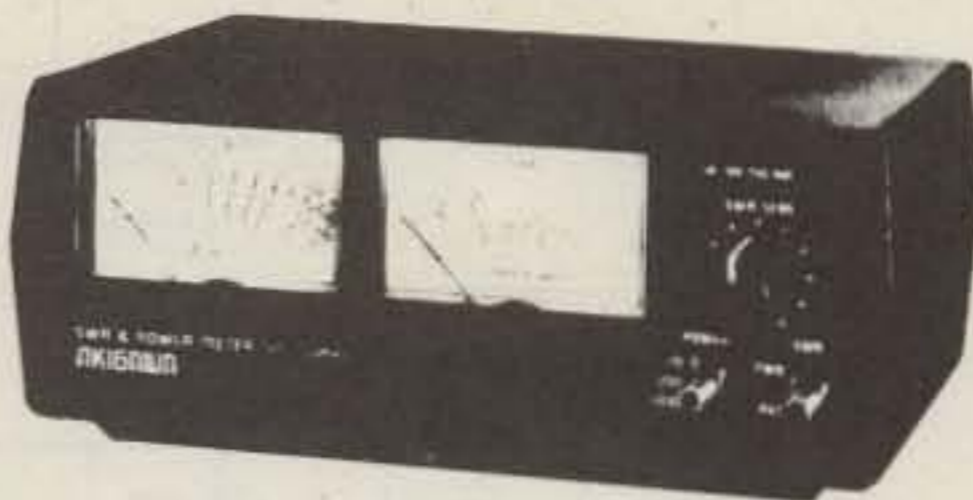


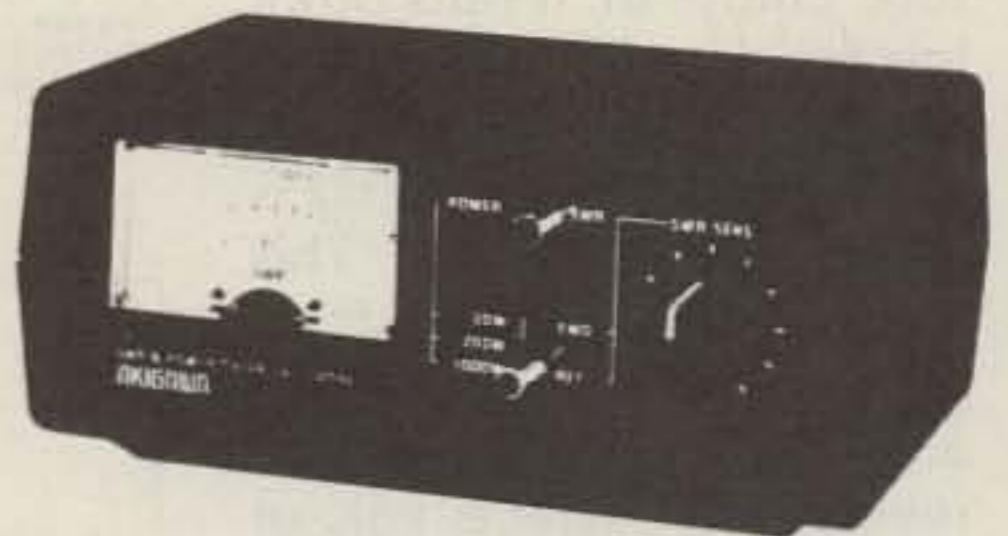
Fig. 1. Apple II interface.



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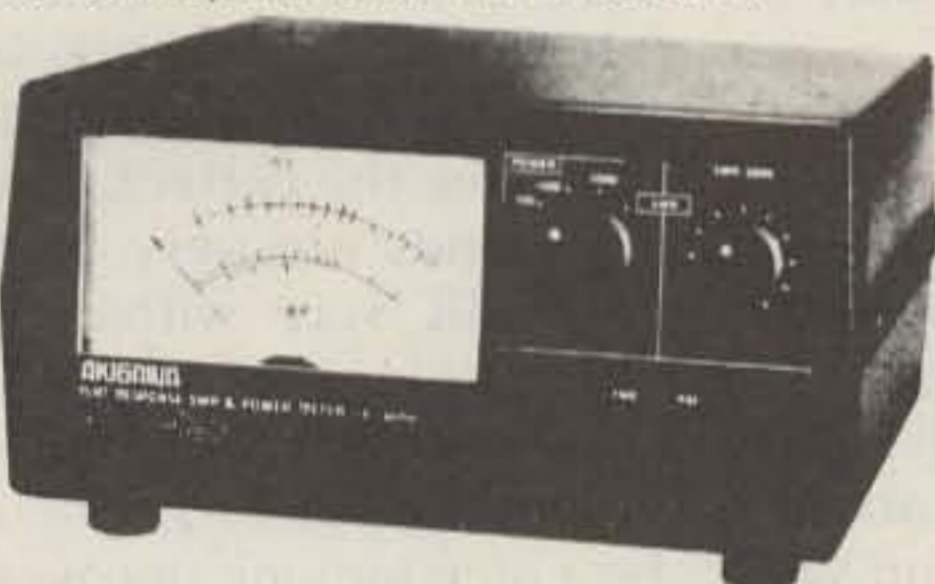
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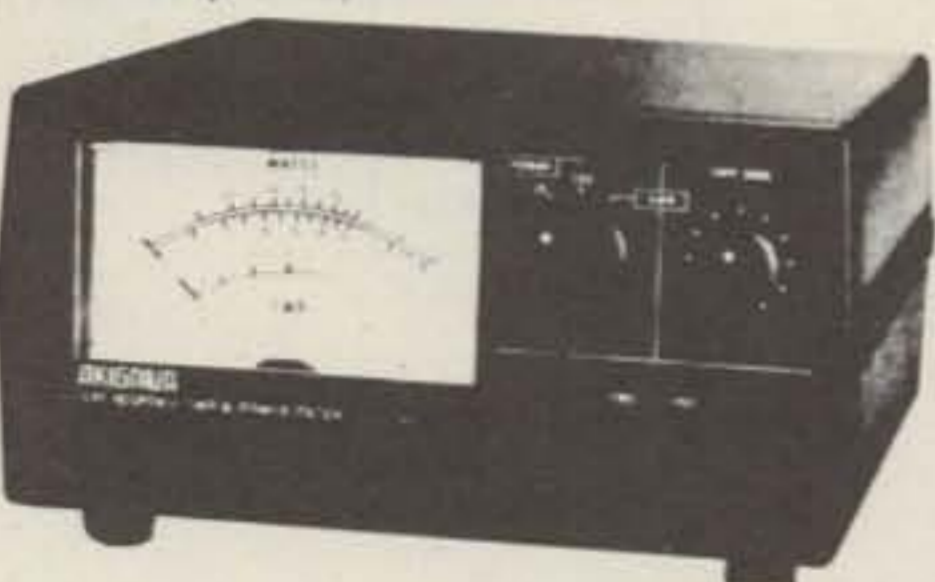
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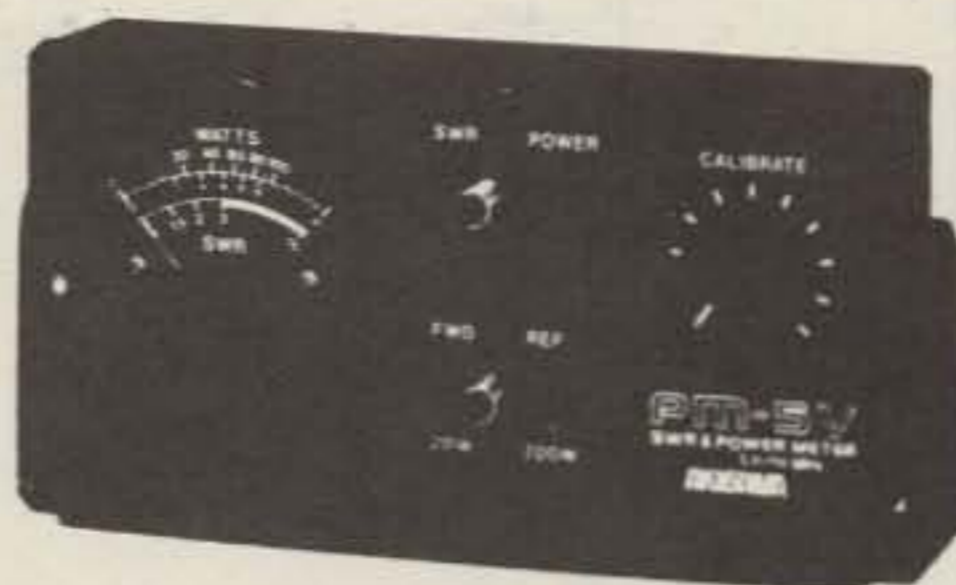
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SWR Range: 1:1 – 3:1
Accuracy: ±10%
Power Requirements: None



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Capability: 200W CW
Power Requirements: 117 VAC 60 Hz

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tone comes in, it puts out a low level. In FSK (10 meters and below), 2295 Hz is used as the mark time; 2125 Hz is used as the space. This gives a downward shift of 170 Hz. In AFSK (6 meters and above), the tones are reversed. S1 selects FSK or AFSK and will be labeled during alignment.

Fig. 3 is the modulator. The input at J1 is from the serial output of the UART. For a high input, we get a 2295-Hz tone at J2. A low input gives us 2125 Hz out. The output of the XR210 is made into a sine wave by the low-pass filter so that our transmit signal will not be too wide. The filter cut-off is about 3 kHz. S1 allows you to identify in CW. S2 is wired in at the mike jack the same way as a PTT switch. S3 selects FSK or AFSK.

Construction

The interface is built on an Apple hobby/prototype board, Apple part number A2B0001X. This board is made to plug into the I/O slots at the back of the Apple. S1 is brought out in back of the Apple so that you can get at it. No layout is included with this project because nothing is critical. You should have no trouble if good general construction practice is used. Capacitors C1, C2, and C3 must be of good quality, like mylar™ or polystyrene. It is a good idea to construct the IC6 circuit on an experimental basis first and trim C1, C2, and C3 to get the clock frequency within 1%. A frequency counter is the only good way to do this. At 60 wpm, the frequency at IC6, pin 3, should be 728 Hz plus or minus 7 Hz. At 100 wpm, it will be 1187 Hz plus or minus 10 Hz. This trimming can be done with small value mica or ceramic capacitors. After you have built the circuit on the Apple board, check the clocks

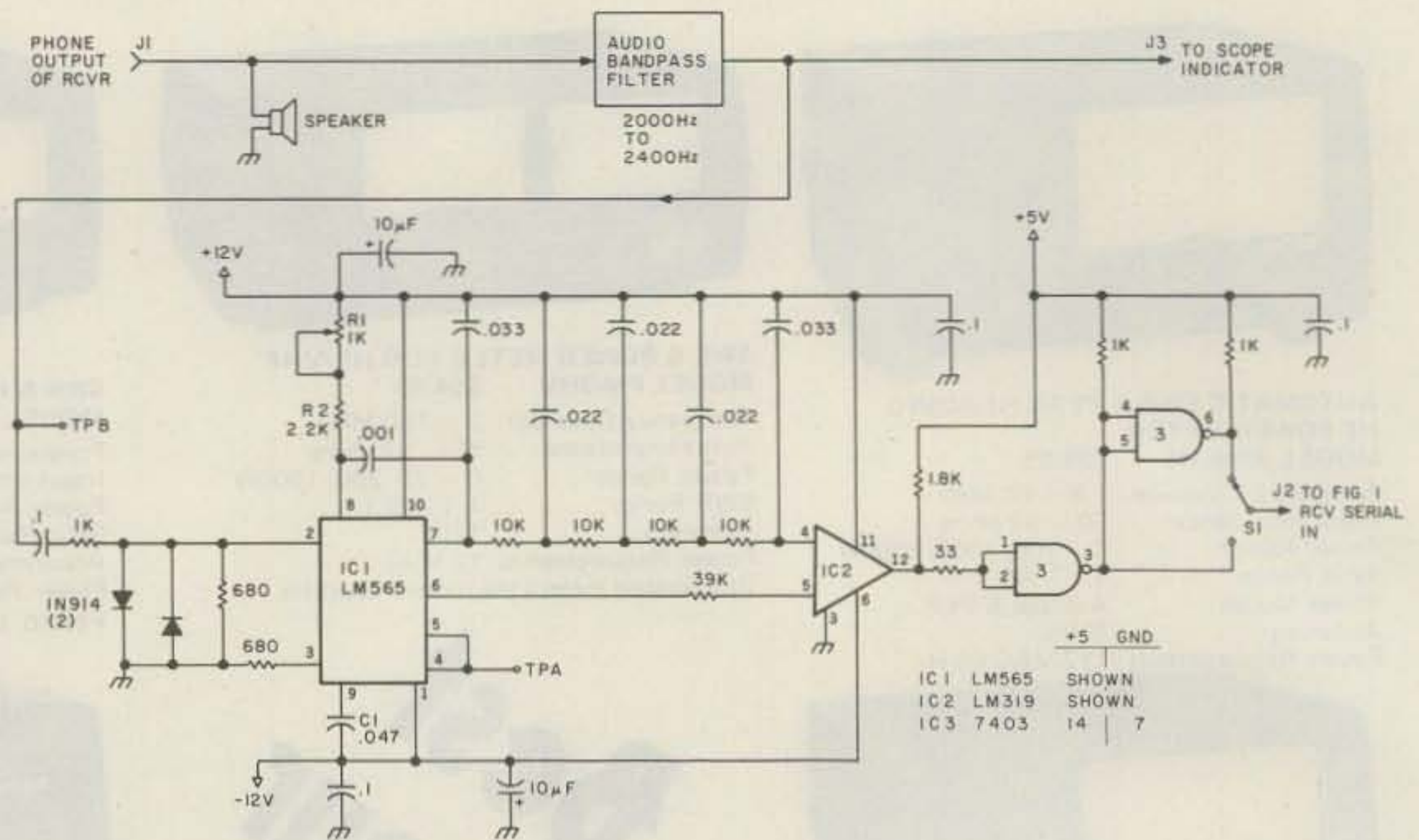


Fig. 2. Demodulator schematic diagram.

again. They may need a little more trimming.

My SSB phone-jack output is 8 Ohms, so a speaker at J1 works fine (see Fig. 2). If yours has a higher impedance, you may need a transformer to match to the speaker. The power supply for Figs. 2 and 3 is separate from the Apple. If you wish, you could use power from the Apple for these circuits also. C1 should be a good quality capacitor. S1 is brought out to the front panel.

C1 in the modulator (Fig.

3) should be of good quality. S1, S2, and S3 are brought out to the front panel. The chokes are the common 88-mH variety or equivalent. In all circuits, resistors are quarter- or half-Watt 5%. All capacitors not mentioned may be of any type.

Alignment

First do the modulator. With S1 in normal, hook the scope to J2 and make sure you have an audio sine wave. Adjust R3 for about 1 volt or enough to run your

frequency counter. Now hook the frequency counter to J2. Put S3 to FSK and short J1 to ground. Adjust R2 for 2125 Hz. If you can't get 2125 Hz, adjust both R1 and R2 for 2125 Hz. Put S3 to AFSK and adjust R1 for 2295 Hz. These controls are interacting, so go back and forth several times until you have the correct tones. The tones are very stable and will stay within 1% drift easily. Now verify the conditions listed in Table 1.

The output at J2 should be a nice-looking sine wave.

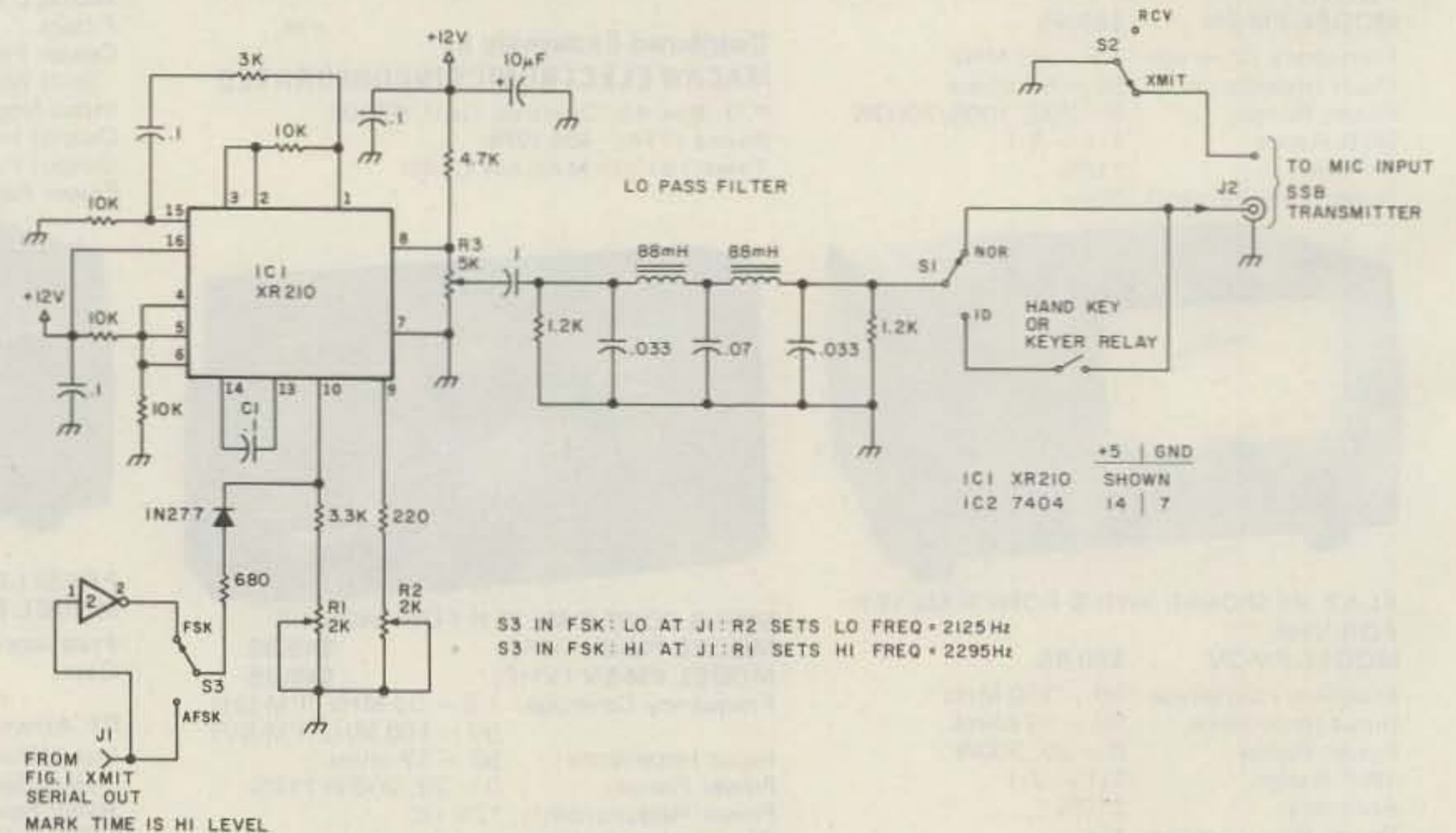
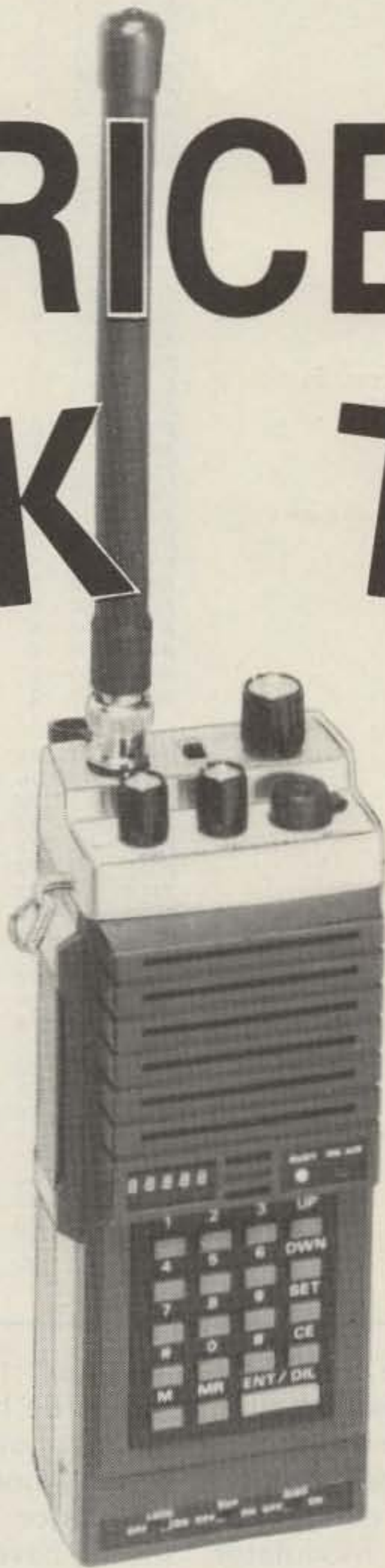


Fig. 3. Modulator. Output in FSK: mark time = 2295 Hz; space = 2125 Hz. Output in AFSK (tones are reversed): mark time = 2125 Hz; space = 2295 Hz.



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0801 C5 E	0839 BF ?	08B1 D7 1	08D3 45 S
0802 8A Line Feed	083A A6 &	08B2 D3 2	08D4 50 T
0803 C1 A	083B AA *	08B3 C1 3	08D5 47 U
0804 A0 Space	083C AE .	08B4 CA 4	08D6 5E V
0805 D3 S	083D AF /	08B5 D0 5	08D7 53 W
0806 C9 I	083E BB :	08B6 D5 6	08D8 5D X
0807 D5 U	083F AA *	08B7 C7 7	08D9 55 Y
0808 8D Carriage Return	0880 AA *	08B8 C6 8	08DA 51 Z
0809 C4 D	0881 AA *	08B9 D8 9	08DB AA *
080A D2 R	0882 AA *	08BA CE :	08DC AA *
080B CA J	0883 AA *	08BB DE :	08DD AA *
080C CE N	0884 AA *	08BC AA *	08DE AA *
080D C6 F	0885 AA *	08BD AA *	08DF AA *
080E C3 C	0886 AA *	08BE AA *	08E0 No Data. This address is
080F CB K	0887 C5 Bell (CTRL G)	08BF D9 ?	for Figs/Ltrs flag.
0810 D4 T	0888 42 Line Feed	08C0 AA *	08E1 No data. This address is
0811 DA Z	0889 AA *	08C1 43 A	for character counter.
0812 CC L	088A AA *	08C2 59 B	08E2 92 CTRL R
0813 D7 W	088B AA *	08C3 4E C	08E3 94 CTRL T
0814 C8 H	088C AA *	08C4 49	08E4 83 CTRL C
0815 D9 Y	088D 48 Carriage Return	08C5 41 F	08E5 81 CTRL A
0816 D0 P	088E AA *	08C6 4D F	08E6 82 CTRL B
0817 D1 Q	088F AA *	08C7 5A G	08E7 88 Line Feed
0818 CF 0	0890 AA *	08C8 54 H	08E8 DF
0819 C2 B	0891 AA *	08C9 46 I	08E9 4C D5 09 JMP To RCV
081A C7 G	0892 AA *	08CA 4B J	08EC 4C 2C 0A JMP To send CQ
081B AA *	0893 AA *	08CB 4F K	08EF 3 Addresses. User define.
081C CD M	0894 AA *	08CC 52 L	08F2 3 Addresses. User define.
081D D8 X	0895 AA *	08CD 5C M	08F5 5F Letters Tmit
081E D6 V	0896 AA *	08CE 4C N	08F6 5B Figures Tmit
081F AA *	0897 AA *	08CF 58 O	08F7 1F Letters Rcv
0820 A0 Blank	0898 AA *	08D0 56 P	08F8 1B Figures Rcv
0821 B3 3	0899 AA *	08D1 57 Q	
0822 8A Line Feed	089A AA *		
0823 AD -	089B AA *		
0824 A0 Space	089C AA *		
0825 87 Bell	089D AA *		
0826 B8 8	089E AA *		
0827 B7 7	089F AA *		
0828 8D Carriage Return	08A0 44 Space		
0829 A4 \$	08A1 CD !		
082A B4 4	08A2 D1 "		
082B A7 *	08A3 D4 #		
082C AC ,	08A4 C9 \$		
082D A1 !	08A5 AA *		
082E BA :	08A6 DA &		
082F A8 (08A7 CB '		
0830 B5 5	08A8 CF {		
0831 A2 "	08A9 D2)		
0832 A9)	08AA A+ =		
0833 B2 2	08AB AA =		
0834 A3 #	08AC CC .		
0835 B6 6	08AD C3 -		
0836 B0 0	08AE DC .		
0837 B1 1	08AF DD /		

Tmit	0900 A9 F5	LDA	Ltrs to A
0901 20 B4 09	JSR	Send Ltrs	
0902 A9 00	LDA		
0903 8D E0 08	STA	Set flag to Ltrs	
0904 8D E1 08	STA	Set character counter to 00	
0905 2C 00 C0	BIT	Is key down?	
0906 10 FB	BPL	Loop if not	
0907 AD 00 C0	LDA	Get key code	
0908 2C 10 C0	BIT	Clear keyboard	
0909 CD E2 08	CMP	Is it CTRL R?	
0910 F0 CC	BEQ	Yes so go to 08E9	
0911 CD E4 08	CMP	Is it CTRL C?	
0912 F0 CA	BEQ	Yes so go to 08EC	
0913 CD E5 08	CMP	Is it CTRL A?	
0914 F0 C8	BEQ	Yes so go to 08EF	
0915 CD E6 08	CMP	Is it CTRL B?	
0916 F0 C6	BEQ	Yes so go to 08F2	
0917 CD E7 08	CMP	Is it a linefeed?	
0918 D0 0B	BNE	Not a linefeed so go to 093C	
0919 20 B4 09	JSR	Send linefeed	
0920 A9 8A	LDA		
0921 20 ED FD	JSR	Print linefeed	
0922 4C 0D 09	JMP	Do again	
0923 CD 04 08	CMP	Is it a space?	

If not, the low-pass filter is not working correctly. Both tones at J2 should be the same amplitude within plus or minus 10%.

Now align the demodulator. With no input at J1, hook the frequency counter to test point A at IC1, pin 4. You should be able to adjust R1 to 2200 Hz. If not, something is wrong with R1, R2, or C1. For the next alignment, we are going to use the modulator. Also, you will need a TTL symmetrical square-wave generator at about 50 Hz. The circuit of Fig. 4 gives you some tips

on how to make one. Hook the output of your TTL symmetrical square-wave generator to the modulator, J1. Modulator S3 can be in either position. Modulator S1 should be in normal. Open the circuit at demodulator TP B and connect modulator J2 to the input of IC1 at TP B. Now hook the scope to demodulator J2. You should get a square wave. The crossover points will be jittery. This is normal. Now adjust demodulator R1 for a symmetrical square wave. Exactly half the square wave should be

low and the other half should be high. Make sure of the following conditions: Ground modulator J1. With modulator S3 in FSK, you should have a low level at demodulator J2. If not, flip demodulator S1 to the other position. Label this position FSK. Label the opposite position AFSK. Now, with demodulator S1 in FSK, connect +5 V to modulator J1. You should get a high level at demodulator J2.

Now let's check out your SSB transceiver. For starters, the output of modulator J2 should be about 50 mV. Set R3 for this value. If this is not enough to drive your transmitter, then increase the level as needed. Connect modulator J2 to the mike input. Put modulator S3 to FSK, S1 to normal, +5 V to J1, transceiver mode to SSB, and mike gain

off. Throw modulator S2 to XMIT; advance mike gain.

Caution! Use only enough mike gain to run your transmitter at about 40% to 50% of its rated dc plate input power on CW.

Next, you must make sure your transceiver is in USB so that the frequency shift will be downward. A good way to do this is to check transmitter frequency with your counter or listen to it on another receiver tuned to USB.

Example in FSK and USB

Your vfo equals 3620000 Hz + 2295 Hz = 3622295 Hz. This is the mark time frequency. Now connect modulator J1 to ground. Vfo equals 3620000 Hz + 2125 Hz = 3622125 Hz. This is the space frequency. Your transmitter shifted 170 Hz lower.

S3 to FSK	J1 grounded	output is 2125 Hz	space
S3 to FSK	J1 to +5 V	output is 2295 Hz	mark
S3 to AFSK	J1 to +5 V	output is 2125 Hz	mark
S3 to AFSK	J1 grounded	output is 2295 Hz	space

Table 1.

```

093F D0 19 BNE Not a space so go to 095A
0941 20 ED FD JSR Print
0944 20 B4 09 JSR Send
0947 EE E1 08 INC Add 1 to character counter
094A A9 43 LDA
094C CD E1 08 CMP Is character counter = to 67?
094F F0 03 BEQ Yes so go to 0954
0951 4C 0D 09 JMP Counter not 67 yet so do again
0954 20 3A FF JSR Ring bell
0957 4C 0D 09 JMP Do again
095A CD 08 08 CMP Is it carriage return?
095D D0 0B BNE Not a carriage return so go to 096A
095F 20 ED FD JSR Print carriage return
0962 20 B4 09 JSR Send
0965 A9 00 LDA
0967 20 0A 09 JMP Do again
096A AA TAX A to X
096B BD 00 08 LDA Get RTTY character
096E CD 1B 08 CMP Is it = to AA?
0971 D0 03 BNE Not AA so go to 0976
0973 4C 36 09 JMP It is AA so print
0976 2D E8 08 AND Is it a letter?
0979 30 17 BMI Not a letter so go to 0992
097B 2C E0 08 BIT Is flag = to letters?
097E 30 04 BMI Flag not = to letters so go to 0984
0980 8A TXA Flag is = to letters so
0981 4C 41 09 JMP Print and send
0984 A9 00 LDA
0986 8D E0 08 STA Set flag to letters
0989 A9 F5 LDA Address of letters to A
098B 20 B4 09 JSR Send
098E 8A TXA Get character back
098F 4C 41 09 JMP Print and send
0992 2C E0 08 BIT It is a figure so is flag = to figures?
0995 10 04 BPL Flag not = to figures so go to 099B
0997 8A TXA Flag is = to figures so
0998 4C 41 09 JMP Print and send
099B A9 80 LDA It is a figure so
099D 8D E0 08 STA Set flag to figures
09A0 A9 F6 LDA Address of figures to A
09A2 20 B4 09 JSR Send figures
09A5 4C 8E 09 JMP Send character

```

Send subroutine

```

09B4 A8 TAY A to Y
09B5 AD B0 C0 LDA Get UART status
09B8 29 20 AND Is TBMT up?
09BA F0 F9 BEQ No do again
09BC B9 00 08 LDA RTTY character to A
09BF 8D B0 C0 STA Send
09C2 60 RTS Do again

```

Rcv

```

09C6 4C 00 09 JMP Go to Tmit
09C9 4C 2C 0A JMP Go to send CQ
09CC 3 Addresses. User define.
09CF 3 Addresses. User define.

```

```

09D5 A9 00 LDA
09D7 8D E0 08 STA Set flag to letters

```

```

09DA A9 20 LDA
09DC 8D B0 C0 STA Reset RDA
09DF 2C 00 C0 BIT Is key down?
09E2 10 1A BPL If not go to 09FE
09E4 AD 00 C0 LDA Get key code
09E7 2C 10 C0 BIT Clear keyboard
09EA CD E3 08 CMP Is it CTRL T?
09ED F0 D7 BEQ Yes so go to 09C6
09EF CD E4 08 CMP Is it CTRL C?
09F2 F0 D5 BEQ Yes so go to 09C9
09F4 CD E5 08 CMP Is it CTRL A?
09F7 F0 D3 BEQ Yes so go to 09CC
09F9 CD E6 08 CMP Is it CTRL B?
09FC F0 D1 BEQ Yes so go to 09CF
09FE AD B0 C0 LDA Get UART status
0A01 AA TAX
0A02 29 40 AND Is RDA up?
0A04 F0 D9 BEQ No so go to 09DF
0A06 8A TXA RDA is up so
0A07 29 1F AND Get rid of control bits
0A09 CD F8 08 CMP Is it figures?
0A0C D0 08 BNE It is not figures so go to 0A16
0A0E A9 20 LDA Set flag to figures
0A10 8D E0 08 STA
0A13 4C DA 09 JMP Do again
0A16 CD F7 08 CMP Is it letters?
0A19 D0 03 BNE It is not letters so go to 0A1E
0A1B 4C D5 09 JMP Do again
0A1E 0D E0 08 ORA Get the address
0A21 AA TAX
0A22 BD 00 08 LDA Get the character
0A25 20 ED FD JSR Print
0A28 4C DA 09 JMP Do again

```

Send CQ

```

0A2C A2 40 LDX Start address
0A2E BD 00 0A LDA Get character from table
0A31 C9 AA CMP Is it end of table?
0A33 F0 07 BEQ Yes so go to 0A3C
0A35 20 B4 09 JSR Send
0A38 E8 INX
0A39 4C 2E 0A JMP Do again
0A3C 4C D5 09 JMP To Rcv

```

CQ character table

```

0A40 F5 F5 C4 C5 A0 D7 C2 F6 B6
0A49 F5 CD C5 D0 A0 A0 C3 D1 A0
0A52 C3 D1 A0 C3 D1 A0 C3 D1 A0
0A5B C3 D1 A0 C3 D1 A0 C4 C5 A0
0A64 D7 C2 F6 B6 F5 CD C5 D0 A0
0A6D A0 C3 D1 A0 C3 D1 A0 C3 D1
0A76 A0 C3 D1 A0 C3 D1 A0 C3 D1
0A7F A0 C4 C5 8D 88 D7 C2 F6 B6
0A88 F5 CD C5 D0 A0 A0 C3 D1 A0
0A91 C3 D1 A0 C3 D1 A0 C3 D1 A0
0A9A C3 D1 A0 C3 D1 A0 C4 C5 A0
0AA3 D7 C2 F6 B6 F5 CD C5 D0 A0
0AAC A0 D7 C2 F6 B6 F5 CD C5 D0
0AB5 A0 CB CB AA

```

Operation

For the program to work as is, you must put the Apple II interface into slot number 3. Operating in transmit is easy. The return key transmits a carriage return. The left arrow key transmits a line feed. Any characters you type on the Apple keyboard that are not compatible with RTTY will print a * and nothing will be sent. You do not have to worry about letters and figures keys. The Apple automatically sends these.

On a standard RTTY printer, 72 characters may be typed before you must type line feed and carriage return. This is hard to keep track of in your head, so the Apple keeps track of how many characters you have typed after the last carriage return, and when the total is

67, the bell rings to let you know you are near the end of a line.

If you are in transmit, you type CTRL R to get to receive. If you are in receive, you type CTRL T to get to transmit. If you want to call CQ, you type CTRL C. Provision is made for special messages or character handling. CTRL A and B are provided in the program for these. Entering the program at \$0900 starts you at transmit.

In receive, tune your receiver until you get good copy on the TV screen. The tones will sound high-pitched when you get good copy; with a little practice you can tune this way, but a tuning indicator is better. If you used a low-pass filter in the demodulator, you can hook a scope to J3 and tune by maximum signal on the

scope. This will get you very close. The idea is to tune your receiver until the received-signal mark frequency produces a tone of 2295 Hz from your receiver. Then the space tone will be 2125 Hz, if the other fellow is using a shift of 170 Hz—which is the case about 99% of the time.

If you are going to operate on 6 or 2 meters, put all switches in AFSK.

AFSK on FM is easier because there is no tuning to do if you are using a synthesized or crystal rig.

When you are trying to tune in a signal, there may be times when you just can't get good print even if the signal is strong. If this happens, try flipping demodulator S1 to the other position. The other fellow may be transmitting upside down.

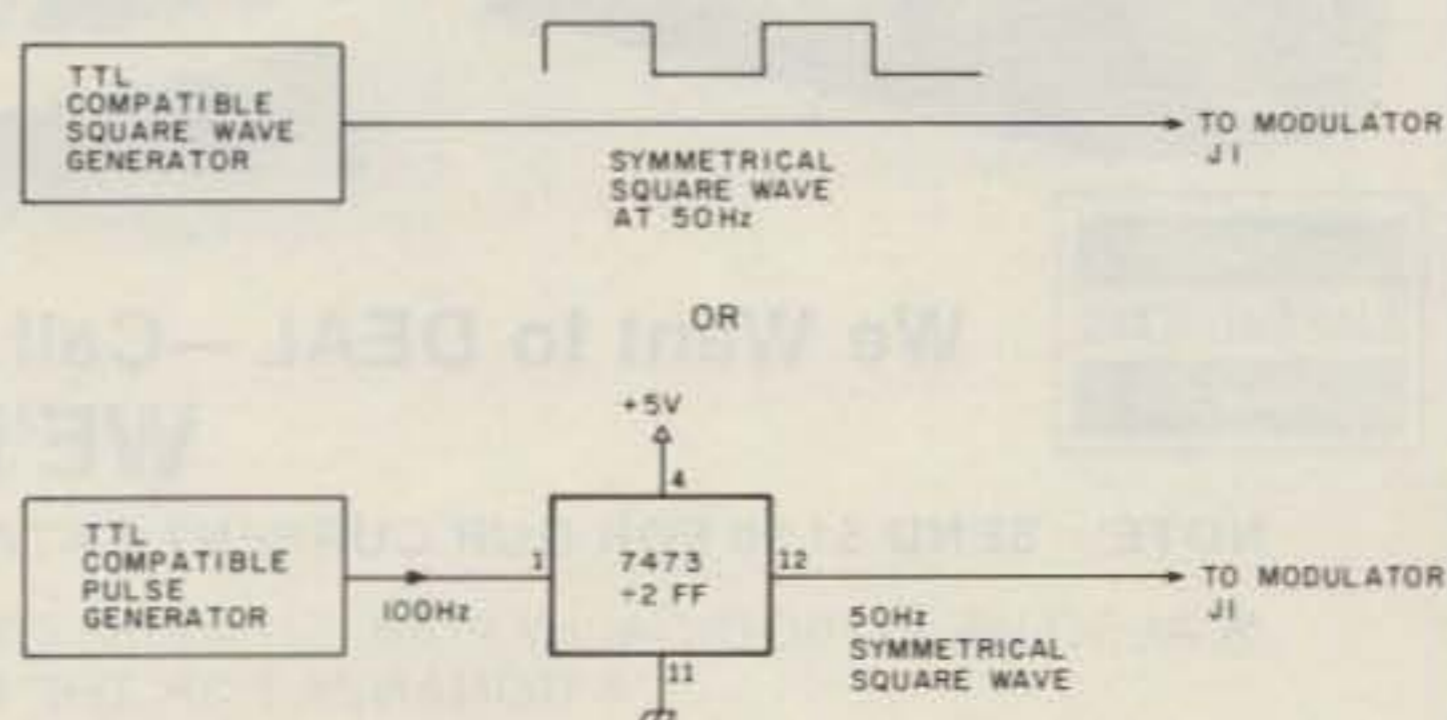


Fig. 4. Square-wave generator.

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About the Program

Addresses \$0800 through \$083F are the characters which will be printed during receive. \$0880 through \$08F6 are the characters to be transmitted. You can start the program at \$0900. In the CQ program data table, starting at \$0A40 you use the address of the character you want to send. You get the addresses from the table located at \$0880 through \$08F6. For example, my call (WB6MEP) is in the program. You must change it to your call. Starting at address 0A40, the following is transmitted during CQ:

0A40	F5	letters
0A41	F5	letters
0A42	C4	D
0A43	C5	E
0A44	A0	Space
0A45	D7	W
0A46	C2	B
0A47	F6	figures
0A48	B6	6

0A49	F5	letters
0A4A	CD	M
0A4B	C5	E
0A4C	D0	P
0A4D	A0	Space
0A4E	A0	Space
Etc.		

Only address low is used. The high order (08) is left out.

Any addresses not listed are "don't care," and you may use them for expansion. If you want to use CTRL A or B for special messages or character handling, you must load the starting addresses of your program at \$08EF for CTRL A and 08F2 for CTRL B if you are in transmit. The same starting addresses will be at 09CC for CTRL A and 09CF for CTRL B when in receive. ■

References

1. *RTTY Handbook*, Tab Books, No. 597, Edited by Wayne Green.
2. *Specialized Communications Techniques*, ARRL.

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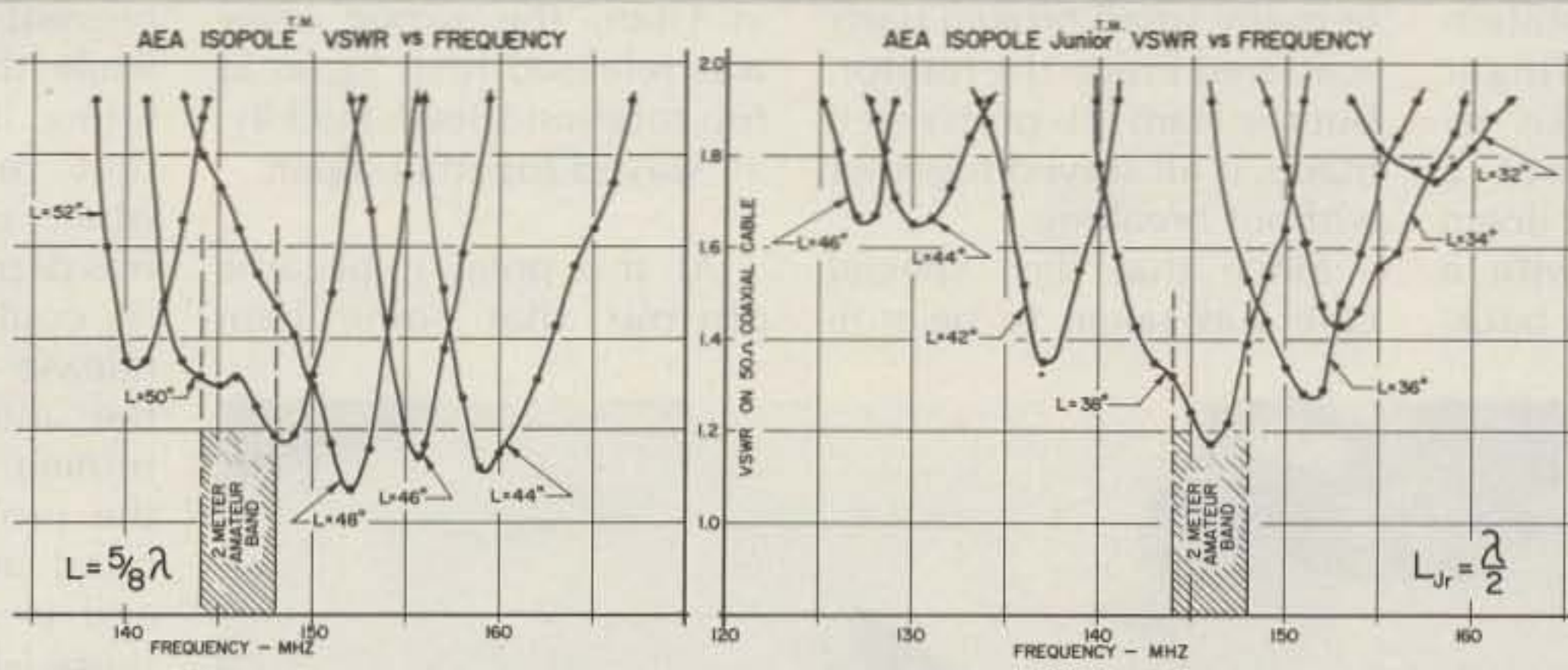
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Rotator Rescue Mission

— prevents sudden stops

It was not too long after installing the new antenna and the Ham II rotator that it happened: The tri-bander and two-meter beams were at top rotation speed when my finger slipped off the brake release lever. There was a loud noise that came down the tower, rippled with a chill up and down my back-

bone, and finally settled in my hip (wallet) pocket. Maybe omitting those torsion bars on the guy wires was a mistake. I had visions of many small broken parts scattered inside the rotator. But the Ham II is pretty well made; it all stayed together without breaking.

Since that day, special care was taken to be sure

that the antenna was at a complete stop before releasing the brake lever. Then in the heat of trying to catch that six-meter station in Utah, the wrong lever was released first, again at top rotation speed. Luckily, all stayed together again.

At this point it became obvious that some ham

might come along who did not know how to operate this equipment and could cause substantial damage! Protection was needed to prevent release of the brake while the antenna was rotating. If a relay was added that released the brake when either rotate lever was depressed, this same relay could be made to delay release of the brake until the antenna had stopped turning. This approach to the problem was incorporated in a Ham II rotator and is presented here for those who would like to do the same. Note that single-lever (instead of two) operation is achieved with this arrangement.

This addition to the Ham II is a very simple circuit. It uses easy-to-find parts and readily accepts substitutes from your junk box. Normal operation of the rotator is not affected; you can still use the brake and rotate levers as the factory intended. On gusty, windy days, it is convenient to use the manual brake release until the antenna has stopped being blown about. Wait for the direction indicator to show a lull, and then release the brake lever. The brake release time delay can be adjusted to suit your particular antenna installa-



Photo A. Added relay with components on perboard cemented to case.

tion. A two-color LED can be used to show when the brake is engaged or released, but can be omitted if you want a "no holes" installation. I understand that the Ham III rotator circuit is the same as the Ham II, so this addition should operate that rotator as well.

The Circuit

The circuit uses two microswitches above the rotate-control levers to supply power to the brake-release relay and to a capacitor for the time-delay function. The schematic is shown in Fig. 1. When either of the two microswitches is closed (by depressing a rotation-control lever), power is supplied through the resistor string to the base of the transistor, turning on the relay.

One set of the relay contacts is wired across the existing brake release microswitch. Thus, the brake is released any time a rotation control lever is depressed. Note that closing either one of the two new microswitches also charges the 47-uF capacitor through the 100-Ohm resistor. The resistor limits the charge rate and prevents the direction indicator from changing due to the otherwise sudden heavy current draw

When the microswitch is opened (the rotation control lever is released), the capacitor discharges through the resistor string and base of the transistor, keeping the relay energized until the capacitor discharges. This delay allows the antenna to come to a stop before the brake is re-engaged. The delay time is set by adjusting the 100k pot. A diode across the relay coil suppresses high voltage spikes generated by the relay's inductive kick.

Ac voltage is applied between points A and C. The two diodes across the second set of relay contacts provide positive or negative

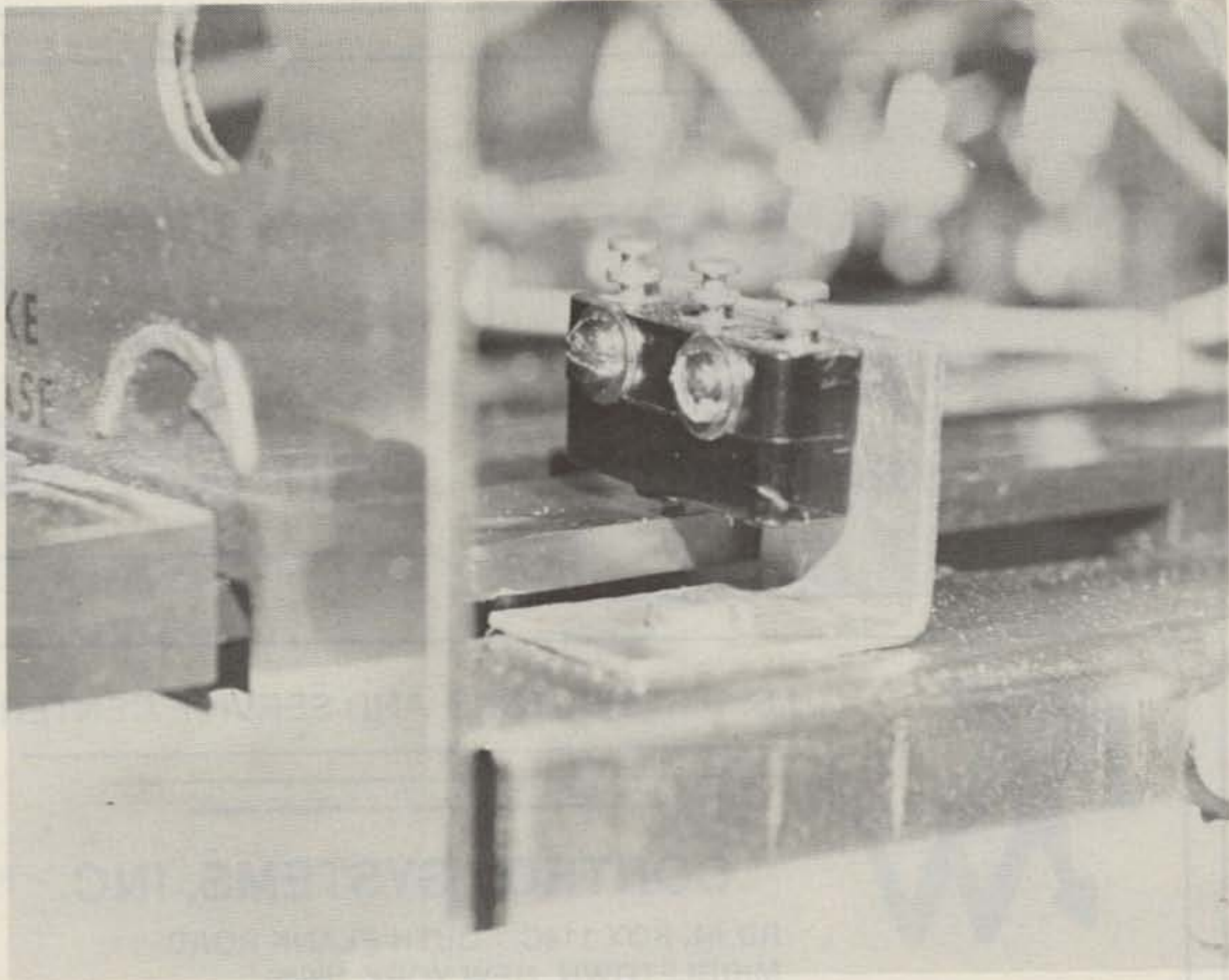


Photo B. Details of microswitch mounting.

voltage (depending on the relay position) through the 1k resistor to the two-color LED. The LED is green when the brake is engaged and is red when disengaged. Power for the circuit is taken from the Ham II direction indicator (meter) circuit. Portions of that circuit are shown in Fig. 1 for reference.

Construction

Perfboard is the easiest way to build the circuit because of its simplicity. Point-to-point wiring using component leads is recommended. Fig 2 shows a suggested parts arrangement. The diode for inductive kick suppression is mounted directly on the relay solder lugs. The two diodes and 1k resistor for the two-color LED also are mounted on the relay lugs.

The perfboard should be wired and checked out first; then connect the relay, being sure to observe the correct polarity on the suppressor diode, and substitute a

clip lead for the microswitch to test the unit. The relay should close when the clip-lead "switch" is closed and should stay closed for several seconds after the "switch" is opened. The time required for your antenna to stop should be measured and the 100k pot adjusted for that time plus about 1 or 2 seconds more.

My antenna required 2-1/2 seconds to stop after re-

lease of the rotation control, so the 100k pot was set to give a 3-1/2-second delay. The 100k pot can be measured and replaced with a fixed resistor as was done on the unit shown in the photos. The perfboard of my unit was then glued to the plastic relay enclosure on 1/8-inch stand-off strips as shown in Photo A.

A standard 1-3/8" x 1-3/8" x 2" plastic-enclosed

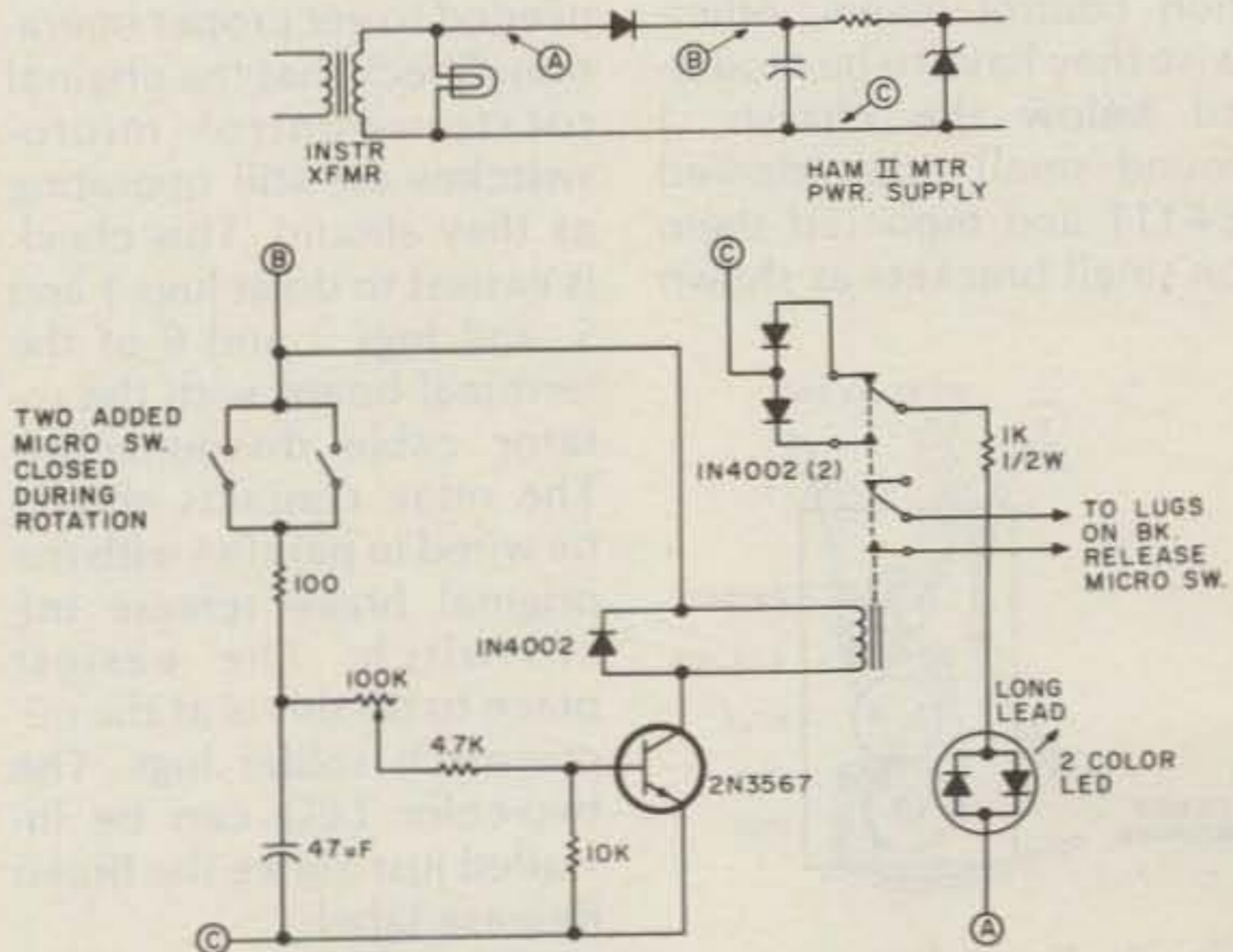


Fig. 1. Delayed-brake modification schematic.

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relay will fit underneath the Ham II chassis if desired. Mine was glued to the top of the chassis just behind the meter and next to the large transformer.

The new microswitches should be mounted next. It is easiest if DPDT microswitches are used. They can be mounted above the rotation control levers, otherwise they have to be mounted below the chassis. I found small ones marked E4-111 and mounted them on small brackets as shown

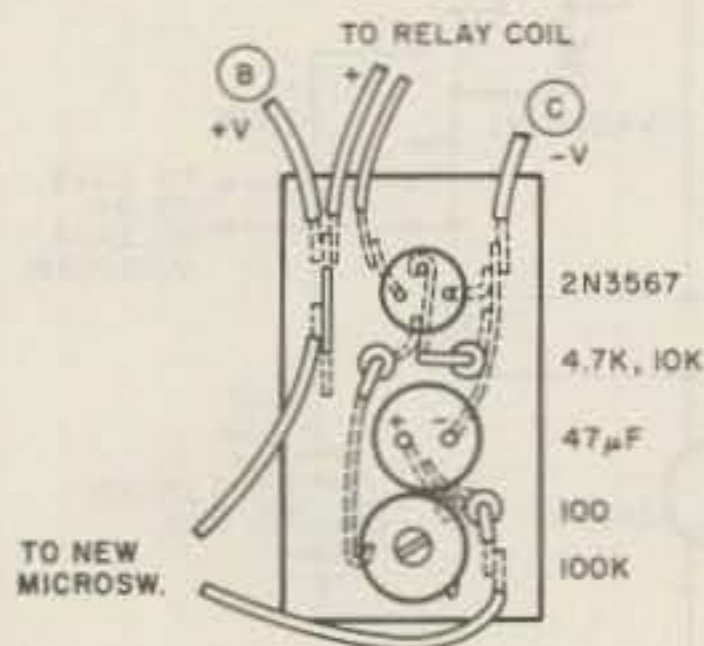


Fig. 2. Typical component arrangement.

in Photo B. Make sure of the clearance around the on-off switch and calibration controls if you mount them on top of the chassis. Check that the new microswitches are operating properly. Add shims between the microswitch and chassis or between the switch and control lever as needed to get proper operation. Check that the original rotation-control microswitches are still operating as they should. This check is easiest to do at lugs 1 and 5 and lugs 2 and 6 of the terminal board with the rotator cable disconnected. The relay contacts should be wired in parallel with the original brake release microswitch: The easiest place to do this is at the microswitch solder lugs. The two-color LED can be installed just above the Brake Release label.

The smoke test is next! With the rotator cable dis-

connected, apply power and check that the relay operates as it should when the control levers are depressed. Check that the time delay is OK and that the LED works correctly. Check that the manual brake release still works OK. Note that the LED does not respond to the manual brake release control. Now connect the rotator cable and you are in business!!

Substitutions

There is nothing critical about the circuit. Resistors of any value near those shown will produce good results. Capacitors in the range of 33 uF to 68 uF should work well. The transistor can be any good-quality NPN type, but it must have a voltage rating of 40 volts or better and reasonably good current gain (i.e., 50 to 100). The relay should be capable of operating on 12 to 20 V dc and its con-

tacts must be able to handle the 110 V ac to the transformer.

My relay was a "hamfest special" marked 20 V dc with a 400-Ohm dc coil resistance. Its contacts looked as though they could handle 5 to 10 Amps; they were about 1/8 inch in diameter. Here is a place to use those relays that do not work very well on 12 V dc.

Diodes should be silicon and have a piv of at least 100 V. The two-color LED can be replaced with two individual ones or a single red one can be used to indicate that the brake is released.

Many thanks to Paul WA2VMS/3 for discussions of ideas about this addition to the Ham II rotator and for describing a similar circuit installed in his Ham III. All of Paul's good ideas were, er, — confiscated (yes, that is the right word!) and used in this article. ■

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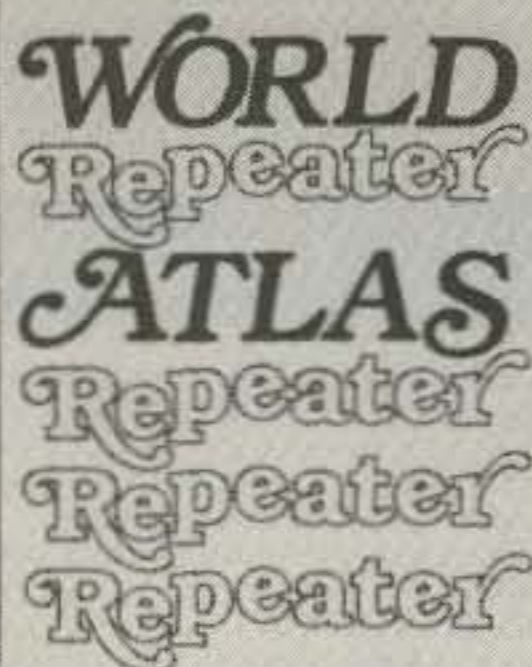
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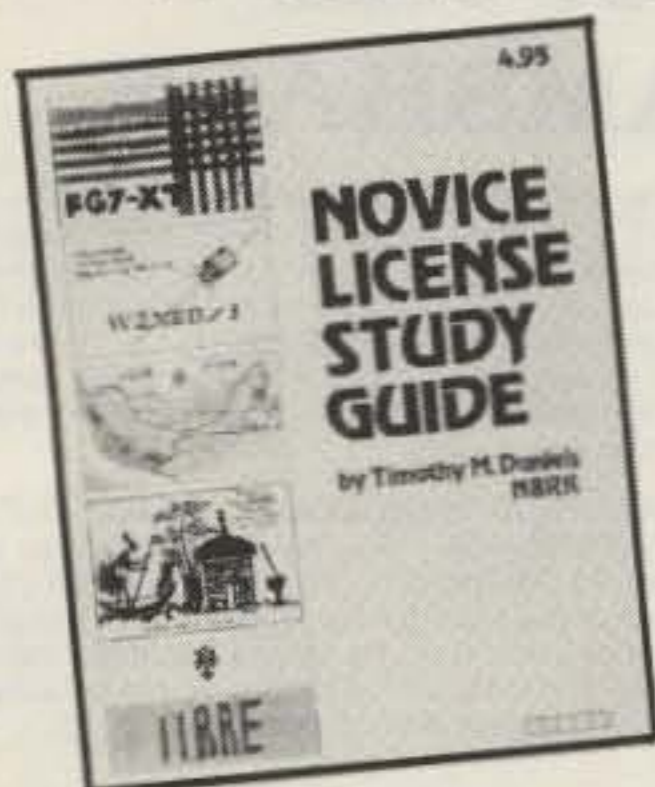
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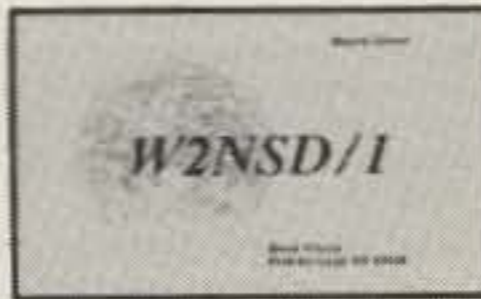
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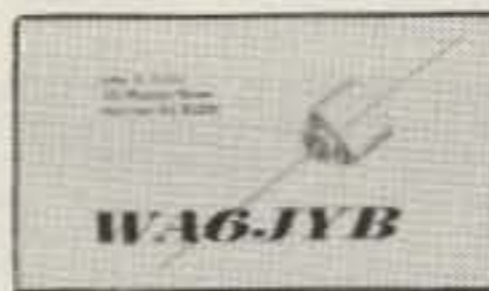
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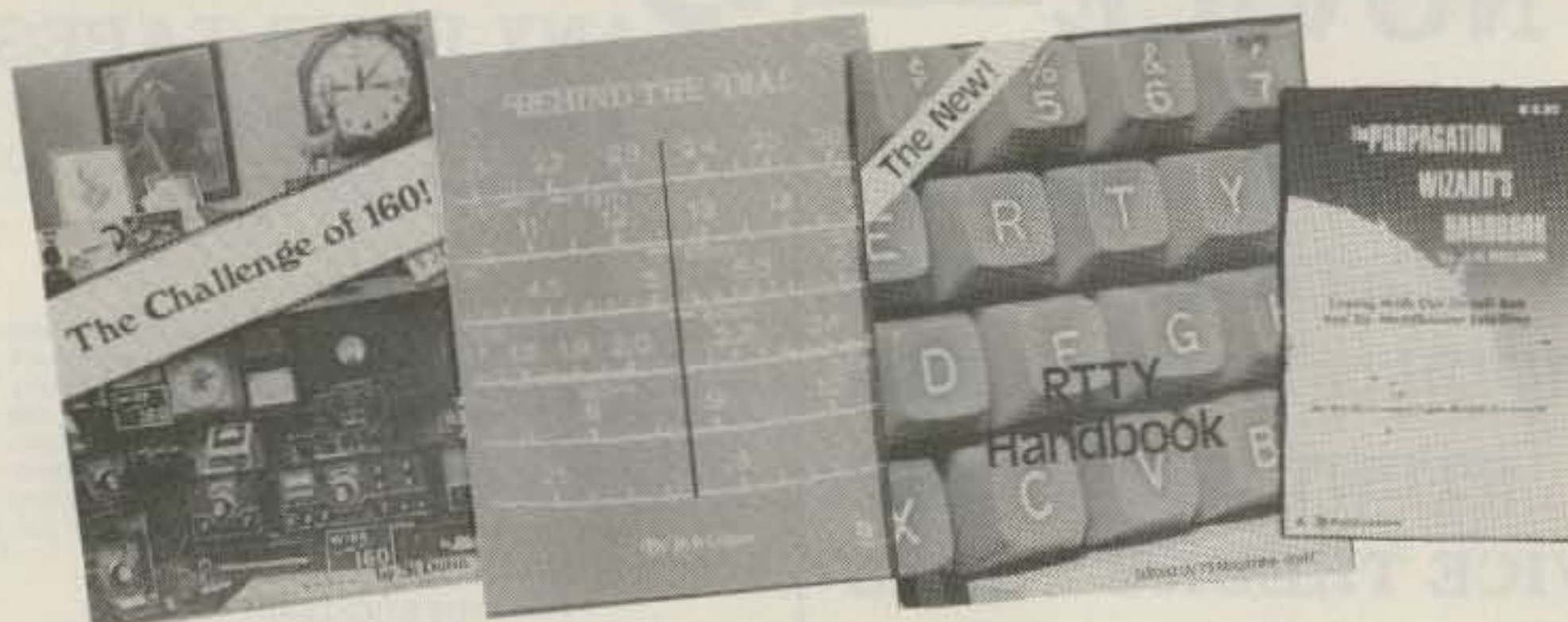
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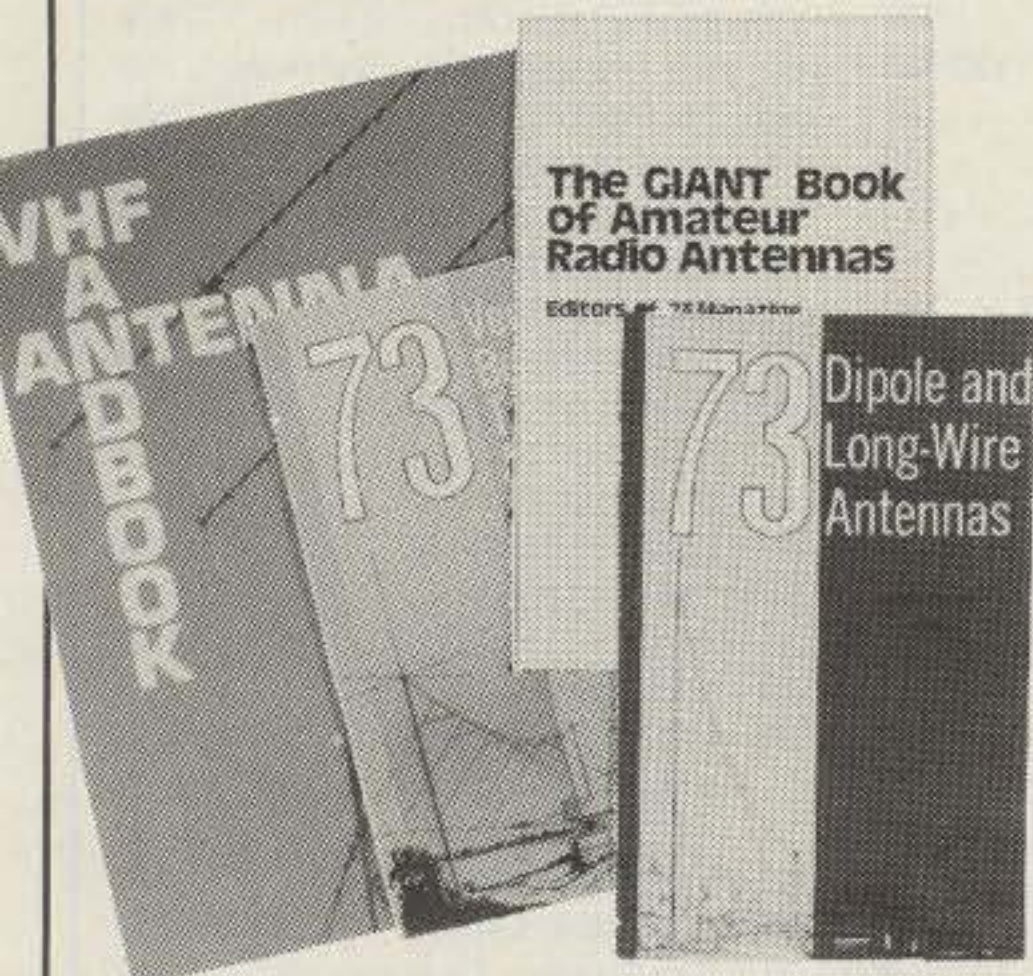
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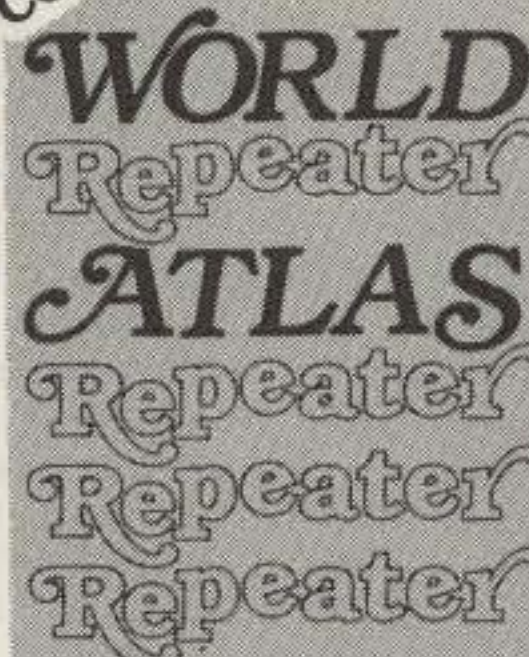
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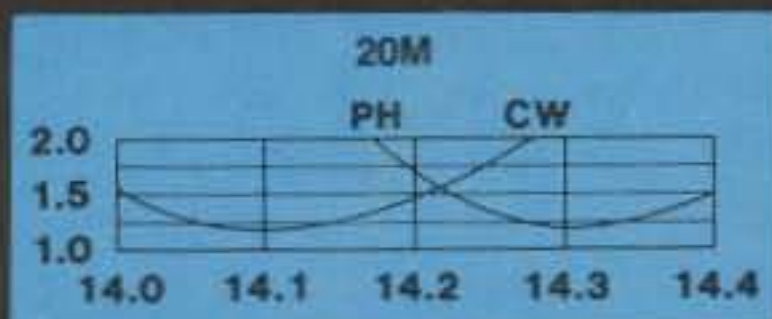
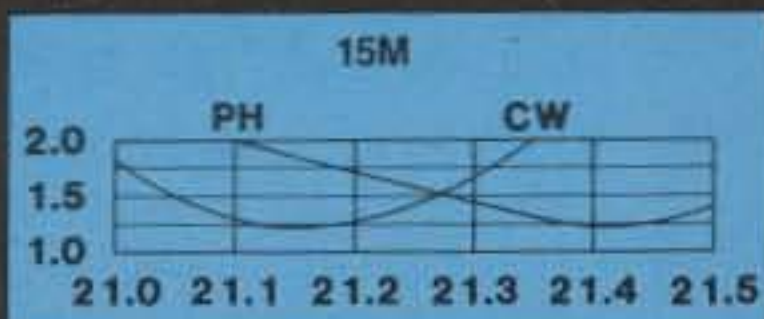
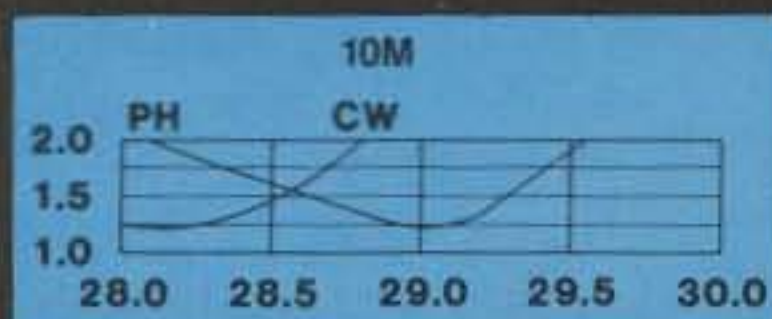
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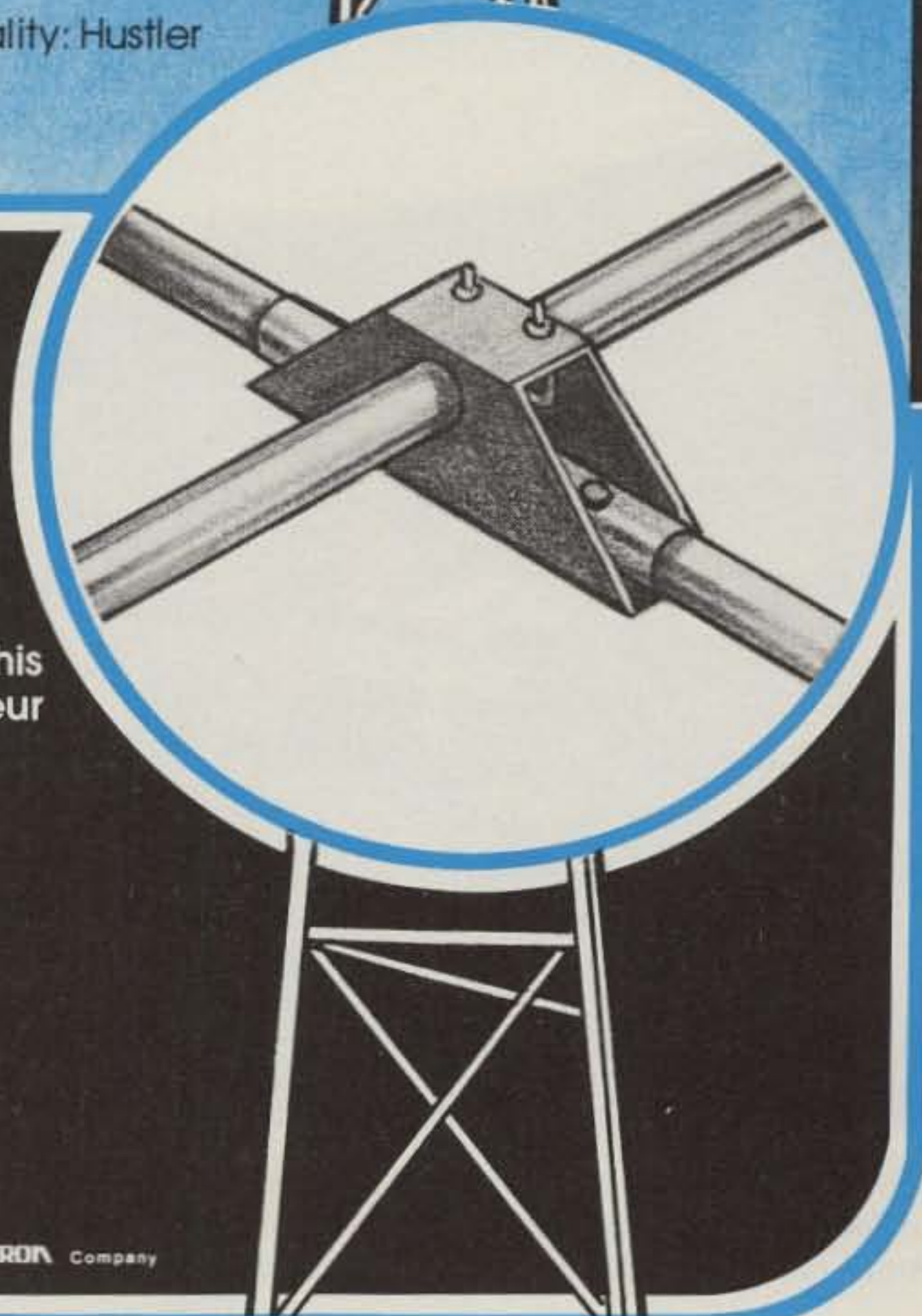


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The Racer's Edge

— it was ham communications at Derby days in Akron

Henry Ruminski WD8JOI
2053 16th Street
Cuyahoga Falls OH 44223

When Dan Purol of Fair Oak, California, crossed the finish line to win the 43rd All-American

Soap Box Derby, August 16, in Akron, Ohio, it was doubly appropriate that the checkered flag was waved by Jim Ott.

Given that honor as president of Novar Electronics, the chief sponsor of the All-American Derby, Jim Ott is KB8CT, and he was quick to praise fellow amateur operators who had provided communications for the week-long Derby activities.

"I don't know how we could have run the Derby without the hams. They provided the instant communications which made it possible to deal with any situation quickly," he said.

Wayne Alley, general manager for the All-American Derby, agreed that amateur radio made his job a lot easier.

"We spend 51 weeks preparing for this one week. Without the radio operators, it would be a lot harder. I can be anywhere I'm needed and still have immediate contact with my staff and other officials. That's especially important when I'm traveling between downtown activities and the track."

Alley's "shadow" throughout the week was Gail Wands WB8VNO, who had

both 2-meter and 220-MHz handhelds for both simplex and repeater operation. Gail had one of the more active roles since Alley had to handle many questions immediately during Derby week activities and the race.

Assignments for Derby communications were handled by Tim McCleod, operations officer for the Community Amateur Radio Service (CARS) and an Akron school teacher. Communications activity was centered on the CARS .04/.64 repeater which provided excellent coverage throughout the Akron area with the handhelds most operators were using. The club station, WB8DJP, served as net control for Derby activities on the repeater, with routine traffic and rag chewing moving to other repeaters in the Akron area.

Tim's real work began on Monday when the volunteers provided communications for the welcoming of the champs at the Orangerie Plaza in downtown Akron. Since the champs were to assemble at the parking deck of the University of Akron dorms following breakfasts with their families, it was impossible to schedule their arrivals in



Derby Downs lies against a natural hill on the eastern edge of Akron Municipal Airport. It has been the scene of the All-American Soap Box Derby for 40 of the event's 43 years.



WB8YNX assists a parade official during the downtown parade on Friday evening. A second parade was held at Derby Downs immediately preceding the race on Saturday morning.

advance. Eighty-two senior champs had come to the city to try for the college scholarships, totaling \$10,000, which went to the top three finishers. The 89 junior division champs were vying for power tools, and the top nine finishers in both classes were to receive trophies. Derby officials wanted to announce the hometown of and to give greetings to each champ on his or her arrival at the plaza. To do this, Tim arranged for operators to be on duty at the pickup point, at strategic corners downtown, and at the plaza to pass on the needed information. Each champ was correctly introduced as he arrived with a police escort.

While Gail WB8VNO was providing communications for the Derby manager, her husband, Ted Wands WD8CVH, was helping with the arrival of the champs. Another husband and wife team, the Musgraves (Scotty K8UCN, and Barb WD8DAI), were working at the pickup point with the champs.

Two other husband and wife teams assisted in the Derby communications effort. Larry Wilson WD8POL and Peggy WD8PZO assisted at "topside," the area where the cars were stored, weighed, inspected, and

prepared for their run down the hill. The pair handled the post during the trial run which each contestant had on Wednesday and during the race itself. Carl Hanson WD8OCH and Audrey KA8DRT provided radio contact at the starting line on race day.

These couples were just a few of the amateurs who provided communication between the Derby Hall of Fame in the Convention Center downtown and the track throughout the week as entrants were weighed, took trial runs, and participated in the activities planned for the champs.

Alley and other officials were particularly impressed with the phone patch capability of the repeater.

"My secretary could find me whenever she needed me no matter where I was, simply by dialing the phone! It made my job easier and saved a lot of time. It helped things run more smoothly," Alley said.

Derby officials were quick to point out the service of Jim McCrory WD8RDW, who was home on vacation from the Ohio State School for the Blind in Columbus. Jim spent most of the week manning 2-meter and 220-MHz rigs in Derby headquarters, located under the grandstands at



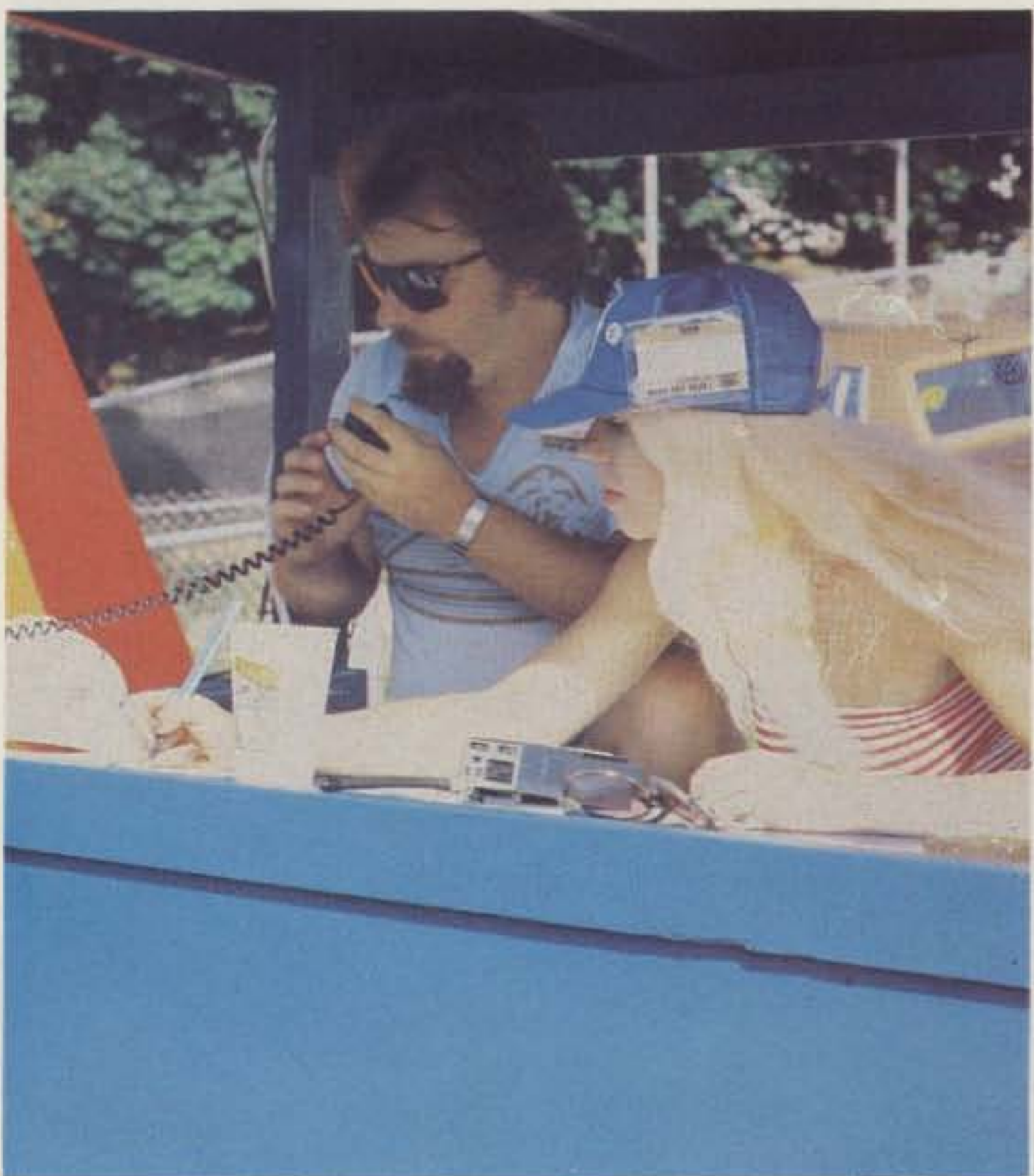
Workers carefully align each car at the starting line. WD8OCH and his XYL, KA8DRT, provide radio support in the booth in the background.

the track in southeast Akron. Jim, who has his General license, became a ham in 1978; he said he enjoys operating the 2-meter rig he has on loan from the Good-year Amateur Radio Club and hopes to acquire his own rig when finances permit.

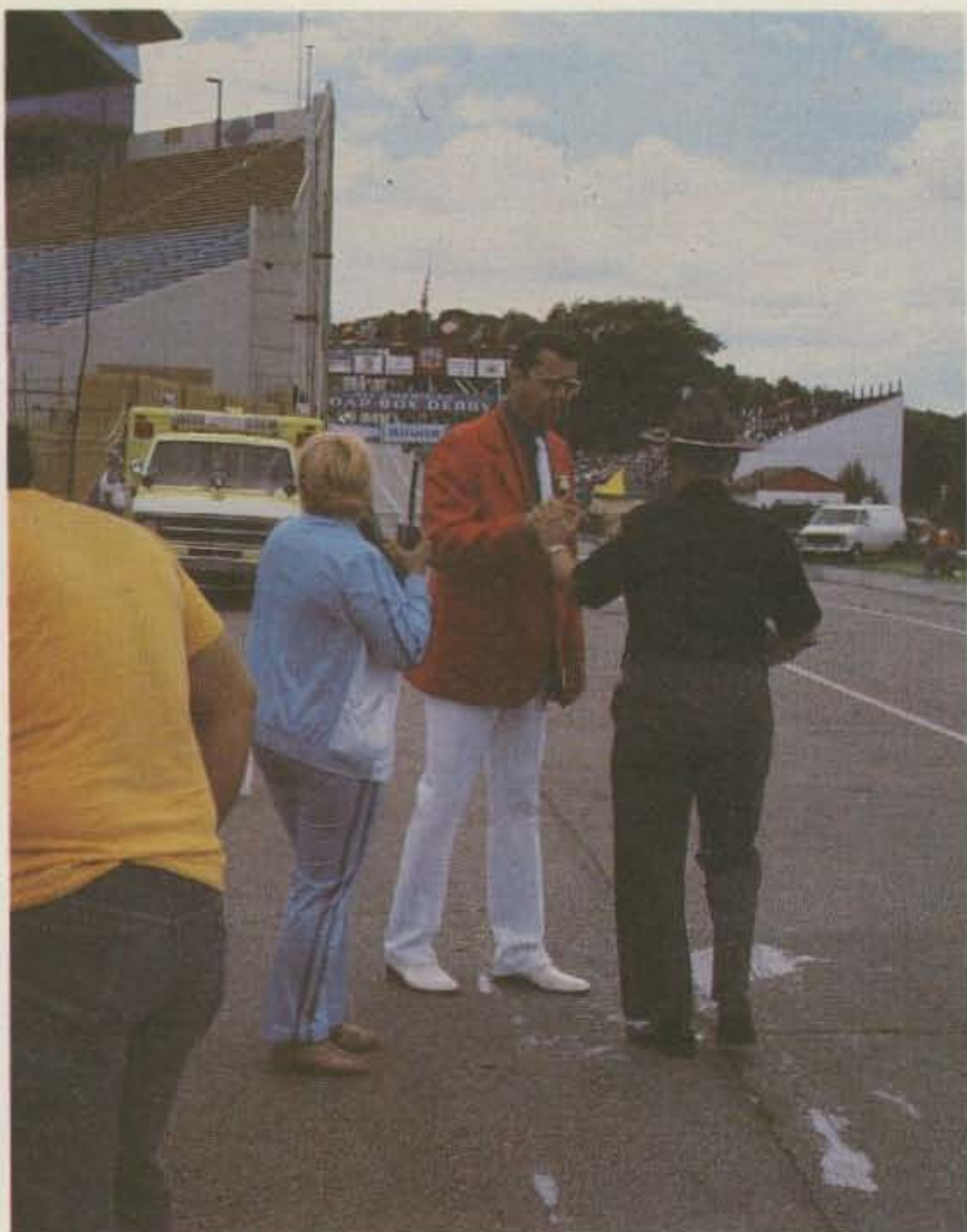
Though the activities which Jim and others helped with during the week were important, they were just more preparation

for Derby officials and the communications team for the big day. Saturday, August 16, when a parade down the track, a skydiving exhibition, and 91 heats would all have to take place.

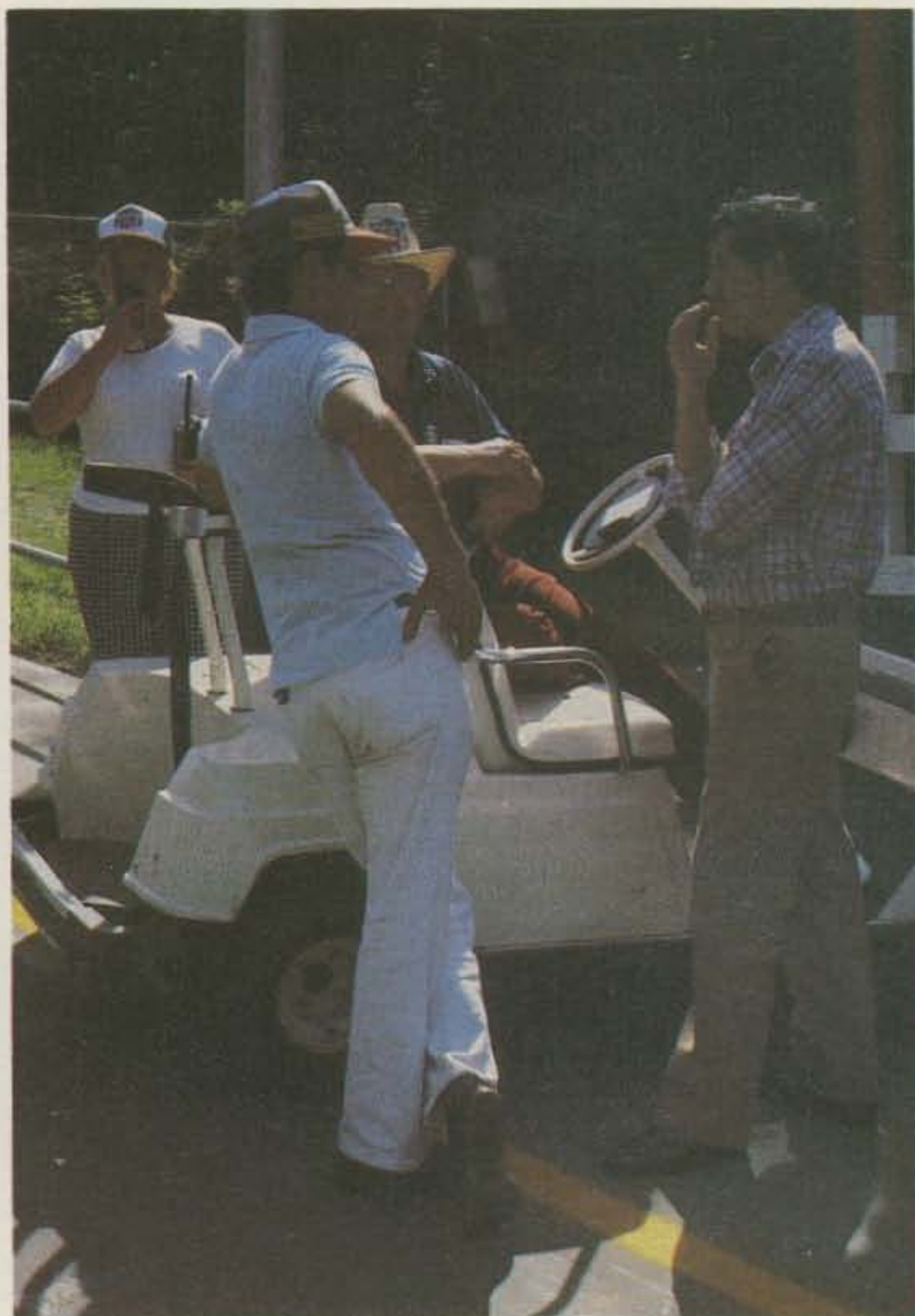
Amateur radio helped to ensure that this year's race went like clockwork. That has not always been the case. Alley recalled one incident which, while it had no serious consequences,



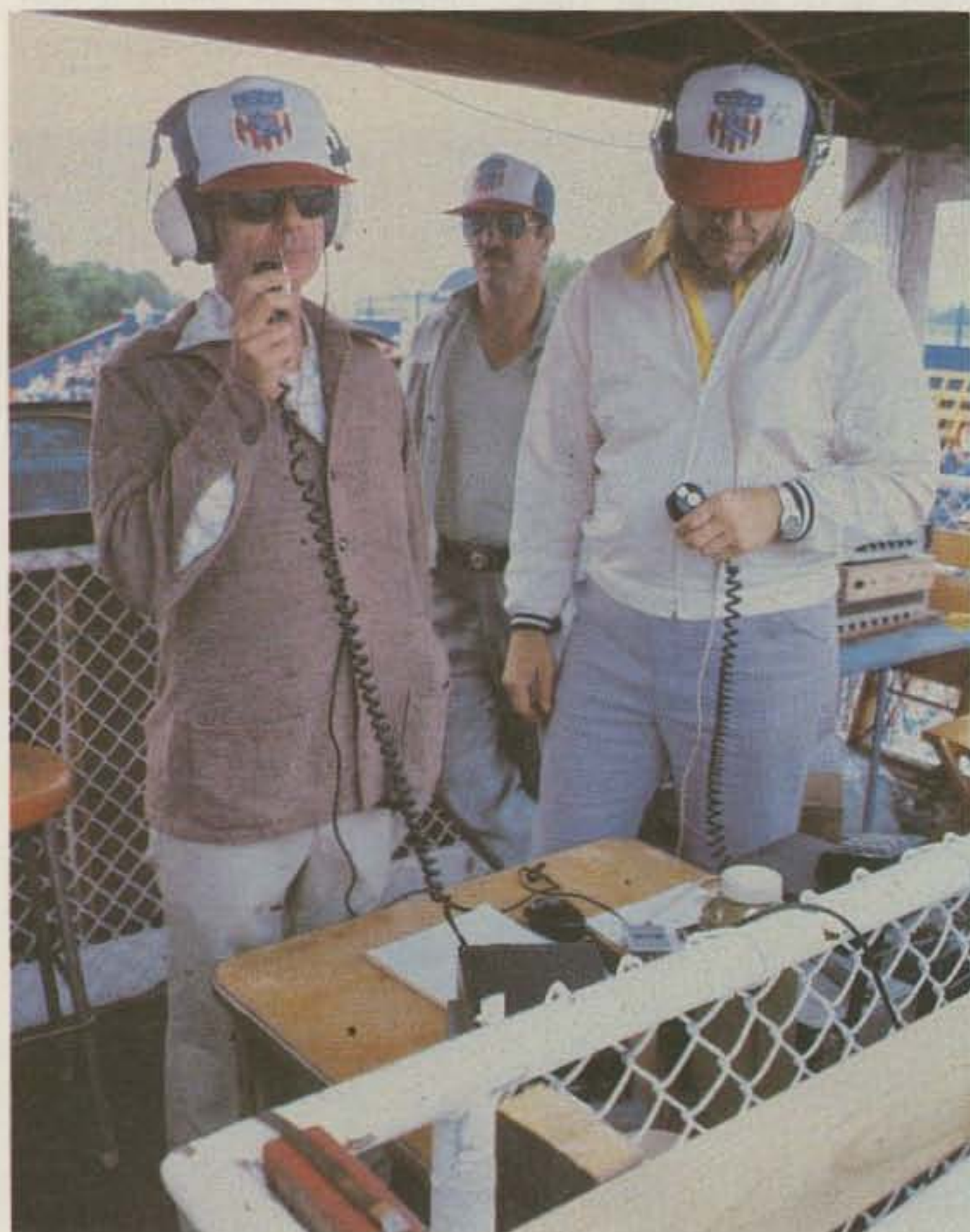
WD8POL and XYL, WD8PZO, work at the topside control booth during Wednesday's trial runs.



WB8VNO provided communication for Derby general manager, Wayne Alley, seen here talking to one of the deputies at the track.



WB8VNO provided communication while Derby officials discussed the race with Kazumi Hotai (right) of Tokyo Television, who taped segments for a special on children of the world.



WB8CBO (left) and WD8CVH operate CARS station WB8DJP on race day from the bridge across the race track.

was embarrassing to the people involved.

Two years ago, a skydiving team was to exit the plane, free fall, and land on the Derby track at the conclusion of the parade. A smoke grenade set off at the tower was to signal the team to jump, and the track announcer was to call the crowd's attention to the team. Unfortunately, a cannon was set off to signal the start of the parade. The smoke from the cannon apparently looked like a smoke grenade from 12,000 feet, and the skydivers arrived considerably ahead of schedule.

Since this year's Derby included another skydiving exhibition, Bruce Bechtol K8VAK flew with the team and provided both 2-meter and 220-MHz communica-

tion with Jeff Brown WD8MMN, at trackside. Jeff was to keep Bruce informed about the timing of the jump.

When Bruce arrived at the airport, the jump team and the pilot expressed some concern about the cloud cover and the wind. After a discussion, they decided to see how conditions were higher up and to make the decision then.

The wind and clouds did present a problem, and Bruce was able to inform officials on the ground of the situation. The track announcer was able to point out to the crowd that the team would be jumping from about 5000 feet with no free fall because of the conditions. In addition, radio communication also allowed the announcer to re-



WD8DAI provided radio communication for the VIP booth on race day. Immediately behind her is KB8CT, president of Novar Electronics, chief sponsor of the All-American Soap Box Derby.

assure the crowd quickly that one skydiver, who had been blown into a fence while landing, was not injured. The team said there would have been confusion on the ground if they had not been able to communicate the change in plans to the announcer.

With the parade and skydiving completed, the race became the important event. There were two classes, junior, for boys and girls 10 to 12, and senior, for entrants 12 to 15. A 12-year-old could choose either division, and this year's senior winner was 12.

For each heat, two or three cars, depending on the pairings, were placed on the starting blocks, the blocks were dropped, and the cars rolled down the 953-foot racing strip to the

finish line where the first car across tripped an electronic timer—and a camera shutter, to provide photos for the judges in races which were too close to call with the naked eye.

After crossing the finish line, the cars had a 1,200-foot runout area in which to slow to a stop. Since each car had a brake, most stopped near the stand, about halfway through the runout area. At that point, if a winner had already been declared over the public address system, Derby volunteers consoled the "losers." (The term loser is never heard at the Derby. Officials throughout the day call each entrant, "champ," since each got to Akron by being the champ of some local derby.)

The winner then waited



WD8POL, his XYL, WD8PZO, and N8AHJ take a break at the control booth during a lull in the heats on race day.

until two other winners were available and the three drew for lanes in the next heat. K8UCN handled the lane assignment chores since enough other volunteers were available for radio duties. After drawing lanes, the winners and the cars were returned topside, where they waited for their next run.

If the Derby were to run smoothly, action had to take place simultaneously at topside, the starting line, the finish line, and the runout area. Safety was the first concern, and an amateur radio operator was stationed at each location. They were coordinated by WB8DJP, operated by WD8CVH and WB8CBO. The control station was located on the second level of the bridge at the finish line and just behind the announcer so that informa-

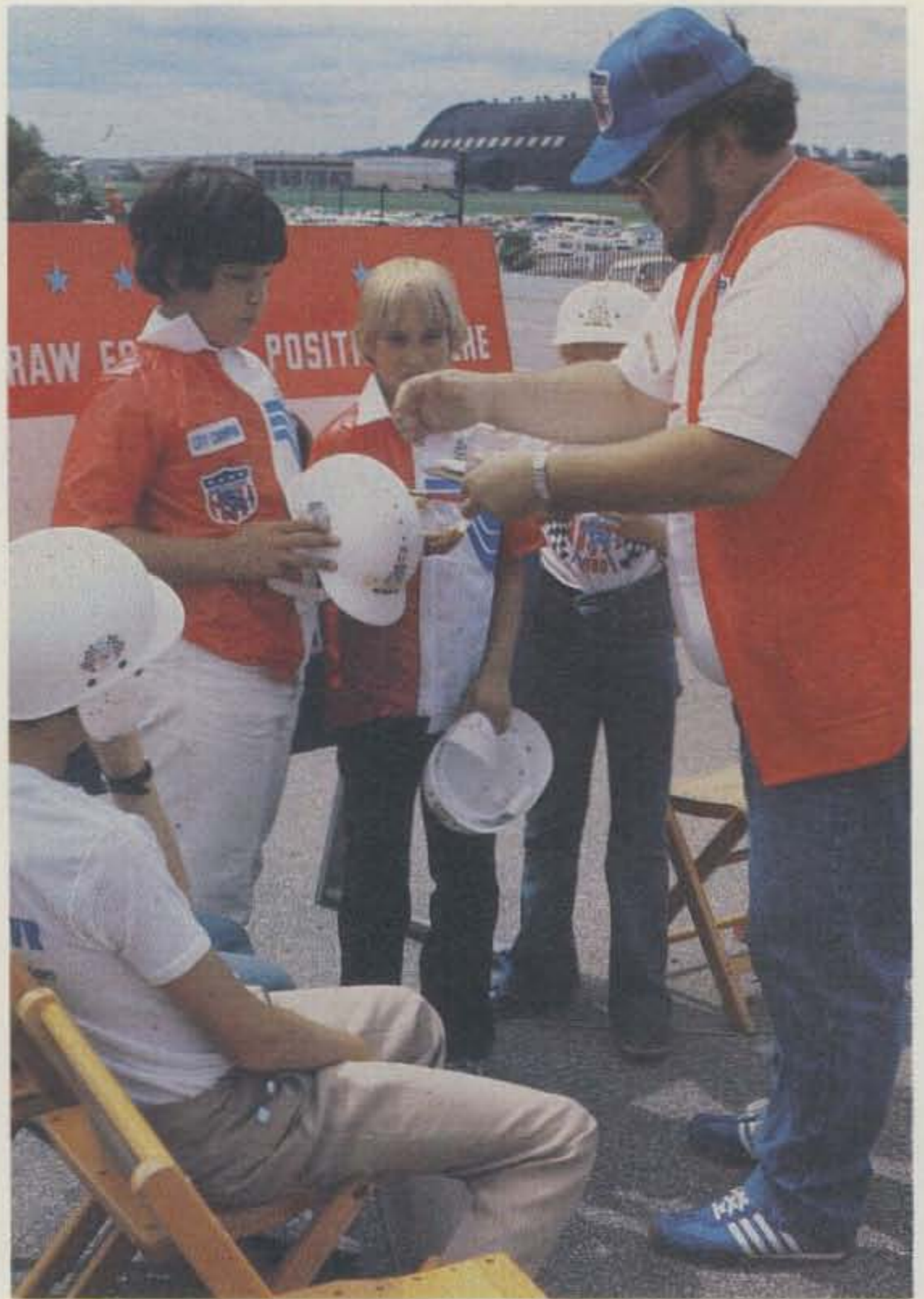
tion could be passed on to the crowd quickly.

In addition, a telephone line connected each station, and, leaving nothing to chance, another heat was not run until each point had given the okay. In addition to radio and telephone communications, a system of red and green lights and red and green flags was used. No car could leave the starting line until a verbal go ahead had been given and both the green light and green flag were visible.

Fortunately, this year there was no serious emergency to test communications capabilities. The few entrants who brushed the wall walked away and shed tears more from the agony of defeat than from any injury. The Akron Fire Department Emergency Medical Team and a US Army Reserve medical team careful-



K8VAK, who provided aerial communication for the skydiving exhibition, has his chute adjusted. Bruce used both 2-meter and 220 handhelds.



K8UCN coordinated lane selections as each heat winner arrived in the runout area. In the background is the Goodyear Air Dock, the largest building without interior supports.



WB8YNX and KB8CJ provided radio communication in the runout area.

ly examined the few champs who bumped the wall. The only damages were to the pride of the youngsters, some of whom had traveled many miles to represent their hometowns and countries. The race included champs from Germany, Venezuela, and Canada.

Other hams working Derby day included Clyde Lorenz WB8YNX, Jeff Ruoff N8BFU, and Tom Haynes KB8CJ (who were stationed in the runout area), Paul Banquer WD8MDG, who was at the finish line, and Bob Cronauer N8AHJ, Ken Langford WD8QWD, and WD8DAI, who provided communications for various Derby officials.

Bruce Rodenkirch WB8WFD shadowed the NBC crew which taped segments of the race for use

during October on the new series "Games People Play." Bill Hessler W8DXT provided communications for Kazumi Hotai and his Tokyo television crew which was shooting footage for a special program on children of the world.

Ken Slezak N8BYS, who was stationed halfway down the track, had the most uneventful post. His only action was to check on an entrant who had applied his brake and stopped in the middle of the track after a shroud on his car loosened and blocked his vision.

It's not possible to name all the hams who helped during the week with the Derby or who might have helped give directions on Derby day on the other repeaters in the Akron area. Nor is it possible to mention all the clubs which were

represented by the people participating. But it is possible to tell a little more about the ham who helped make it all possible, Jim Ott KB8CT.

In the fall of 1972, Chevrolet officials (who had first sponsored the Derby in 1936) decided to withdraw their sponsorship. The Derby was sponsored by local groups until the fall of 1975 when another national sponsor was found. Novar Electronics of Barberton, an Akron suburb, pledged \$165,000 toward the next Derby, and has supported each Derby since.

Ott, who was first licensed in 1962 as K8CAA, founded Novar when he was 17. (Novar stands for Northern Ohio Video and Radio.) Ott had gone to Ohio State University to study electrical engineering. While working with a deaf student there, he developed the Whisperlite, a device which converts

sounds into light. When commercial interest in the device developed, Ott quit school and founded his company which, today, is a recognized leader in security systems including a new identification system which uses the vibrations created by the human body.

Though the Novar name is prominent during Derby week, on T-shirts and other Derby promotional materials, Ott does not make commercial use of his sponsorship during the rest of the year.

On race day, he said, "It's fun to be here seeing the kids enjoying themselves. This is a great program and I'm happy to be able to contribute."

Jim said that his work doesn't give him as much time on the air as he would like, but if you do hear KB8CT, jump in and say hello to a ham who helped make August 16 an important day to 91 champs. ■



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Amateur Radio Profiles



KB8CT waves home the final heat of the 1980 All-American Soap Box Derby. Dan Purol of California, in the red car, took home a \$5000 scholarship and a California Replicar kit in addition to the trophy.



KB8CT presents the senior division All-American Derby trophy to Dan Purol of Fair Oak, California.

Perfect Parabolas

— use some solar technology on your next dish antenna

I became interested in building an MDS TV converter after reading an article in the August, 1979, issue of *73 Magazine* entitled "You Can Watch Those Secret TV Channels."

After building the converter and coffee-can feed-

horn, I was concerned over the number of trees between my location and that of the MDS transmitting station. A line-of-sight path is normally required at the frequencies used for MDS TV and trees greatly attenuate signals. I suspected that

I would need an antenna with more gain than that of the "snow-saucer" type.

Whenever UHF or microwave frequencies are mentioned, I form a mental image of a parabolic dish. However, they are expensive and I knew nothing about designing or building them. So what do I do now?

Research

After a long and fruitless search through my limited library of radio publications, I was ready to give up when I spotted my *Solar Energy Handbook*. It contains information on collecting light waves with parabolic reflectors. Having read that the properties of high frequency radio waves and light waves are similar, I decided to design and build a parabolic reflector based upon the information in the book. This information is shown in Figs. 1(a), 1(b), and 1(c) and illustrates three approaches that can

be used to produce a parabolic curve.

Design materials needed are:

- Several sheets of linear graph paper
- Straightedge or ruler
- Compass for drawing circles
- Pencil
- Piece of wood—1" × 6" × 24"
- Approximately 5' of string
- 4' × 4' piece of plywood or heavy cardboard

Dimensions

Due to my limited knowledge, my choice of dimensions was based upon common sense and convenience. Choosing a diameter of four feet for high gain and a focal length of 26 inches so the feedhorn mounting tube could be short and rigid, I followed the instructions shown in Fig. 1(a). I let each square on the graph paper represent one inch (not shown for purposes of clarity).

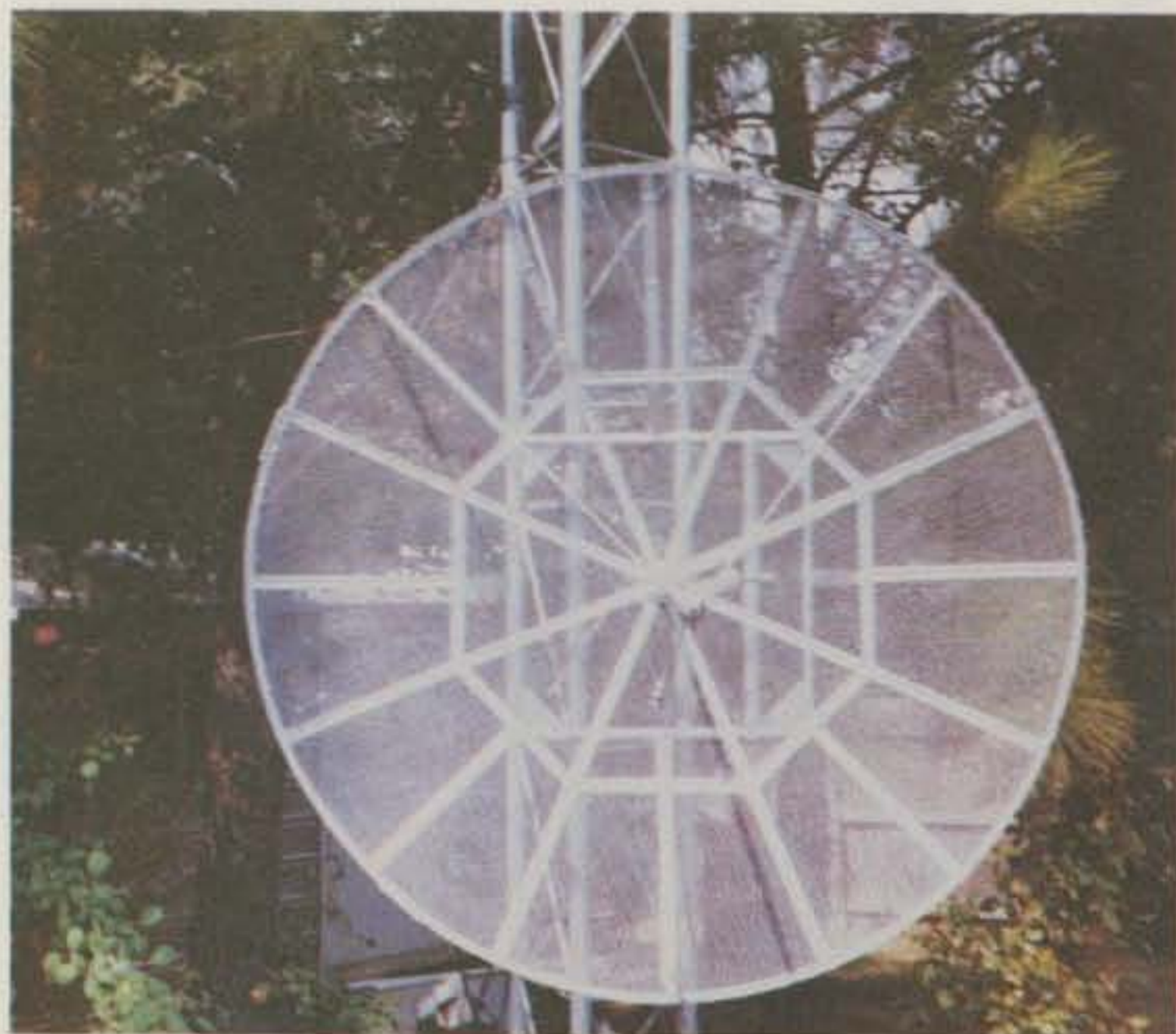


Photo A. Front view of completed four-foot dish showing rib structure.

After marking the graph, it is necessary to obtain a full scale graph. This is accomplished by drawing vertical and horizontal lines 1" apart for the full length and width of the 1" x 6" x 24" board. Having done this, observe the markings on your graph paper and mark the corresponding points on the 1" squares on the board. If you draw a line from point to point on the board, you will have a full-scale pattern on the board for forming the ribs of the dish. See Fig. 2.

Attach the 5' length of string to the center of the 4' x 4' plywood and, holding the pencil tightly against the string, draw a four-foot diameter circle on the plywood. This is your "rim" pattern. A complete list of materials is provided in the Construction Materials box.

Construction Details

Cut eight 22½" pieces of "Tee" metal and bend each of these so the flat surface will conform to the pattern on the wood graph. Be accurate because these 8 pieces are the ribs which establish the curvature of the dish. Refer to Fig. 3 for the following assembly steps.

Position the most curved end of the ribs in 1" from the outer edge of the pipe flange. Attach these eight ribs so the flat side will be against the bottom of the flange and will radiate outwardly with equal spacing. This should form a hub with eight spokes.

Keeping the flat side outward, carefully bend a length of the Tee metal around a large round object such as a 55-gallon oil drum and make a four-foot circle to match the circle on the plywood pattern. Using flat strap aluminum as a backing plate, attach the ends of this circle to form a 4' hoop or rim.

Attach the rim to the top of the eight ribs. Measure in

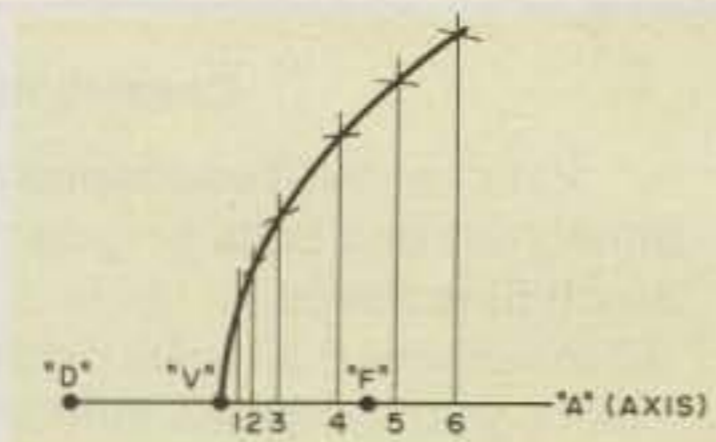


Fig. 1(a). If vertex "V" and focus "F" are given on axis "A", mark point "D" so that "DV" = "VF". Draw lines perpendicular to the axis at any points, 1, 2, 3, 4, 5, etc. Bisect each with an arc drawn from "F", with a radius equal to the distance of the particular point from "D". Thus, bisect line 3 with radius "D3" drawn from "F".

12" from the rim and attach eight pieces of Tee metal braces between the ribs to form an octagon-shaped circle on the rear of the dish. Attach eight more pieces of the Tee metal from the octagon-shaped circle to the rim, centered between each of the main ribs. See Fig. 3(d).

Dish Support

The dish supporting and mounting frame is made by making an 19" x 19" square with Tee metal. See Fig. 4. Each corner is braced with a 16-gauge triangle cut from the 4" x 4" sheet of aluminum. The frame is attached to the rear of the dish with 5" lengths of Tee metal. Additional braces are formed with the four 16-gauge 1" x 6" aluminum strips.

The two ½" x 8" aluminum strips are formed around one leg of the tower and will bolt to the rear, flat surface of the frame when the dish is mounted on the tower.

The 7/8" o.d. tubing, 3" long, is slipped over the ¾" x 19" aluminum tubing and the 19" tubing is attached to the upper and lower frame members. The 7/8" U-bolt clamps the 7/8" sleeve to the ½" x 23" aluminum tubing which will form the adjusting arm for

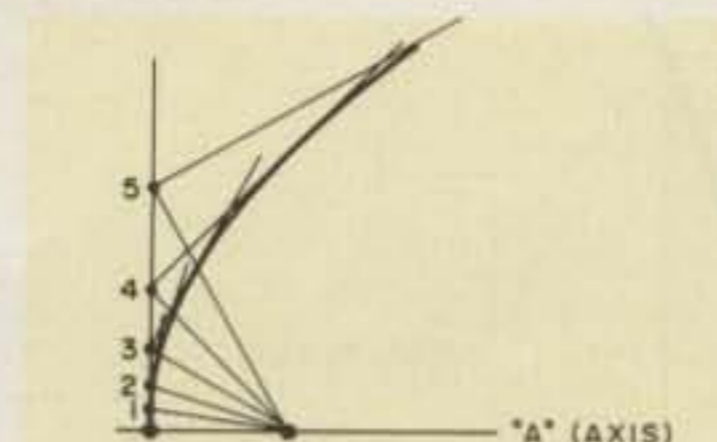


Fig. 1(b). If, as in 1(a), vertex "V" and focus "F" are given on axis "A", draw line from "V" perpendicular to axis. Mark any point on this line (1, 2, 3, etc.) and connect it to "F". Draw a line from each point at right angles to the line to "F". (Thus, from point 5, draw line at right angles to "5F".) Each of these lines will be a tangent of the parabola, which must be drawn inside these tangents, touching each section at its center.

the dish. This 23" length of tubing is inserted through a clamping bracket which is attached to another leg of the tower.

Covering the Frame

Using ¼" mesh wire (hardware cloth) or aluminum window screen, cut four pie-shaped wedges and attach them with bare aluminum wire to the ribs of the dish. The "tie wires" are bent into a U shape and inserted through the mesh over the braces. They are

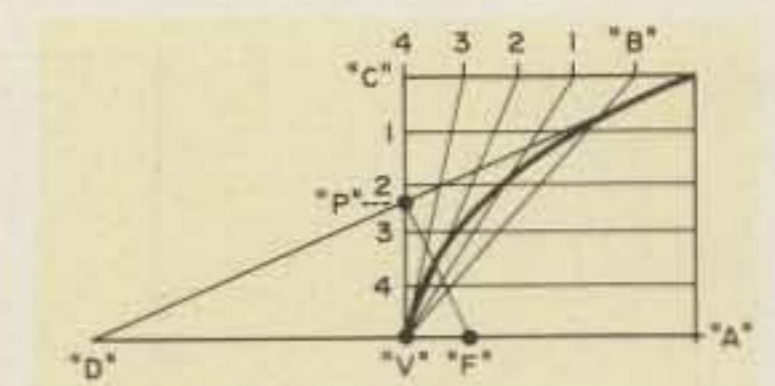


Fig. 1(c). If vertex "V" and axis "VA" are given as well as width "BA", draw "CB" parallel to axis and "CV" perpendicular to axis. Divide both into an equal number of equal sections (1, 2, 3, 4, etc.). Connect "V" to each point of "CB" (radial lines). Intersect each radial line with parallels drawn from corresponding points of "CV". The intersections are points of the parabola. Mark point "D" on extension of the axis so that "DV" = "VA". The line connecting "D" with "B" is a tangent at "B". Where "DB" intersects "CV", mark point "P". Draw line from "P" at right angles to "BD"; this will determine the position of focus, "F", on the axis.

spaced at 2" intervals. This causes the mesh to closely follow the curvature of the ribs when the wire is twisted. For a neater appearance, you may wish to spray the entire assembly with aluminum paint as I did.

Testing

After construction came

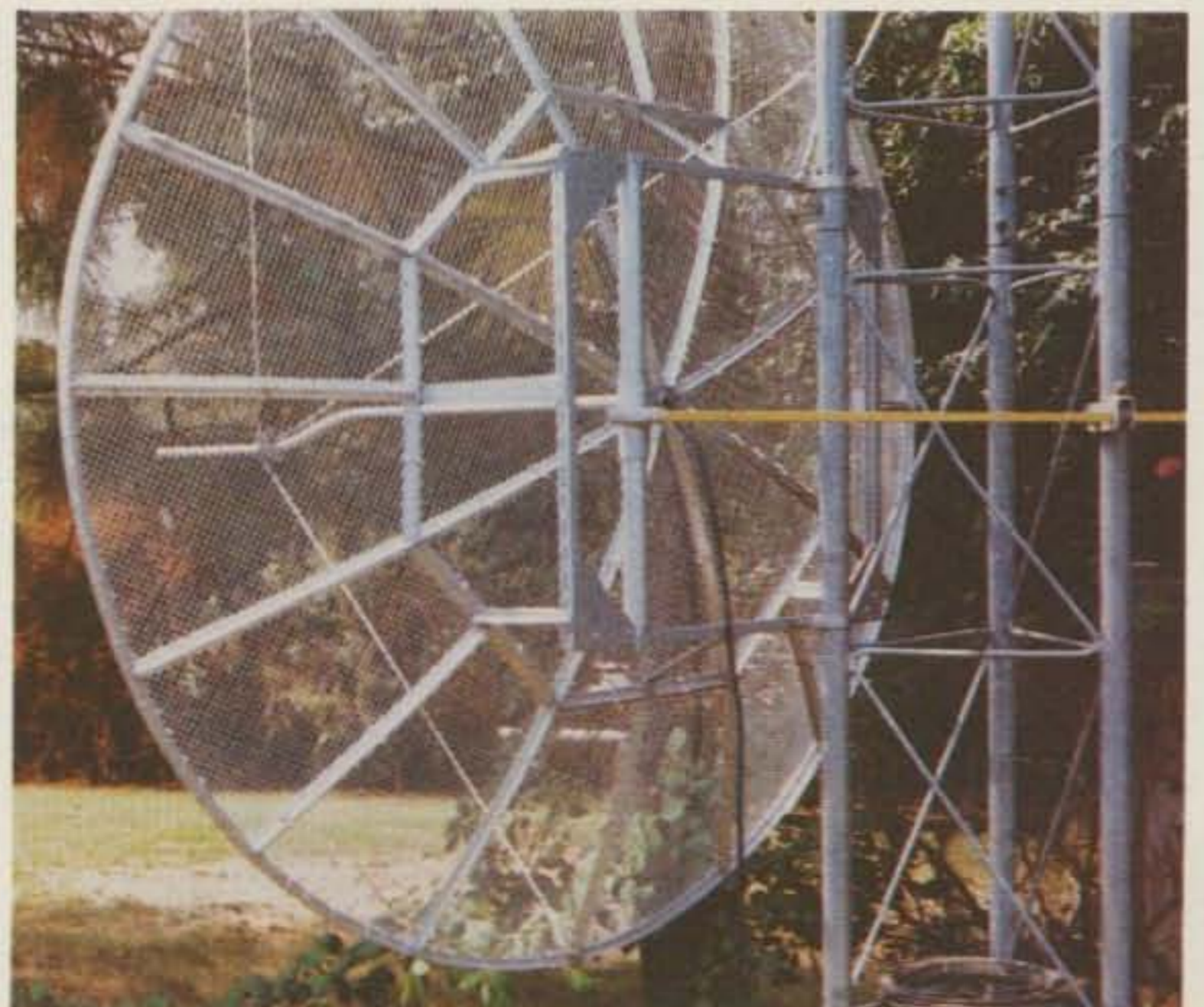


Photo B. Rear view of dish showing mounting details.

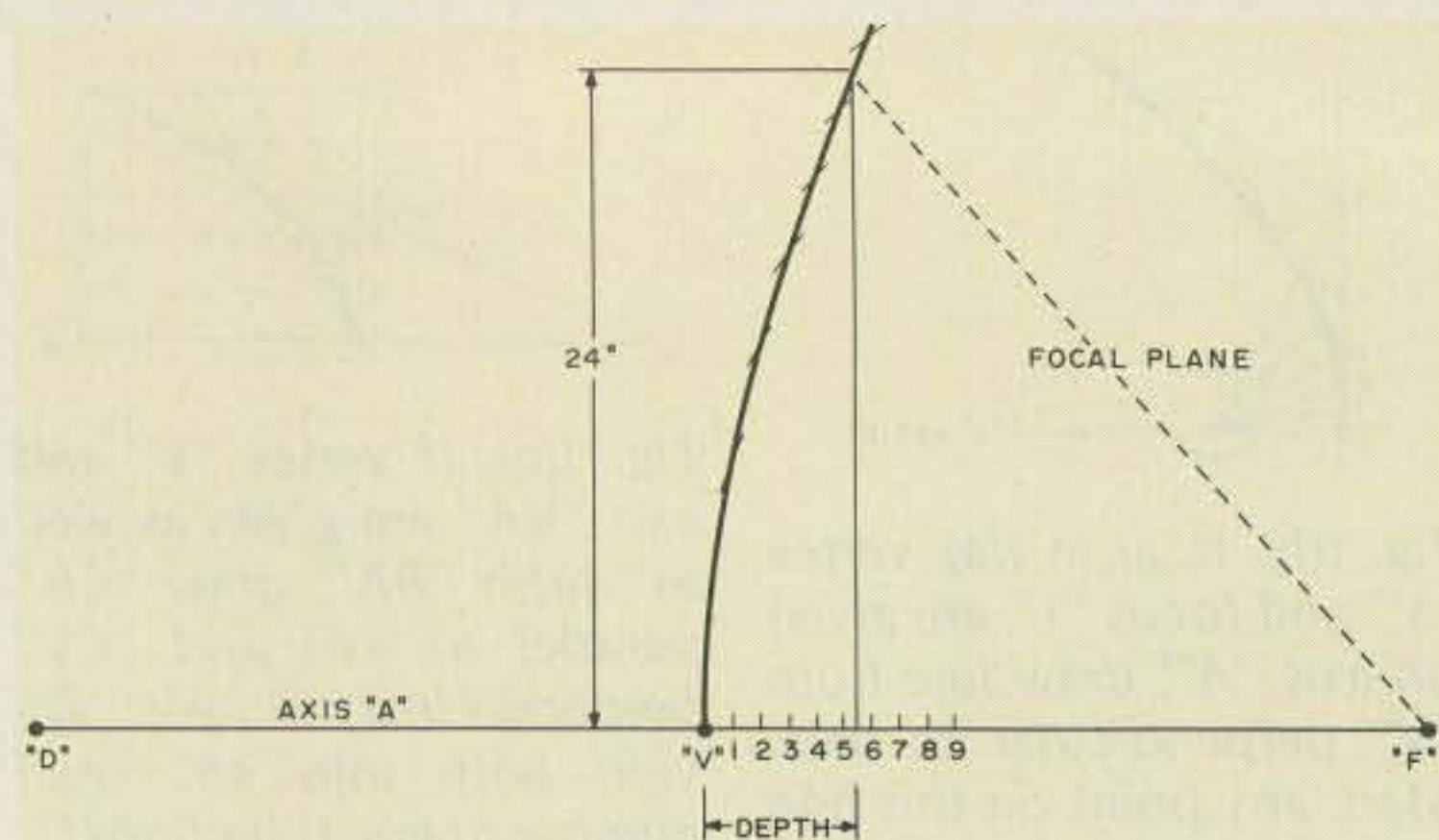


Fig. 2. Details for making full-size construction pattern (top half of the parabola graph).

Construction Materials

- 1/2" x 1/2" x 1/2" Tee-shaped aluminum strips
- Small nuts and bolts or "pop rivets"
- 3-inch pipe flange
- 1/4" mesh wire (hardware cloth) or aluminum window screen — enough to cover the reflector.
- Aluminum tubing, 3/4" o.d. x 19" long
- Aluminum tubing, 7/8" o.d. (3/4" i.d.) x 3" long
- Aluminum sheet, 16-gauge, 4" x 4"
- Aluminum strips (2), 1/2" wide x 8" long
- Aluminum strips (4), 16-gauge, 1" x 6"
- Aluminum strip, 16-gauge, 1" x 2 1/4"
- Aluminum tubing, 1/2" x 36"
- Aluminum tubing, 1/2" x 23"
- 1 U-bolt clamp (to fit 7/8" pipe)
- 1 U-bolt clamp (to fit tower leg)
- Several feet of aluminum wire (clothesline wire), small gauge

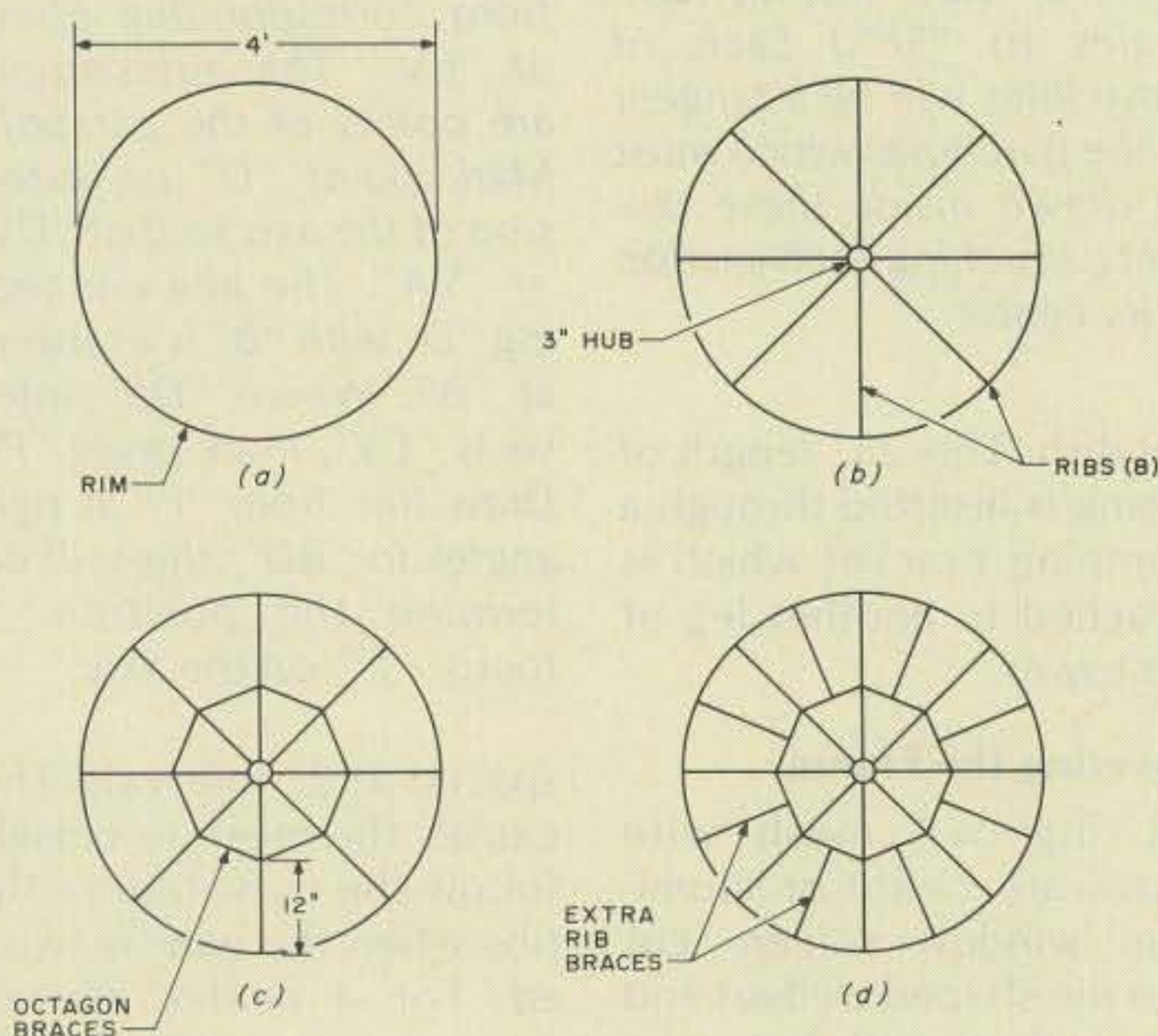


Fig. 3. (a) Rim dimensions. (b) Spoke installation. (c) Octagonal bracing placement. (d) Installation of extra rib braces.

the pleasure of testing something that worked right the first try. I was fortunate enough to have a Gunn diode oscillator operating at 10.5 GHz and the waveguide-horn from an old police radar detector. The Gunn oscillator was set up facing the waveguide detector at a distance of ten feet and the meter reading was noted. The Gunn oscillator was then pointed at the mouth of the dish, and by standing to one side and moving the detector around, I was able to locate the point of highest rf concentration. This point was 26 1/2" from the vertex of the dish, only a half-inch off

the design and now the meter read full scale (100 microamperes). This was much greater than the direct reading without the dish, indicating a great deal of gain.

The Gunn oscillator was then moved to a point three feet from the front of the dish and the detector was used at the rear of the dish to check for rf leakage through the mesh cover. None could be detected. This would seem to indicate that spacings greater than 1/4" could be used for frequencies below 10.5 GHz.

Miscellaneous

The pipe-flange center hub makes horn attachment easy. You may wish to thread a short pipe nipple into the flange and slide a piece of aluminum tubing or PVC plastic over the nipple to mount the horn. You can clamp the two together with screw-type pipe clamps or hose clamps.

Conclusion

If you should build a parabolic reflector from the solar book information given, I believe that you will be well pleased with the results. I certainly am. I have become so interested in the design of dishes that I have completely dropped the MDS project and I am presently contemplating a 12 footer for satellite reception. Good luck. ■

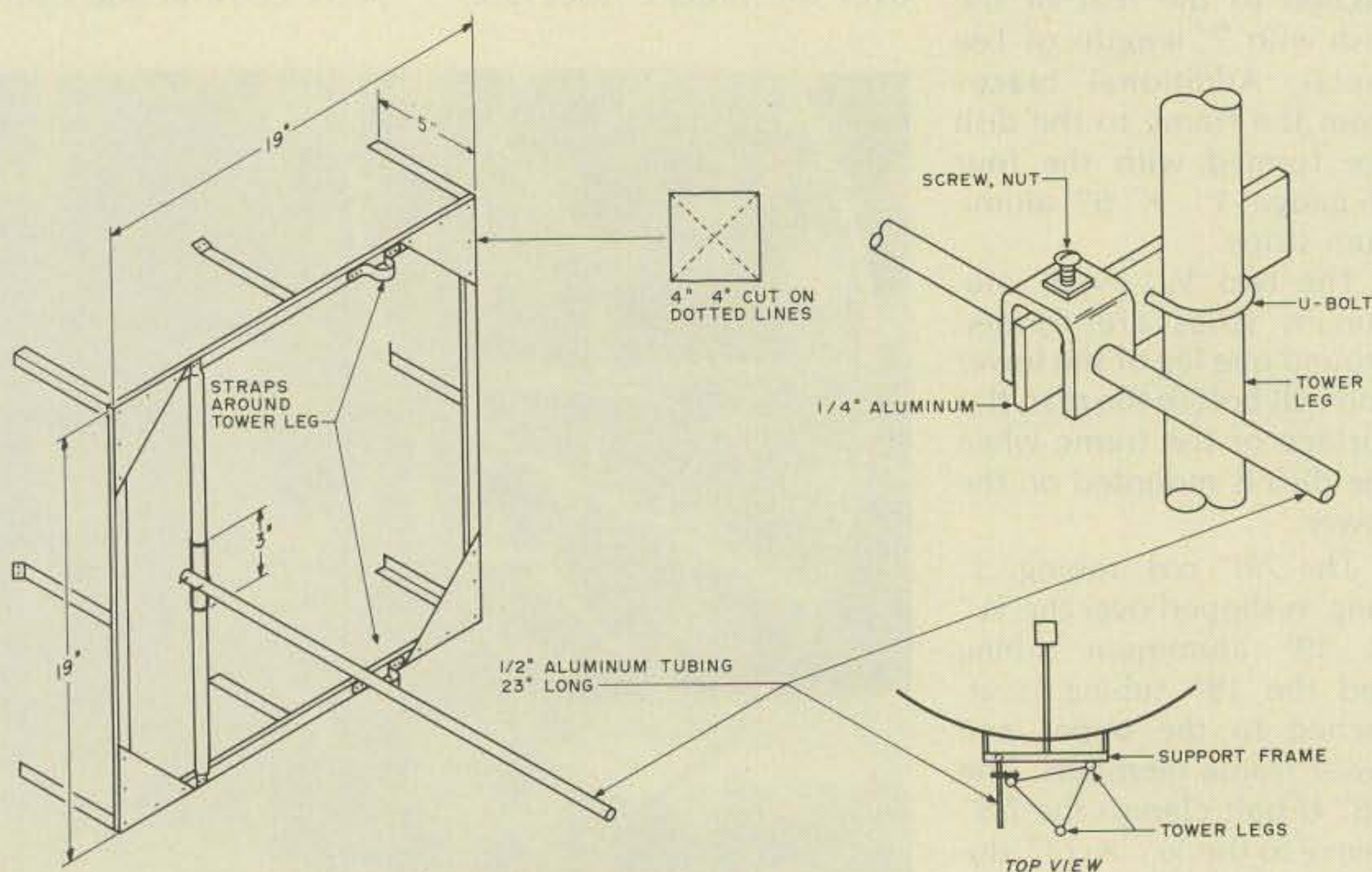


Fig. 4. Supporting and mounting construction details.

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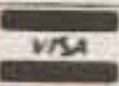
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Help for the HW-2036 — hum mods for Heath-equipped hams

Almost immediately after I put my Heathkit® HW-2036 on the air, two problems cropped up. First, there was a terrible hum on the transmit audio whenever I tried to work

through a repeater, and second, the phono plug coax connector kept coming loose. Daunted but not defeated, I put the thing back on the bench and proceeded to dig into the problems

with great exuberance.

If you live in an area that doesn't require a Private Line® (PL) for repeater access you may never have noticed the hum. But if you use PL you undoubtedly

have been told that you have a noticeable—if not objectionable—hum on your signal. It's not humming because it doesn't know the words, it's humming because the injection level is simply too high. Unfortunately, Heath did not see fit to include a level adjustment. Enter modification #1.

The square-wave output from the tone generator is fed through several stages of RC filtering to R134, a 470k resistor. (See Fig. 1.) Although R134 is part of the waveshaping network, its actual value does not appear to be critical. Replace it with a pot and you'll have a tone level adjustment.

In my first attempt at this mod, I used a 750k pot—and promptly ran out of adjustment range! A second trip to the junk box produced a 2.5-meg linear PC board pot that worked very well. Actually, any value from 1 to 5 meg will work. The lower the value, the easier it is to adjust—but the more you risk running out of adjustment room.

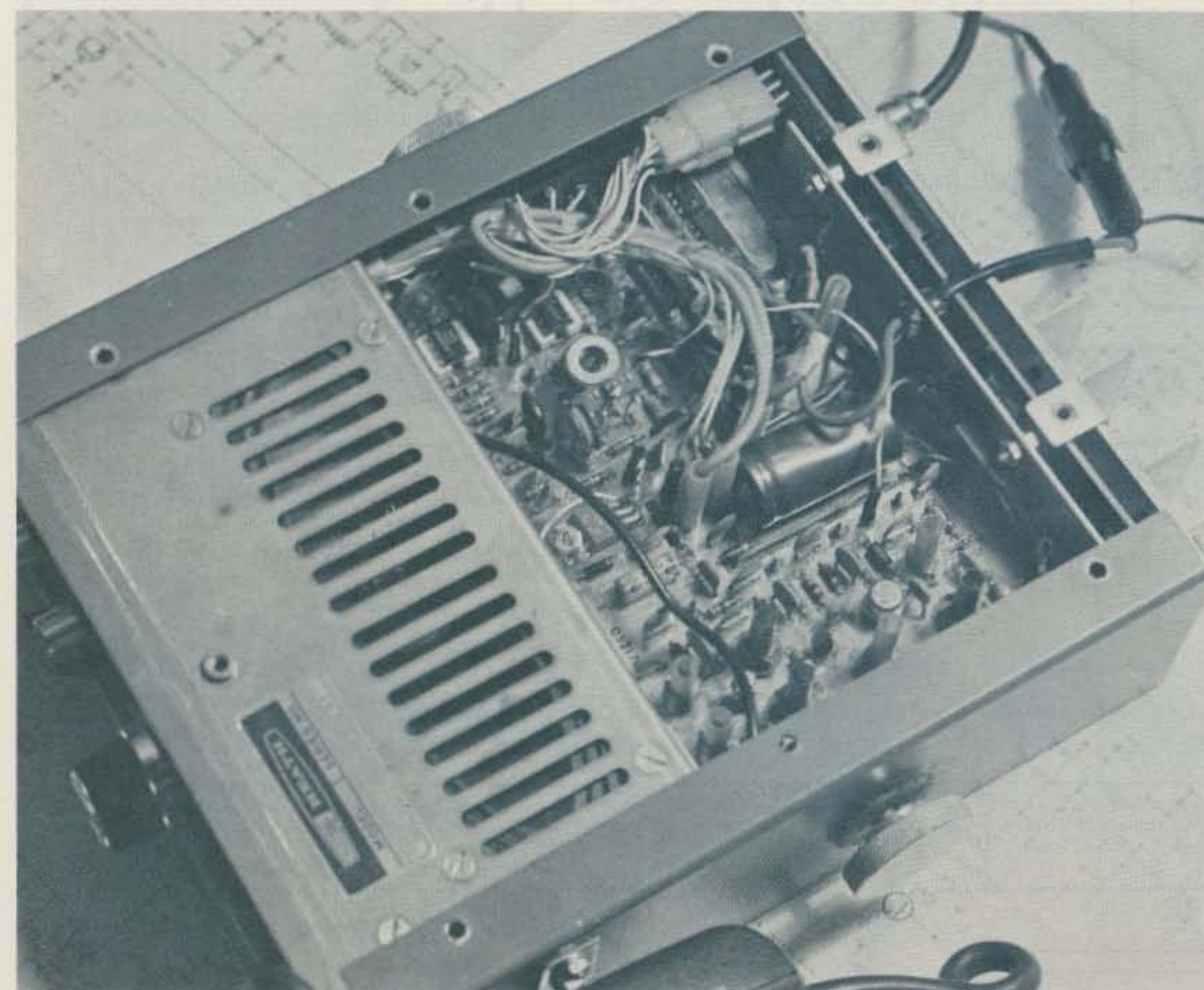


Photo A. This shows the completed modification. The PL adjustment pot is mounted horizontally behind the deviation pot. Note the coax pigtail at the antenna jack.

To prepare the pot, first

solder one end terminal and the arm together. Then solder about 3/4-inch lengths of wire to each end terminal. Bend the leads straight back from the front of the pot and set it aside for a few moments.

Pull the bottom cover off the rig to expose the transmitter circuit board. R134 is located behind the deviation pot. (See Fig. 2.) Snip the resistor in half, crush the carbon and composition from the leads, and bend the leads straight up. Now solder the leads from the pot to the leads protruding from the circuit board. Be careful—not too much heat—you don't want the solder to flow on the foil side of the board.

To adjust the pot, set it for about 500k and get into a QSO on a PL-controlled repeater. Slightly increase the resistance on each transmission. When the other stations report that they can no longer hear the tone, note the position, but continue increasing the resistance until you can no longer hold the machine. Then set the pot midway between those two points. If you find that you can no longer hold the machine while the tone is still audible, check the frequency of the tone.

As long as you have the rig on the bench, you may as well consider one other simple mod. My rig is in and out of the car several times a day. At that rate, it didn't take long for the phono plug coax connector to become loose and intermittent. After taking the rig apart several times to

tighten up the connector, it finally dawned on me that there must be a better way.

One way would be to replace the phono jack with a chassis-mount BNC connector. That would require some (slight) mechanical rework of the box, however. Since my mechanical ability is zero—I can't even put the cap on a peanut butter jar without getting it cross-threaded—I began considering alternative solutions. I decided that a short piece of coax and a few connectors could do the trick.

For most practical purposes, the input and output characteristics of a half-wave section of coax are the same. If you were to solder a half-wave section of coax to the output of the rig, you would effectively move the output point to the end of the coax. That is the theory.

To put theory into practice, solder a UG-89/U BNC connector to one end of a piece of solid-dielectric RG-58. On the other end, solder a phono plug. The distance from the open end of the UG-89 to the tip of the phono plug should be 24-1/2 inches.

Now, tack solder the phono plug to the antenna connector on the rig. I emphasize *tack solder*, because you may eventually have to take the rig apart for maintenance, and a completely soldered connection would be a bear to get apart.

Replace the phone plugs in your car or shack, or wherever else you operate, with UG-88/U connectors; you'll be back in business

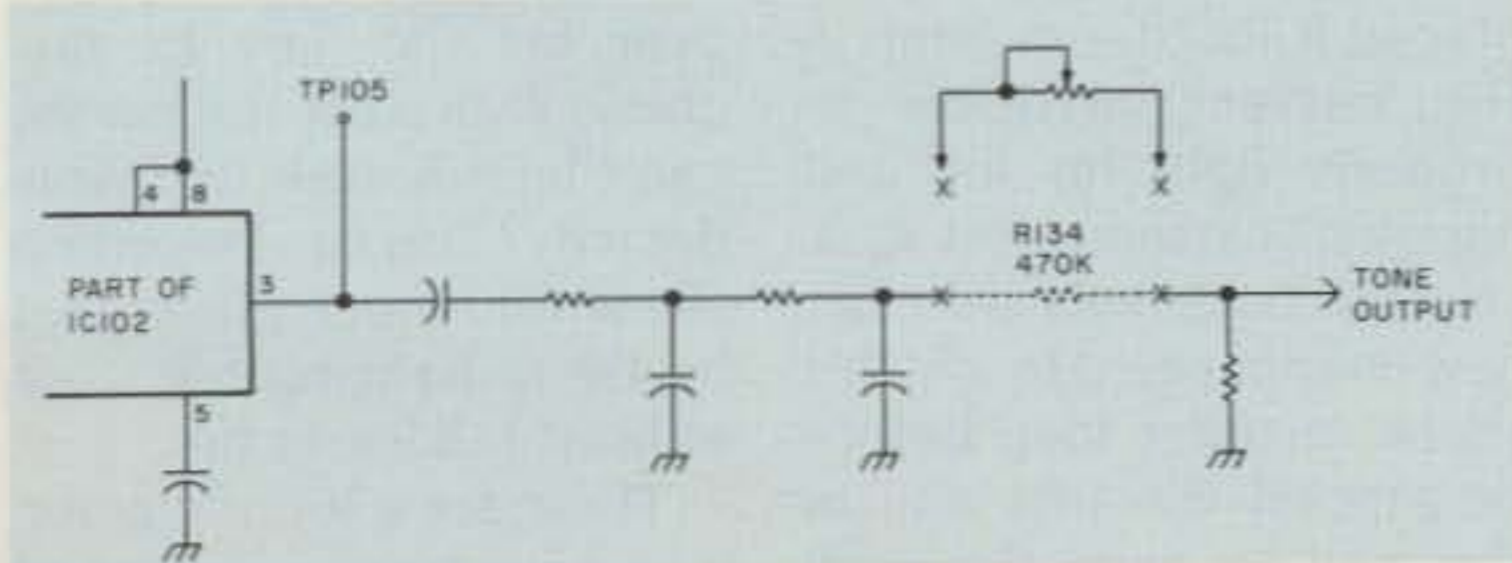



Fig. 1. The tone generator, IC102, and the electrical location of R134 in the output circuit.

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without intermittent coax connectors.

There are several other mods which I would like to describe in future articles.

In the meantime, you can enjoy operation without intermittent coax connectors and without the hum. ■

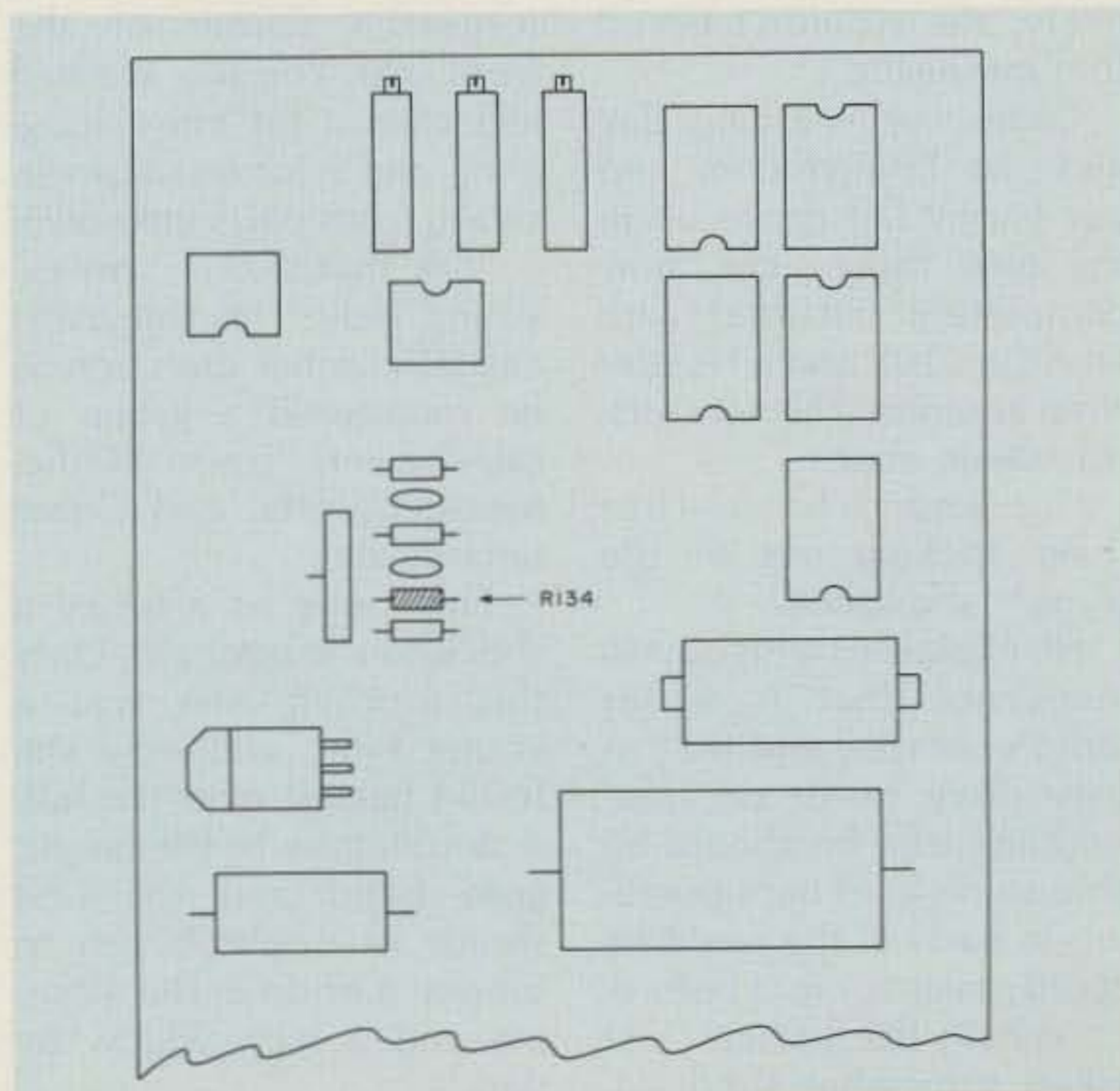


Fig. 2. The physical location of R134 behind the transmitter deviation pot. Most minor components have been omitted for clarity.

The Honeymoon is Over

— hints and kinks for ham husbands

Let me tell you the tale of K9CNC and how he turned a YL into an X-XYL through the marvels of amateur radio.

A bright and shining boy was he, happy in love with his bride-to-be, and an eager radio amateur, as well. He never thought to tell the love of his life much about his involvement with radio, thinking that, most likely, she wouldn't be all that interested.

Came the wedding day and the honeymoon, and our happy lad drove up in the new family car, now completely outfitted with an Atlas 210X and a Hustler whip antenna. The new Mrs. was taken aback.

"...and what's that thing sticking out of the trunk?" she asked.

He explained with boyish innocence that it is for radio contacts, and that as they drive north on their wedding trip, he should be able to pick up ham operators in parts of the world he could never contact before.

"What's the matter?" she asked somewhat subdued. "Don't you want to talk to me?"

Well, they were off.

Somewhere along the Florida turnpike he picked up Australia. As they reached Georgia, British Columbia was 20 over 9.

"Just sitting here with my XYL, driving up to New York City and watching the stars come out," he purred contentedly to a CQer from Pago Pago.

"What's an XYL?" the new bride asked from her forgotten corner of the front seat. You see, she had expected a bit more snuggling and a lot less conversation from parts unknown.

"Oh, that's you... my ex-young lady," he threw off casually in her direction as he monitored a group of rag-chewers from Maine, Massachusetts, and Guantanamo Bay.

This came as a bit of a shock to the poor girl. Only this morning she was a young lady, and now she found herself over the hill. A doubletake to the bright, gold band and the first shreds of doubt began to bloom: a bride in the morning and a ham widow by dark.

Slowly our little bride came to hate the squawking little black box and to

look on with embarrassment and discomfort when the antenna worked itself loose and tangled up traffic, as it frequently did. The honeymoon was over. Quickly.

Moving in to the new QTH only added to our XYL's joys. Where was her OM? Helping to carry the packing crates upstairs, deciding where to put Aunt Mary's lamp, or adjusting the water heater? 'Course not. He was hanging by his heels out their 9th floor apartment window, making the final arrangements on his dipole.

"My heavens," she breathed. She would really be a ham widow if he wasn't more careful. He survived sufficiently, however, to commandeer her best table for his transceiver, meters, and tools, smiling as he placed Aunt Mary's lamp in the perfect position to properly light his log and happily scattering his QSL cards decoratively over her new wallpaper. He got his shack in order long before he tapped the first nail in the wall to hang the wedding pictures.

Life went on for the XYL

and her OM. He came home from the office, kissed the little woman hello, and headed for the shack. "K9CNC here on schedule," while the dinner got cold and the XYL began a slow burn. One day she had had enough. She left the ring on his QSL cards, murmured a quick 88, pulled the plug, and QSTed.

How to Keep Your XYL from Becoming an X-XYL

Poor K9CNC was a sorry case, indeed. Radio wasn't the only cause for his problems, but it was a contributing factor. It is an acknowledged fact that a radio operator can appear to be a strange breed of cat, especially to a wife who has no personal involvement with the romance of the airways, except to watch the back of her husband as he hunches over his CW key or rag-chews with a DX station she can't hear herself and wonder why? You can be certain she would much prefer that he be romancing her... or at least *talking* to her.

There are a lot of women who have become resigned to being ham widows. They've gotten accustomed

to watching the food get cold on the dinner table while they nag at their microphone-mouthed maniacs, or while they stand by the door, waiting for their Good-Samaritan husbands to finish that last, never-ending phone patch, as the concert starts without them or the shopping center closes for the night.

As an XYL myself, I can vouch that tolerance and understanding did not come easy. It took until I became a radio amateur to come to understand the ties that bind the enthusiastic ham. You don't have to turn your wife into an Extra-class operator to make life more livable, but with a few reminders, you might just be able to turn off (instead of tuning out) her long-suffering sighs, give her a greater appreciation for your hobby, and turn her on to the magic of radio for herself. Be careful, now. Don't be too good at this or you might find yourself a ham widower.

Introduce Her To the Hobby

Don't lecture, but do make it a part of your daily conversations to fit in explanations about simple electronics, history statistics, and/or the motivations that make for a radio amateur. She will become a more understanding part of your world when you share it with her.

Explain It To Her

If you are a serious ham and enjoy spending time with the rig, explain that from the onset. Tell her it is a hobby you enjoy, have long cultivated, and from which you take great pleasure. She'll appreciate the pastime more if she understands what you went through to master the code and pass those exams and sacrificed to construct or purchase the equipment. If she is new to the game, she is going to be doing a lot of wondering, as she sits alone

watching TV or reading a book, as to why you have so much to say to strangers and nothing to say to her.

Explain the Lingo

Don't offhandedly throw out an explanation (as K9CNC did) that XYL means ex-young lady, without cushioning the blow. When you know nothing about the jargon, a young lady is one thing, while an ex-young lady is something else again. Don't rattle off abbreviations she couldn't possibly have any background knowledge about, as you spin your dials and rotate your antenna. Take the time to stop, give her your full attention, and answer her questions, no matter how simple or how complex. She'll retain information presented this way, believe me. It seems one of the great complaints from non-hams is their failure to understand what is being said. It turns them right off.

Don't Be Condescending

If you are going to try to make your hobby understandable to a wife who has difficulty plugging in the toaster or setting the clock, don't lecture as if you didn't expect her to understand. Again: Answer her questions. Explain a point as many times as it takes, if she is interested. . . but *don't* get angry at her if she still doesn't understand. After all, it is not her hobby: It's yours. She might pleasantly surprise you someday with her knowledge, as she proudly shows off your shack and finds she can speak intelligently about the operation of your Yaesu, Kenwood, or Swan.

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Make the Shack a Welcome Place

Just because the little woman is not an electronic wizard, she can be trusted within 10 feet of your equipment. If she moves your dials or misarranges your meters or tools, don't jump at her. Instead, use the incident as a way to continue your introductory course in electronics. Make the shack and your equipment comfortable, interesting, and familiar to be around. Turn the shack into a place where she can come and talk to you as well as a place where you go to talk to your fellow aficionados. When she brings you that needed cup of coffee, occasionally ask her to pour one

for herself and join you. Show her the same courtesies you show to your fellow hams on the air.

Don't Let the Hobby Get Out of Hand

Don't turn every available space like the backyard, garage, or spare room into a graveyard for electronic equipment. It's easy to become a collector, but keep it within reason, and keep it neat.

Encourage Her Interest in Radio

If your XYL gets bitten by the radio bug, become her teacher, or point her in the right direction toward a course of study. You'll have a partner in the shack, a worthwhile experience to share, and a little woman who can appreciate your true meanings when you tell your fellow amateurs you've got an XYL that's 40 over 9. That's some Young Lady. ■

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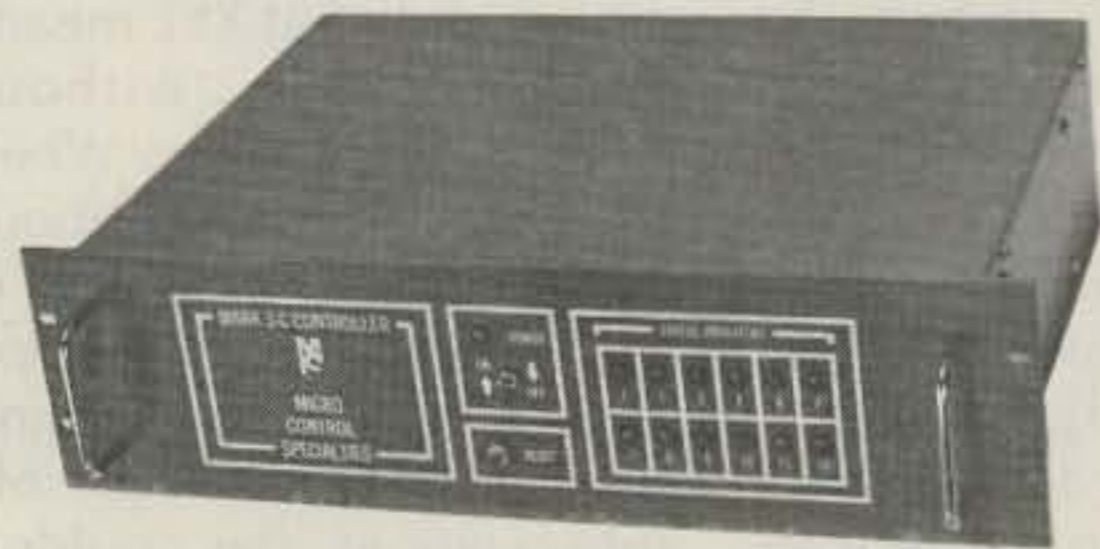


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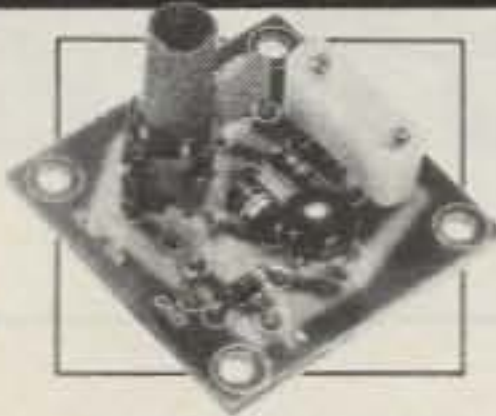
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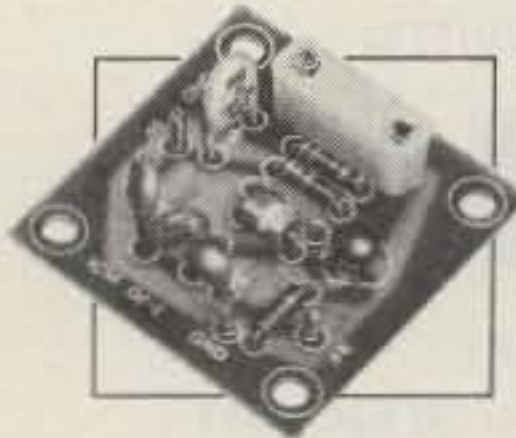
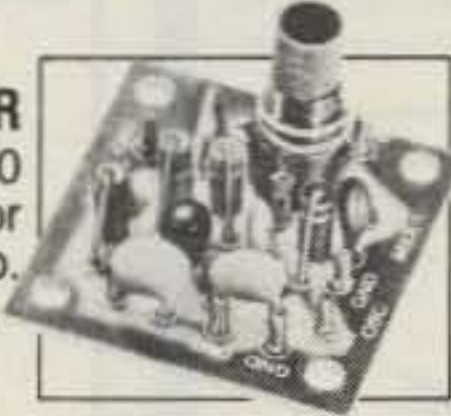
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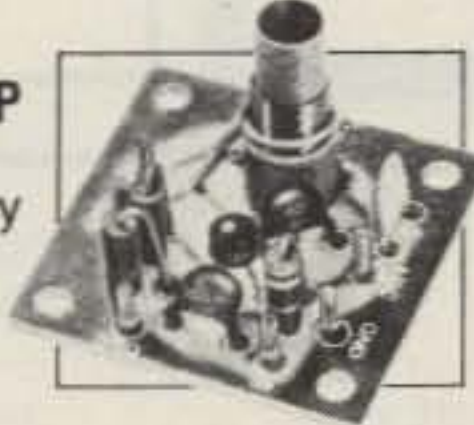
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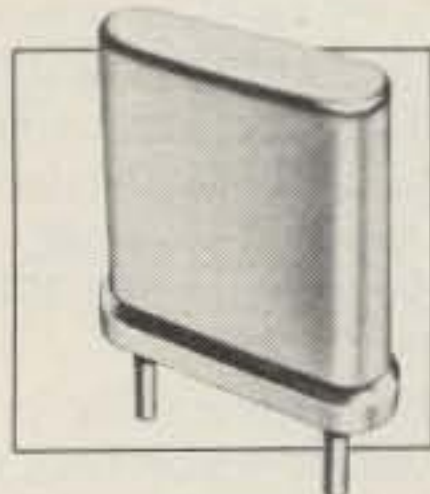
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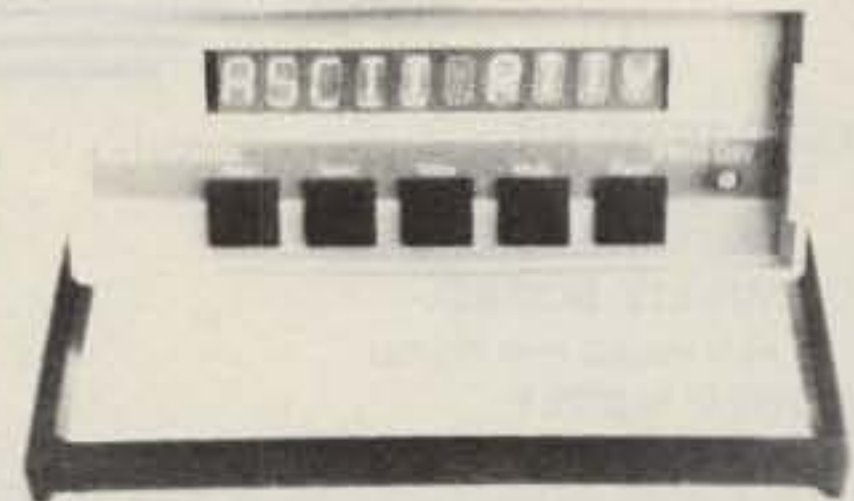
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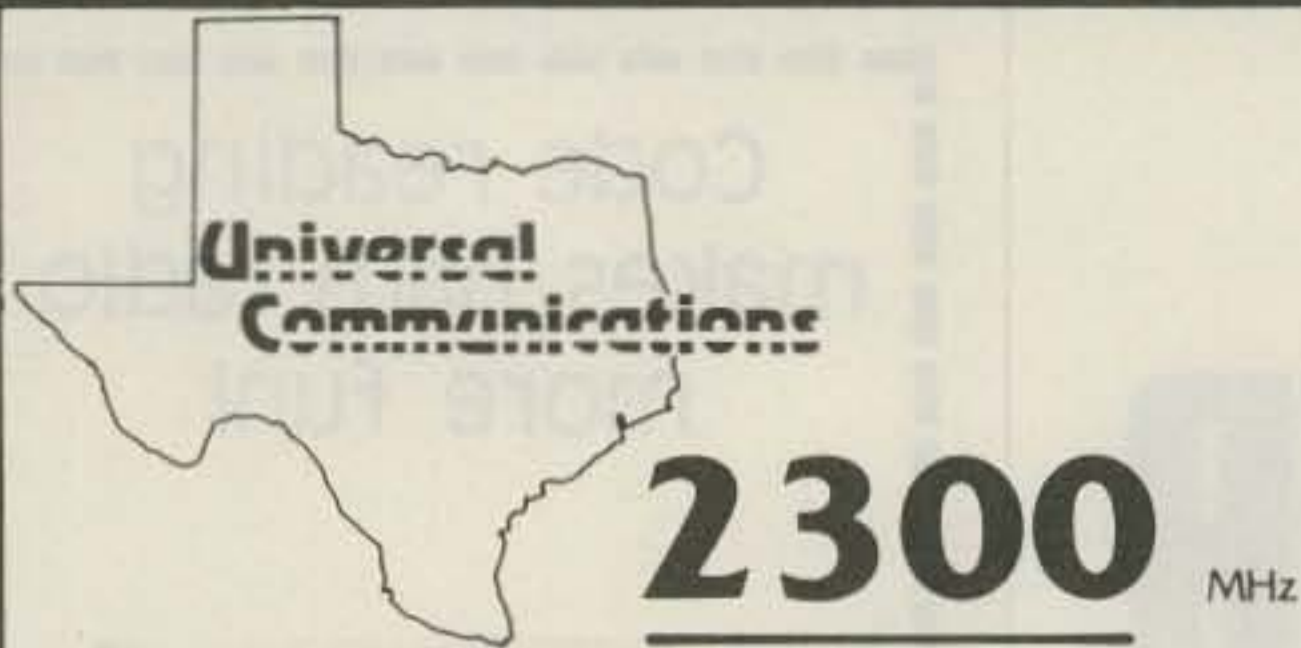
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Any fool knows all these things aren't going to happen to you at once. But if it is 'one of those days' maybe you can just forget the whole mess and brighten your and someone else's day a little by taking some time to think of a fellow ham you admire and respect to nominate for Dayton's "Amateur of the Year Award" for 1981. No, it's not too early to think about it. It does take a little time and effort to nominate some one for "Amateur of the Year."

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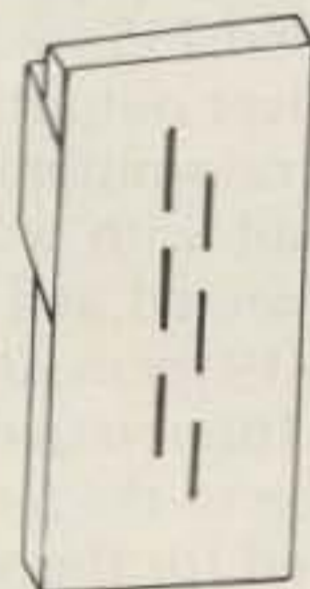
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CB to 10

— part XXX: the Midland 13-866

The basic applications of this conversion will apply to most CB chassis using the 23-MHz series of crystals. The chief difficulty with this radio, which uses no crystal trimmers, is to figure the pF load for the crystals needed. The load of the circuit is about 58-60 pF, but since the crystals are third-overtone cut, the

load to request is about 22 pF cut for third overtone operation. There are two methods of approaching this chassis, but changing the 23-MHz crystals is recommended. The formula is simple: Just add 2 MHz to the existing crystals.

The crystals required are: 25.290, 25.340, 25.390,

25.440, 25.490, 25.540.

Changing these crystals is simpler on an initial conversion because their fundamental range is only 8 MHz, and they are far easier to work with than fundamental 16 MHz crystals. In addition, it is possible to add 24 more channels to the synthesizer circuit by use of a 4PDT switch and four more crystals. Frequencies needed are: 15.220, 15.230, 15.240, and 15.250 MHz, which are stock items at most crystal houses, and range in price from \$3.50 to \$6.00 each (so shop around).

Activating the channel 24 position can be accomplished by locating the white wire coming from the selector switch and going to TR6. Using a piece of hookup wire, as diagramed, or a spare wiper from an old rotary switch, solder it to this terminal in such a way that it makes contact with the switch when the defeat cut in the switch meets the normal wiper. (Refer to Fig. 1.)

Install the new 25-MHz crystals in place of the ones removed from the circuit board. Apply power to the set, and with a frequency counter check for oscillation at the collector of TR6. If the oscillator is not func-

tioning, back out the slug on T6 until the circuit fires. With TR6 oscillating, you now can proceed with the tune-up procedure.

Connect a signal generator through a .01-uF capacitor to the base of TR17. Ground the generator to chassis ground, not the case. With the set on channel 13, (23 if you are installing the 15-MHz crystals as well), inject a 29.115-MHz signal with 1000 Hz, 30% modulation (29.255 MHz for channel 23). Adjust T12, T13, T14, and T15 for maximum receiver output.

Key the transmitter into a dummy load with a wattmeter connected and tune T1 through T9 for maximum rf output. The relative output function of the S-meter may be used for this initial tune-up. Then peak C24 and L5 for maximum power output. At this point, you should have about 2- to 2.5-Watts output. The value of the tank coils in these sets varies greatly, and it may be found that maximum power output occurs when the L5 slug is all the way out. If this is the case, replace C22 (150-pF capacitor) with a 100-pF ceramic disc. This will allow the coil to tune over its mid-range and increase power output to about 5 to 6 Watts. Modula-

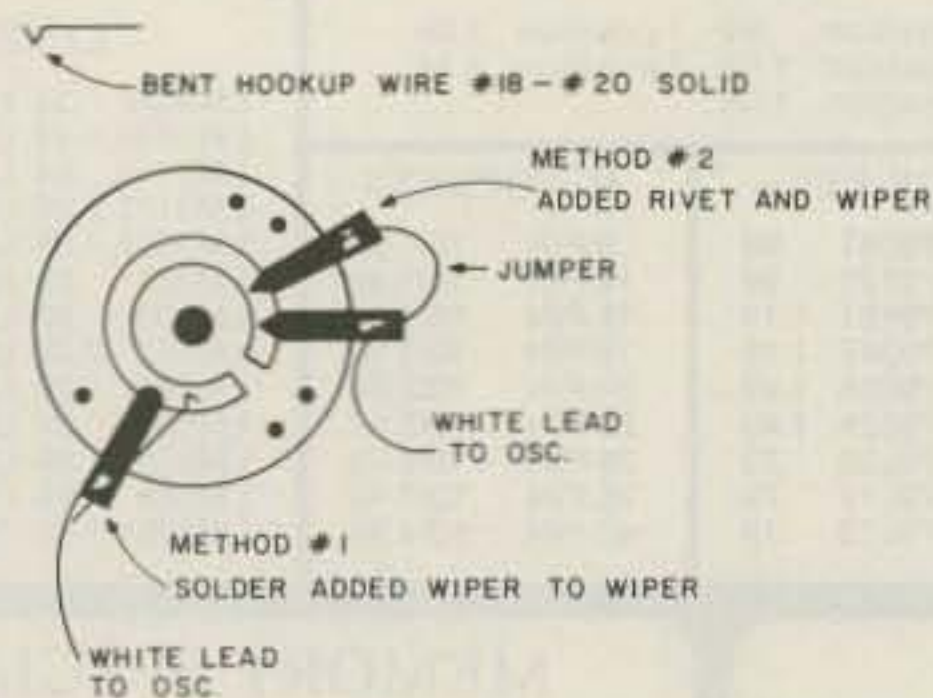


Fig. 1. Two methods of activating position 24 on the channel selector.

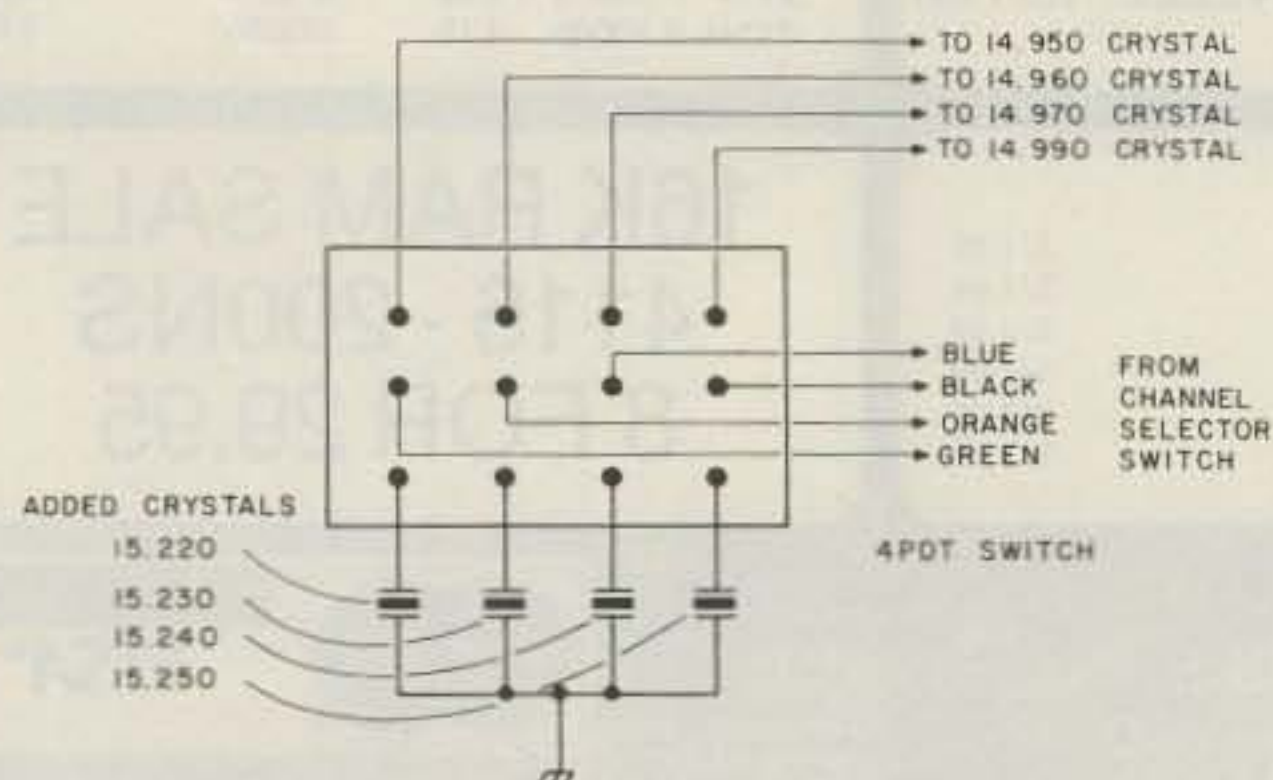


Fig. 2. Adding 24 extra channels to the Midland 13-866.

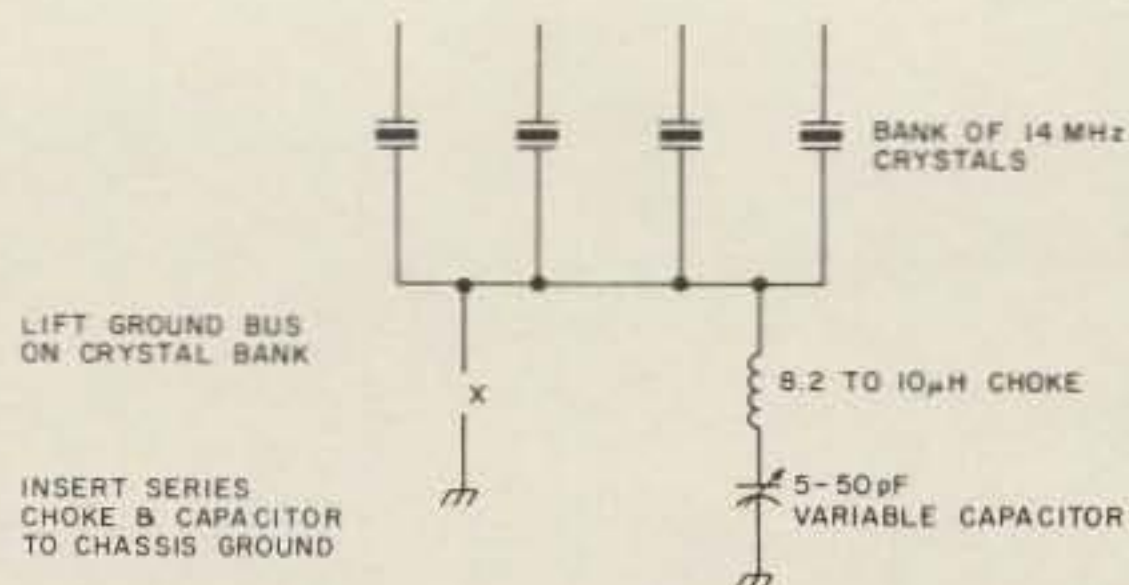


Fig. 3. VXO operation with the Midland 13-866.

tion can be increased by removing TR8 from the circuit.

Adding additional channels by using a 4PDT switch is accomplished by removing the green, orange, blue, and black leads going from the selector switch to the 14-MHz crystals on the chassis. Connect these wires as diagramed in Fig. 2. With the switch down, the 24 low channels will be obtained. With the switch in the up position, the upper range can be used.

For frequencies other than, or in addition to, the

normal 73 band plan, the basic conversion has a usable range of about 800 kHz without retuning.

VXO operation with this radio can be obtained by lifting the ground bus of the 14-MHz crystals and inserting a 10-uH choke and a 5-50-pF variable capacitor in series with the crystal bus to chassis ground, as in Fig. 3. This trick will work with any fundamental crystals up to about 16 MHz. Do not attempt to use it on crystals operating in the overtone mode because severe instability will result. ■

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The Nicad Conditioner

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Quite a few nicad battery-charger circuits have appeared in print lately. However, as none of the circuits would fill my re-

quirements, considerable research and planning was done before starting on this project. Most of the chargers described in articles were for the preferred constant-current method. Others used the constant-potential system. Still others used a combination of both. Each of the articles

detailed the advantages of its method, but neglected to mention the disadvantages. Let us look briefly into each of the systems mentioned.

Constant-current charging is usually done at the 10-hour or .1C rate (C is the rated capacity of the battery). This is fine, except that it takes from 14 to 16 hours for a full charge—an awful long time to be without your HT! Some of the newer chargers use constant-current charging at the .3C rate so that full charge can be obtained in as little as four hours. Remember that we must replace between 130% to 150% of the battery capacity due to inefficiencies in charging. This is a step in the right direction, but we must be careful about overheating as this can ruin the cells.

Constant-potential charging is definitely not recommended. With this method, the charge would start out at quite a high level, resulting in some heat being generated within the cells. As we approach the overcharge condition, additional heat will start to

build up. As the battery heats up, the cell voltages will decrease somewhat, leading to even more overcharge current and greater heat buildup. This is called thermal runaway, which will eventually destroy the cells. Because of this problem, constant-potential charging is generally not recommended. The voltage cannot be set low enough to prevent thermal runaway and still fully charge the cells.

Combinations of constant-current and constant-potential systems have also been described. These systems charge the battery at perhaps the .3C or an even higher rate. A voltage sensor is provided so that when the battery reaches some predetermined level, the constant-potential method will take over. The voltage here can be set to hold additional charging current to a suitable value. One drawback to this system, however, is that cell voltages can vary with repetitive charges. It can also vary with ambient temperature. Then, of course, suppose the battery develops a shorted

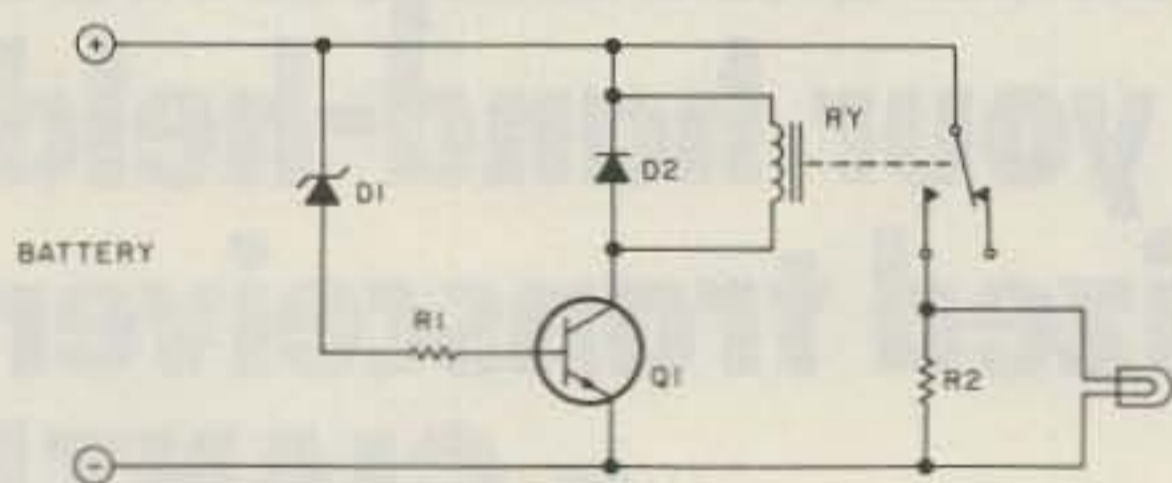


Fig. 1. Conditioner circuit.

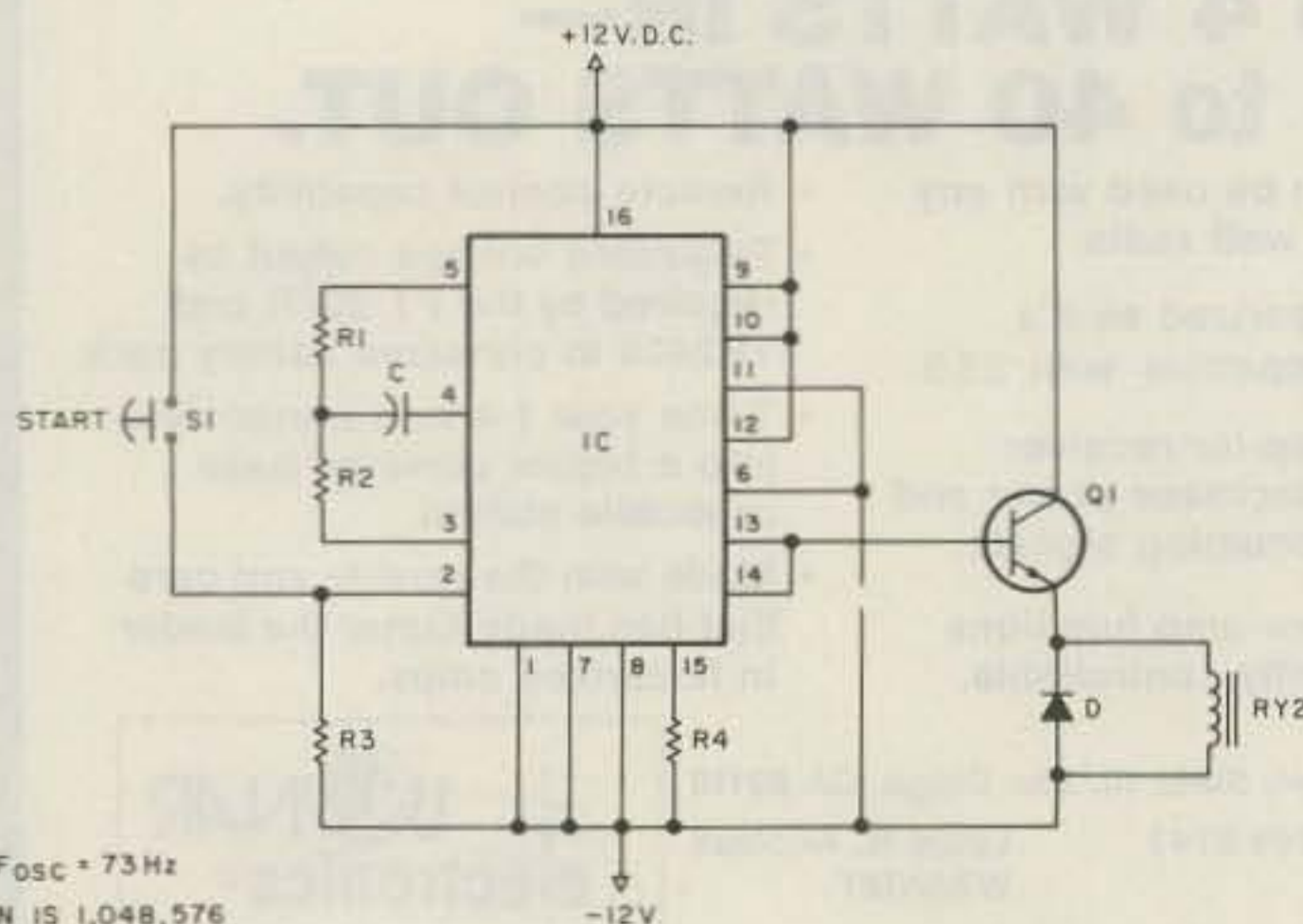


Fig. 2. Timer circuit.

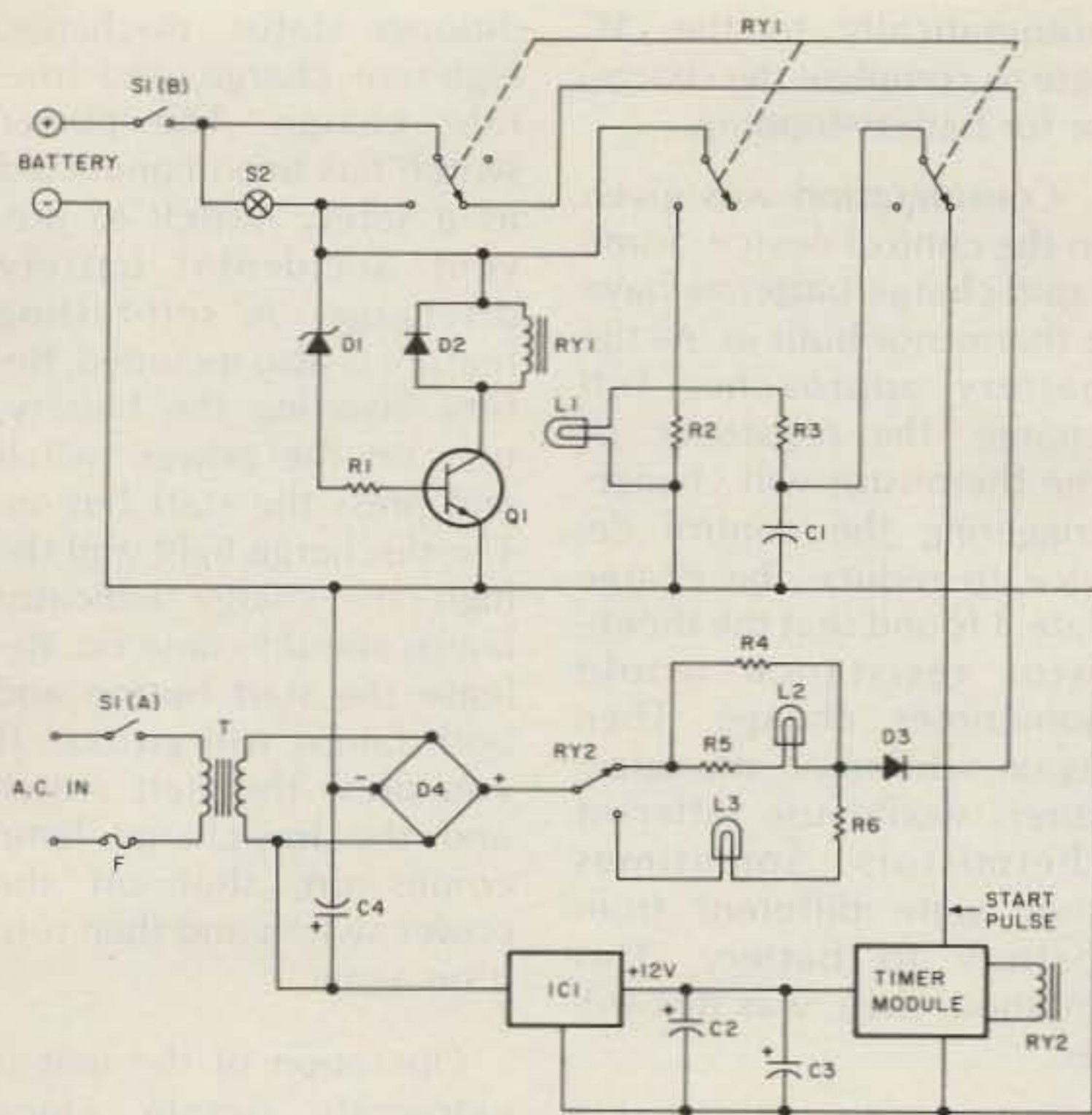


Fig. 3. Circuit for complete conditioner/charger.

cell. All of these problems mentioned will prevent the battery from reaching the sensor cutoff, so that high-rate charging can continue, eventually damaging the battery.

At this point, let me digress. Some experimenters and suppliers of chargers believe that the charge should be terminated after replacing 130% to 150% of the battery capacity. This is to prevent losing electrolyte within the cells. Others prefer the battery to remain on a trickle charge which may be as low as .01C of the battery capacity. General Electric Company's *Nickel Cadmium Battery Handbook* recommends that nicad batteries be charged at a fairly high rate, but that at completion of the normal charging period they be kept on a .1C-rate topping charge. As all cells in the battery may not have identical characteristics, the topping charge will permit the weaker cells to get a full charge without harming the other cells. G.E. goes on to say that most nicads may be left on the .1C charge rate for extended periods of time without harm.

Another item worth men-

tioning here is the memory effect of nicads, but since we are all probably aware of this condition by now, no discussion should be necessary.

Evolution of the Conditioner/Charger

Very few chargers described in magazine articles or that are available from the HT manufacturers take into consideration the state of charge remaining in the nicad battery. If the battery is not depleted when put into the charger, this can lead toward developing the memory effect just mentioned. To prevent this from happening, the conditioner shown in Fig. 1 was developed. This can be built as a stand-alone unit or may be incorporated into a complete charger system. Before the battery is placed on charge, it is put into the conditioner. It will immediately go into discharge at the 1C rate. When the battery voltage drops to the 1-volt-per-cell cutoff point, the relay will drop out, thereby terminating any further discharge. This procedure will not harm the battery and it will erase any memory effects.

Parts List for Fig. 1

- D1—Zener diode (1 V per cells in battery)
 - D2—Silicon diode
 - R1—1000 Ohms, 1/2 Watt
 - R2—75 Ohms, 10 Watts
 - RY—Coil rated at less than battery voltage
 - Q1—Motorola HEP S0038
- Lamp is type 387 in suitable holder.

Parts List for Fig. 2

- IC—HEP C4058P programmable timer
- Q1—HEP S0038 transistor
- D—Silicon diode
- RY—12-volt relay with dc coil resistance greater than 250 Ohms
- R1—2700 Ohms, 1/4 W
- R2—6200 Ohms, 1/4 W
- R3—1 megohm, 1/4 W
- R4—10k, 1/4 W
- S1—Momentary contact push-button switch
- C—2.2 uF, 35 V

Parts List for Fig. 3

- T—Stancor P 6469, 25.2 V @ 1 A
- F—1-A fuse
- D1—Zener diode (1 V per cells in battery)
- D2, 3—Silicon diodes
- D4—1-A bridge rectifier
- R1—1000 Ohms, 1/2 W
- R2—75 Ohms, 10 W
- R3—1000 Ohms, 1/2 W
- R4—250 Ohms, 10 W
- R5—430 Ohms, 1/2 W
- R6—620 Ohms, 1/2 W
- RY1—4PDT 12-volt coil (Allied Control TF 154C-C) (P and B KHU 17D11)
- RY2—SPST 12-volt coil (greater than 250 Ohms)
- S1—DPST toggle switch
- S2—Momentary contact push-button-type switch
- L1, 2, 3—Type 387 lamps in appropriate holders
- C1—10 uF, 25 V
- C2—4.7 uF, 35 V
- C3—.47 uF, 35 V
- C4—50 uF, 50 V
- Q1, 2—Motorola HEP S0038
- IC1—7812 regulator

Another advantage gained by this conditioning is more operating time per charge. In Fig. 1, the relay used should operate on a low current and have a coil rating somewhat lower than the battery voltage. Resistor R is chosen so that the total current drain on the battery, including the pilot light and relay, should total the Ampere-hour rating of your battery.

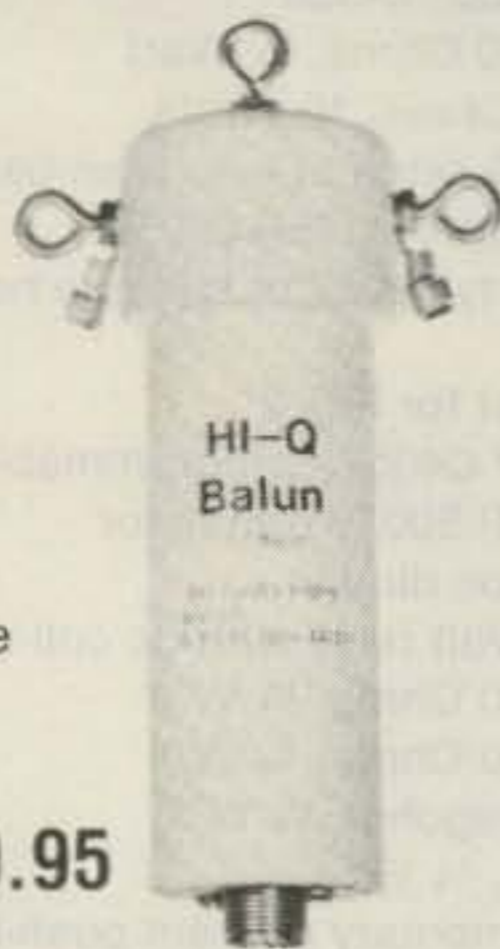
To describe the operation of the conditioner: When a battery which is not fully discharged and has greater than 1 volt per cell is connected, current will flow through the zener diode. This will place a positive bias on the base of the transistor, causing it to con-

duct. The relay is pulled in and the discharge cycle starts. When the battery voltage drops to the 1-volt-per-cell level, the zener diode stops conducting, cutting off the transistor. This causes the relay to drop out, terminating any further discharge.

The next consideration in the design of the charger was the method to be used. I wanted a constant current to charge at a fairly high rate. As it is necessary to replace about 130% of the battery capacity for a full charge, I decided to charge at the .5C rate for approximately two hours to replace 100% of the capacity. At the end of this time the charger should switch

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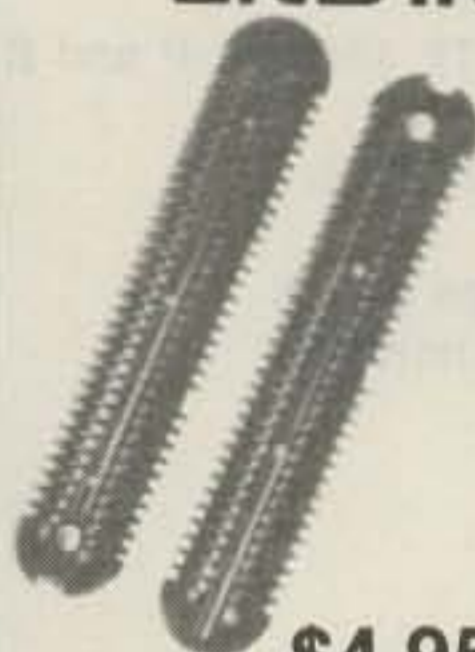


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automatically to the 1C rate to complete the charge, or for battery-topping.

Consideration was given to the control device. Some rapid-charge batteries have a thermistor built in. As the battery approaches full charge, the resistance of the thermistor will change, triggering the control device to reduce the charge rate. I found that the thermistor resistance would sometimes change. Then again, different manufacturers would use different thermistors. Sometimes they were different from battery to battery. This method, then, was discarded.

What was finally decided upon was a timer method of control. The Motorola 4058 Programmable Timer proved ideal, as it can be set for any time period desired. The circuit of the timer is shown in Fig. 2. Once the timer is triggered, the countdown begins. At the end of two hours, my timer operates, pulling in the relay for a low charge rate. This system has proven itself most reliable, with none of the defects listed for other charge-control methods. A copy of the 4058 application bulletin may be obtained by writing to Motorola, or I will send you a copy upon request and an SASE.

Fig. 3 shows the circuit of the complete conditioner-charger. Although the parts listed apply for use with my Motorola HT 220 Slimline using a 225-mAh rapid-charge battery, the same circuit can be applied to any other battery. Only a few resistors may have to be changed to vary the charging rates. The length of the high-rate charge time can be changed very easily by changing two or three jumper wires.

Several refinements were added, such as pilot lights to indicate the charger/con-

ditioner status, discharge, high-rate charge, and low-rate charge. The power switch has been connected as a safety switch to prevent accidental battery discharge. A self-testing feature is also included. Before inserting the battery, turn on the power switch and press the start button. The discharge light and the high-rate charge indicator lamps should come on. Release the start button and both lamps will go out. If you press the start switch and the low-charge lamp comes on, shut off the power switch and then turn it on again.

Operation of the unit is extremely simple. Once you've checked the charger as described, connect it to the battery. The high-rate lamp should come on. Press the start button and the discharge lamp should come on. When the battery is down to 1 volt per cell, the high-rate charge lamp should come on again. This will now indicate that the battery is receiving its charge.

As soon as the battery goes into the charge mode, a pulse is sent to the timer to initiate the countdown. At the end of the scheduled period, the timer will pull in relay 2, shifting the charge to the low rate. High-rate charging was purposely limited to 100% return rather than 130% to prevent overheating of the cells.

This charger has now been in use for over a year, and it performs flawlessly. A fully automatic system at last! ■

References

1. *Nickel Cadmium Battery Handbook* GET 3148A, General Electric Co., Battery Business Dept., PO Box 861, Gainesville FL 32602
2. Motorola Semiconductor Products, Inc., HEP/MRO Operations, PO Box 20902, Phoenix AZ 85036. (Application bulletin HEP HN 102.)

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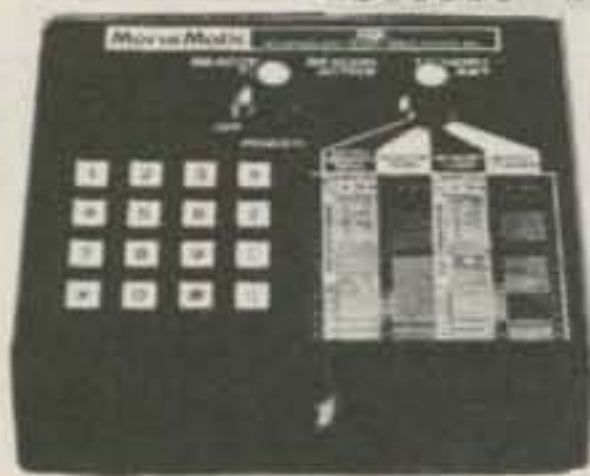
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HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time away from other duties to decipher cryptic notes scrawled illegibly on dog-eared post cards and odd-sized scraps of paper. Please type or print (neatly!), double spaced, your request on an 8 1/2" x 11" sheet of paper and use upper- and lowercase letters where appropriate. Also, please make a "1" look like a "1," not an "l," which could be an "el" or an "eye," and so on. Hard as it may be to believe, we are not familiar with every piece of equipment manufactured on Earth for the last 50 years! Thanks for your cooperation.

I am looking for instruction books or diagrams for Navy receivers R-516/URR-27 (VHF) and CNA-46188A/RBH-3, and for GE mobile (accent) 450-MHz model EG48ST8. Can anyone tell me how to extend the receiver frequency range of the KDK-2015A to cover more of the 140-to-150-MHz spectrum? I will pay reasonable prices.

Joel Jones W4JQB/7
PO Box 745
Airway Heights WA 99011

I need a schematic for an Eico model 427 oscilloscope. I will be glad to pay any copying costs.

Steve Stout KA5CRI/9
1537 Winslowe Dr. #1-B
Palatine IL 60067

Does anyone have an owner's manual for a Drake TR33-C 2m transceiver? If you do, I would like to copy it or pay you for a copy.

John Vercellino WB9OVV
4636 Pershing
Downers Grove IL 60515

Old-timer desperately needs service and operating manual with schematics for a Phase-master II-B transmitter manufactured by Lakeshore Industries, Manitowoc, Wisconsin.

This old tube-type transmitter covers 160-10 meters and is capable of CW, PM, AM/DSB, or SSB emission. It has a vfo, a 1626 final amplifier, and utilizes a "tuning eye" tube as tuning indicator.

Will pay copying and mailing costs or will purchase manuals outright. Thank you.

Jeff Giesar KA7HHQ
19309 Winesap Road
Bothell WA 98011

I need a schematic and instruction manual for a Halli-crafters SR-46 6-meter transceiver. I will pay for these items (or for copies) or I can reproduce these documents and return originals. Thank you.

Theodore J. Cohen N4XX
8603 Conover Place
Alexandria VA 22308

I'm looking for an instruction manual and schematic for a Heathkit® IB-2 impedance bridge. I would like to copy and return but will pay copying costs. Thanks.

Gene Smarte WB6TOV
Nubanusit Road
Hancock NH 03449

I have an old military transmitter (World War II era), model BC-696A. It was part of the SCR-274N Command Set. I would like to get this rig working, but I'm in need of necessary info. If you have any manuals and schematics, I would deeply appreciate your help, and will pay any return postage.

Angelo Pepe
2330 Voorhies Ave., Apt. 6H
Brooklyn NY 11235

I need a schematic and/or operation manual for a Trio 2200-G 2m transceiver. I will pay for copy or copy and return original. Thanks.

Daniel H. Soares PY2TTP
PO Box 12113
Sao Paulo SP 01000
Brazil

I would like to contact anyone with technical information concerning the Regency Model ACT-W10 Whamo scanner receiver. This is the one with the "combs" for frequency selection. I need the theory of operation and alignment data. I will pay for postage, copy work, or information.

Wilbur T. Golson W5CD
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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. They should be sent directly to Editorial Offices, 73 Magazine, Pine Street, Peterborough NH 03458, Attn: Social Events.

MUSKEGON MI APR 3-4

The Michigan Area Amateur Radio Council will sponsor the ARRL Michigan State Convention and Hamfest on April 3-4, 1981, at Muskegon Community College. On Friday evening, April 3rd, the "Ham Hospitality" room will be open to all at the Muskegon Holiday Inn. At 10:00 pm there will be a presentation and at midnight, an initiation. On Saturday, April 4th, doors and registration will open at 8:00 am at the college. An interesting ladies' program will be presented as well as many other events. Saturday tickets are \$3.00 each, with no advance or mail ticket sales. Swap and shop table space may also be purchased on Saturday. Advanced registrations are required for the Saturday dinner program. Overnight reservations should be made directly.

For additional information, write to MAARC, PO Box 691, Muskegon MI 49443, or contact Mr. Clarke Cooper K8BP, Convention Chairman, at (616)-865-6198.

ROCHESTER MN APR 4

The Rochester Amateur Radio Club and the Rochester Repeater Society will sponsor the Rochester Area Hamfest on Saturday, April 4, 1981, at a new location, John Adams Junior High, 1525 NW 31 Street, Rochester MN. Doors will open at 8:30 am. There will be a large indoor flea market for radio and electronics items, prize raffles, refreshments, and plenty of free parking. Talk-in on 146.22/.82 (WR0AFT). For further information, contact RARC, WB0YEE, 2253 Nordic Ct. NW, Rochester MN 55901.

UPPER SADDLE RIVER NJ APR 4

The Chestnut Ridge Radio Club will hold a ham radio and computer flea market on April 4, 1981, from 9:00 am to 3:00 pm at the Education Building, Saddle River Reformed Church, East Saddle River Road at Weiss Road, Upper Saddle River NJ. Tables will be available for \$10; tailgating, \$5. There is no admission fee. Food and drink will be available. For further information, contact Jack Meagher W2EHD, (201)-768-8360, or Neil Abitabilo WA2EZN, (201)-767-3575.

COLUMBIA MO APR 4

The Central Missouri RA will present Columbia Hamfest '81 on April 4, 1981, at the Columbia Ramada Inn, Columbia MO. Admission will be \$3.00 at the door and advance tickets are available for \$3.00 each or 4 for \$10.00. Prizes to be awarded include an Icom IC-2AT and a Kenwood TS-130S. Many commercial exhibitors will be present and a large, hard-surfaced tailgate area is available. Forums, association meetings, and XYL activities will round out the day. A banquet on Friday, April 3rd, at 7:30 pm at the Ramada Inn will feature a talk and question and answer period conducted by Mr. James Dailey, FCC Engineer-in-Charge, Midwest Region. An Icom IC-2AT will be given away at this banquet. Banquet reservations must be made in advance and the cost will be \$14.00. Special group rates for overnighters will be made by the Ramada Inn. Talk-in on 146.76/.16 and 223.34/224.94. For tickets, information on reservations, available indoor flea-market space, etc., write to Columbia Hamfest '81, PO Box 283, Columbia MO 65201.

GOTEBORG SWEDEN APR 4-5

The Goteborg Transmitting Amateurs invite all interested hams to an international ham meeting in the Swedish Trade Fair Centre, Goteborg, Sweden, on April 4-5, 1981. Featured will be a thematic stamp exhibition; lectures on VHF, UHF, and SHF; and meetings for YLs, award-hunters, and DXers. Other programs to be announced are fox-hunting, a mobile-radio contest, and a CW speed contest. A hamfest will be held on Saturday night.

PADUCAH KY APR 5

The Paducah ARES Club will hold its 2nd annual ham/swapfest on Sunday, April 5, 1981, from 8:00 am to 5:00 pm, at the National Guard Armory, Paducah KY. There will be hourly as well as grand prize drawings. Dealers will be on hand. Talk-in on 147.66/.06 and 146.52. For additional information, contact Larry Reid AI4T, Chairman, 220 Longview Drive, Paducah KY 42001.

ST. CLAIR SHORES MI APR 5

The South Eastern Michigan Amateur Radio Association will hold its Swap & Shop on April 5, 1981, at South Lake High School, St. Clair Shores MI. There will be a grand prize as well as hourly prizes. Ample parking will be available. For table space, write Robert Boudreau WD8RPQ, 27117 Shelbourne, Warren MI 48093, or phone (313)-754-1793.

PARAMUS NJ APR 5

The Bergen ARA will hold a Ham Swap 'N Sell on April 5, 1981, at Bergen Community College, Paramus NJ. There are thousands of spaces available for tailgating only. Buyers are admitted free. Sellers must pay \$3.00 and bring their own tables. For more information, contact Jim Greer KB2EI, 444 Berkshire Road, Ridgewood NJ 07450, or phone (201)-445-2855.

WEYMOUTH MA APR 11

The South Shore Repeater Association will hold its fifth annual ham auction on April 11, 1981, at Central Junior High School, Broad Street, Weymouth MA. Check-in begins at 8:00 am and the auction starts at 12:00 noon. There will be a raffle with a Yaesu FT-207R HT as the grand prize, as well as many other small prizes during the auction. The winner need not be present to receive the grand prize. Minimum bids of 15% are allowed. Talk-in on 147.90/.30.

KANSAS CITY MO APR 11-12

The PHD Amateur Radio Assn., Inc., will sponsor the 12th annual Northwest Missouri Hamfest and Missouri State ARRL Convention on Saturday and Sunday, April 11-12, 1981, at the Kansas City Trade Mart, Kansas City MO, from 9:30 am to 5:30 pm. The 1981 directory of all amateurs in the 20-county metropolitan Kansas City, Missouri/Kansas area will be on sale at the hamfest. Display booth spaces are available at a minimal cost of \$40.00 for a single 10x12 booth, which includes 4 passes, security, electric hookups if needed, tables, chairs, and free parking. For an additional fee of \$20.00, extra space (10x12) is available. Displays may be set up from

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8:00 pm to 10:00 pm on Friday, April 10th, and from 7:00 am on Saturday, April 11th. For further information, contact L. Charles Miller WA0KUH, 7000 NE 120th, Kansas City MO 64166, (816)-781-7313, or Thomas L. Bishop K0TLM, 4936 N. Kansas, Kansas City MO 64119, (913)-342-4939.

**FRAMINGHAM MA
APR 12**

The Framingham Amateur Radio Association will hold its annual spring flea market on Sunday, April 12, 1981, at the Framingham Police Station drill shed, Framingham MA. Doors will open at 9:00 am and admission is \$1.00. Sellers' tables are \$7.00 in advance and \$8.00 at the door. Talk-in on .75/.15 and .52. For more information or seller pre-registration, contact Ron Egalka K1YHM, 3 Driscoll Drive, Framingham MA 01701, or phone (617)-877-4520.

**RALEIGH NC
APR 12**

The Raleigh Amateur Radio Society is sponsoring its ninth annual hamfest on Sunday, April 12, 1981, at the Crabtree Valley Mall, US 70 West, Raleigh NC. Activities begin at 9:00 am. General admission is \$3.50. There will be many prizes, including a first-prize choice of a Kenwood TS-130S HF transceiver and PS-30 12-volt power supply or an IC-251A multi-mode 2-meter transceiver with Mirage B-108 80-Watt amplifier. Second prize is a triband beam; third prize is a heavy-duty CDE rotor. The drawings will be held all day Sunday. A covered flea market will also be featured. There will be a hospitality room from 7:00 pm to 11:00 pm on Saturday. Talk-in on WR4ACF 146.04/146.64 and WR4AOE 146.28/146.88. For additional information or reservations, write to RARS Hamfest, PO Box 17124, Raleigh NC 27619.

**WELLESLEY MA
APR 18**

The Wellesley Amateur Radio Society will hold its annual auction on Saturday, April 18, 1981, beginning at 11:00 am, at the Wellesley High School Cafeteria, Rice Street, Wellesley MA. Doors will open at 10:00 am. Talk-in on .60/.03, .04/.64, and .52. For further information, contact Kevin P. Kelly WA1YHV, 7 Lawnwood Place, Charlestown MA 02129.

**WAUKEGAN IL
APR 18**

The Civil Air Patrol, Waukegan Squadron, will hold its first annual Spring Hamfest on April 18, 1981, from 0700 to 1700, at the Lake County Fairgrounds, IL Rte. 20 and US Rte. 45, Waukegan IL. The donation is \$2.00 and tables are \$1.50 on a first-come basis. Features will include a large indoor flea market, refreshments, and free parking. Talk-in on 146.94. For more information, call (312)-

244-2134, or send an SASE to W9NXR, 637 Emerald, Mundelein IL 60060.

**DAYTON OH
APR 24**

The 12th annual B•A•S•H will be held on Friday night of the Dayton Hamvention, April 24, 1981, at the convention center, Main and Fifth Streets, Dayton OH. Parking is available in adjacent city garage. Admission is free to all. Sandwiches, snacks, and a COD bar will be available.

Live entertainment will be provided. Awards include a new synthesized HT. For further information, contact the Miami Valley FM Association, PO Box 263, Dayton OH 45401.

**SPOKANE WA
APR 25**

The Inland Empire Amateur Clubs will sponsor a swapfest at the Floral Building at the Spokane Interstate Fairgrounds, Spokane WA, on Saturday, April 25, 1981, beginning at 9:00 am.



**1800 to 2500 MHZ
DOWN CONVERTER**

Down Converter Kit Printed Circuit Board with all parts for assembly..... \$38.50
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 Assembled and Tested Down Converter with 50' RG59 cable with 75 to 300 ohm adapter ready to install..... \$175.00

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The "Communications Extender" series from Valor promises the most exciting new products you can own this year! Mobile antennas are 5/8 wavelength design power rated at 200 watts. Adjustable whips allow field tuning for optimum VSWR, typically 1.5:1 or less at resonance. "COMM-X" has a typical gain of 3dB over 1/4 standard, too. Made in U.S.A. with quality long-lasting materials.

MODEL	FREQ.	LENGTH
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CX-220	220-225MHZ	35"

See you at Dayton Hamvention, April 24-26, 1981
VALOR ENTERPRISES, INC.
 185 West Hamilton Street
 West Milton, Ohio 45383
 (513) 698-4194 or 698-4195
 Outside Ohio: 1-800-543-2197 ✓ 422



Admission and exhibit space are free. Flea market tables are \$5.00 per 4' x 8' table. Features include an auction, contests, raffles, old and new gear, a YL's corner, a snack bar, a Dixieland band, and commercial and non-commercial displays. Talk-in on 146.34/.94 and 146.52. For reservations for tables, exhibit space, and/or a free RV site (without electrical hookup), write Swap Fest, c/o Jan Thiemann KA7DDU, 7803 E. Mission, Spokane WA 99206.

MOUNT PLEASANT TX APR 25

The Mount Pleasant High School Amateur Radio Club will sponsor an indoor swapfest on April 25, 1981, at the Mount Pleasant High School campus, Mount Pleasant TX. Doors will be open from 7:00 am to 3:00 pm. Admission is free and table space is \$3.00. Door prizes will be awarded. Talk-in on 146.34/.94. For further information, contact Scott Redfearn N5BQG, Box 105, Mount Pleasant TX 75455.

AMBOY IL APR 26

The Rock River Amateur Radio Club will hold its 15th annual hamfest on April 26, 1981, at the Lee County 4H Center in Amboy IL, one mile east of the junction of Rtes. 52 and 30, 10 miles south of Dixon IL. There will be free coffee and donuts

starting at 8:00 am. Camping space will be available at a nominal charge. Six-foot display tables are \$5.00 each and tickets are \$1.50 in advance, \$2.00 at the gate. Talk-in on .37/.97 and .52. For full details, contact Charles (Chuck) Randall W9LDU, 1414 Ann Avenue, Dixon IL 61021, or phone (815)-284-6380.

NEWTON MA APR 26

The Middlesex Amateur Radio Club will hold its first annual indoor flea market on Sunday, April 26, 1981, at the Wayland High School Commons building, located on Rte. 126, between Rtes. 30 and 20, Wayland MA, from 10:00 am to 4:00 pm. Admission is \$1.00 at the door and ample off-street parking is available. Advance reservations for tables are \$6.00 each and at the door \$7.50 each on a first-come-first-served basis. The doors will open at 9:00 am for setups. Talk-in on 147.96/.36 and 146.52. For table reservations, contact Irving Geller WA1CDW, Apt. 8422A, 1450 Worcester Road, Framingham MA 01701.

JACKSON MS APR 26-27

The Jackson Amateur Radio Club will host the ARRL Mississippi State Convention from 12:00 noon to 5:00 pm on April 26, 1981, and from 8:00 am to

2:00 pm on April 27, 1981, at the Raymond Road National Guard Armory, off Interstate 20, Jackson MS. Activities will include dealers, forums, a flea market, prizes, and YL prizes. Admission is free. Swap tables will be \$5.00 each day. Talk-in on 146.16/.76, 146.52, and 3987.5. Food will be available at the site on both days. A banquet will be held Saturday night at the Holiday Inn-Southwest. Please make reservations for both the swap tables and the banquet in advance. For more information, contact Nita Stone N5AGV, Rte. 1, Box 157, Brandon MS 39042, (601)-825-2060.

WOODBIDGE NJ MAY 2

The DeVry Technical Institute Amateur Radio Club (WA2MDT) will hold its fifth annual amateur radio and computer flea market on May 2, 1981, at DeVry Technical Institute, 479 Green Street, Woodbridge NJ. The flea market will begin at 9:00 am and for those who wish to set up tables, a fee of \$3.00 will be charged. Talk-in on 146.520 beginning at 8:00 am. For further information, call Frank Koempel WB2JKU at 634-3460 or Steve Hajducek KA2IFX at 727-5962.

MEADVILLE PA MAY 2

The seventh annual Northwestern Pennsylvania Hamfest will be held on May 2, 1981, at the Crawford County Fairgrounds, Meadville PA. The gates will open at 8:00 am. Admission is \$3.00; children under 12 will be admitted free. Indoor table spaces are \$5.00 per space and outdoor car spaces are \$2.00. Bring your own tables. Refreshments will be available. Commercial displays are welcome. Talk-in on .04/.64, .81/.21, and .63/.03. For information, write CARS, PO Box 653, Meadville PA 16335, Attention: Hamfest Committee.

GRAY TN MAY 2-3

The Bristol Amateur Radio Club, the Johnson City Amateur Radio Association, and the Kingsport Amateur Radio Club will hold their first annual Tri-Cities Hamfest on May 2-3, 1981, at the Appalachian Fairgrounds, north of Johnson City (off Highway 137), Gray TN, from 9:00 am to 5:00 pm on Saturday and from 8:00 am to 4:00 pm on Sunday.

The dealer space charge at the door is \$30.00 for the weekend for a 10 x 12 space. The advance reservation charge is \$25.00 and must be received by April 1, 1981. The dealer charge also includes security and admission for five employees. There are approximately 40 RV spaces with complete hookups renting for \$5.00 per night inside the fairgrounds. Motels are available nearby. Dealers can set up anytime after Friday noon or after 6:00 am Saturday and Sunday. Advance reservations or further information can be obtained by writing Mary S. Biggs KA4EXP, Secretary-Treasurer, Tri-Cities Hamfest, PO Box 3682 CRS, Johnson City TN 37601, or phoning either (615)-928-1818 or (615)-282-1711-x380.

GREENVILLE SC MAY 2-3

The Blue Ridge Amateur Radio Society will hold its annual hamfest on May 2-3, 1981, at the American Legion Fairgrounds, Highway 25 bypass, Greenville SC. On Saturday, FCC exams will be given at Greenville Tech from 10:00 am till 3:00 pm. Other features will include dealer exhibits, inside flea markets, chicken/pork plates, prizes, overnight RV parking, and motel rooms available at the Ramada Inn (1-800-228-2000).

PENNS PARK PA MAY 3

The Warminster Amateur Radio Club will hold the 7th annual Ham-Mart on Sunday, May 3, 1981, from 9:00 am to 4:00 pm (rain or shine) at a new location, Middleton Grange Fairgrounds, just minutes from I-95 or the Pennsylvania Turnpike on Penns Park Road, Penns Park PA. Featured will be door prizes, plus a grand prize to be drawn at 3:00 pm, a flea market, a free FM Clinic, and an auction. There will be refreshments, rest rooms, and shelter available. Registration is \$3.00 per person, which includes one ticket for door prizes. YLs, XYLs, and children under 14 will be admitted free. Seller (tailgater) spaces are \$2.00 (with tables available). Talk-in on 146.52 or WARC 147.69/.09. For additional information, write WARC, PO Box 113, Warminster PA 18974, or call Mark Hinkel WA3QVU at (215)-657-7295.

HAM HELP

I'm looking for any information about a typewriter, a Singer Flexwriter type 2309, manufactured by the Business Machines Division in the mid 60s. The typewriter has tape punch and tabulate options.

I need especially information on how to interface the typewriter to a Z-80-based microprocessor system, electrical and logical diagrams of the typewriter, or the postal address of the Singer Company. I'm ready to bear the expenses for copies and for mailing. Thank you very much for any help.

Dominikus Maisl DF6TQ
Wehrstrasse 37
7320 Goeppingen
Federal Republic of Germany

I am in need of a schematic diagram and operating manual for an Eico model 425 oscilloscope, produced in the 1950s. I'll be glad to pay copying costs. Thank you.

Ed Danielczyk K9SXU
9 Lloyd St.
Cary IL 60013

I'm looking for information on the replacement of the 7360 balanced modulator in a Yaesu FTDX-560 with solid-state unit. This is due to the current price here of \$26 (Australian) for the tube. Thank you.

David B. Simpson VK4VHR
PO Box 2311
Mount Isa 4825
Queensland, Australia

CONTESTS

from page 14

only once for each team. When DX/WK partners contact each other it counts as a double multiplier. Final score is the sum of QSO points times the total multiplier.

AWARDS:

Extraordinary certificates will be issued to the highest individual score, DX/WK teams, YL/OM teams, and score for highest single operator category. Regular certificates to the highest state, country, and Canadian province winners.

ENTRIES:

Logs must show date/time (GMT), RS, SSBer number, partner's call, mode of operation, a band, and period of rest time. Summary sheets show number of states, Canadian provinces, countries, YL/OM teams, DX/WK teams, and partner contacts. All entries must be postmarked by May 15th.

Any member desiring to enter the DX/WK team category should immediately send request to: Lyle F. Shaw KC4LF, 6329 Fairway Blvd., Apollo Beach FL 33570. For record purposes, requests should be made in writing. In the week preceding the QSO party, members wishing a partner may request one through system controls on SSBers daily systems. No team assignments will be made after the party begins.

YL/OM teams are self-evident

in their operation and need not file. Single-operator category members are eligible unless entered with teams. Non-members enter single op *only!* DX/WK teams consists of a DX and WK member. The team score is the sum of both partners. Score to be determined when both logs are received. When only one log is received, credit will be given as a single operator. YL/OM teams consist of one YL member and one OM member who are related: husband/wife, father/daughter, mother/son, brother/sister. Operation must be from the same QTH, using the rig with his/her own call.

HELVETIA CONTEST

1500 GMT April 25 to
1500 GMT April 26

Use all bands, 1.8 to 28 MHz, on CW or phone. Each station can be worked once per band regardless of mode.

EXCHANGE:

RS(T) plus three-figure serial number starting at 001. Swiss stations will also give their canton.

SCORING:

Each contact with an HB station counts 3 points. The multiplier is the sum of Swiss cantons worked on each band, 26 maximum per band. Final score is sum of QSO points multiplied by the sum of cantons worked on each band.

RESULTS

1980 SARTG WORLDWIDE RTTY CONTEST

Single Operator—Class A

I3FUE	350,900
I7FKO	278,760
SM6ASD	215,670
W3FV	215,040
G3HJC	195,500

Multi Operator—Class B

I5MYL	324,360
OE9ERI	244,720
G3UUP	210,540
OK3KFF	137,550
OH2ZY	128,040

Shortwave Listeners—Class C

G8IZD	227,525
H. Ballenberger	164,755
Y2-2814/M	140,400
G8CDW	96,960
K. Wustner	86,790

RESULTS

1980 CAN-AM CONTEST

Trophy Winners

Canadian Combined Champion: John Sluymer CZ6OU
American Combined Champion: David Hachadorian K6LL7
Canadian Phone Trophy: Doug Freestone XJ5UF
American Phone Trophy: Jack Webb W5JW
Canadian CW Trophy: Graham Williams VE2WA
American CW Trophy: Trey Garlough WN4KKZ
Canadian Multi-Op Champion: Prince George CC VE7ZZZ
American Multi-Op Champion: Stan Griffiths W7NI
Club Competition: The Other Club (Wash., B.C.)

ENTRIES AND AWARDS:

Certificates will be given to the highest scorer in each country. USA and Canadian call areas are considered as separate countries. Logs must be postmarked not later than 30 days after the contest and sent to: TM USKA K. Bindschedler HB9MX, Strahleggweg 28, 8400 Winterthur, Switzerland.

Canton abbreviations are: ZH,

BE, LU, UR, SZ, OW, NW, GL, ZG, FR, SO, BS, BL, SH, AR, AI, SG, GR, AG, TG, TI, VD, VS, NE, GE, and JU.

H26 Award—for contacts made after January 1, 1979: Send a list and QSL for each of the 26 cantons worked on CW and/or phone, RTTY, and SSTV to: Walter Blattner, Postbox 450, Locarno 6601 Switzerland.

HAM HELP

Three years ago, you published a letter from us asking for hospitality on our visit to California. Thanks to you, we made many new friends and had a marvelous time.

We plan another visit to the U.S. this August and want to spend a few days in Washington DC, where we don't know anyone. If any family can offer hospitality for 3 to 4 days, we would

be glad to reciprocate and offer our home for a visit.

We are an easygoing, adaptable couple in our mid-thirties who enjoy meeting people and dislike formal hotels. Michael is an electronics engineer, a ham, and a pilot. I am a children's nurse.

We live in a beautiful and historic part of England, about 2 hours from Edinburgh and the

Lakes District, and about 3 hours by train from London. We love visitors and meeting people, so I am sure this vacation will be as great as our last.

Pat and Michael Stott
"Wellview"
12 Castle View, Ovingham
England NE42 6AT

I heard from a friend that there was a Dungeons and Dragons net on 20 or 40 meters and I would appreciate any info on this. Thanks.

Al Fogleson KA8HFS
1654 Dyson
Muskegon MI 49442

I'm searching for a Collins 32S1 transmitter in any condition that is not being used and is cheap. State condition and price.

H.F. Schnur
115 Intercept Ave.
North Charleston SC 29405

I'm looking for a Collins KWM-2-to-KWM-2A conversion kit, Collins main tuning knob (553-5787-003), and quad antenna spreaders.

Hobie Steele
Rte. 3, Box 273
Cambridge MD 21613
(301)-228-7595

FUN!

from page 34

- 6) Soviet jamming stations, intent on keeping "undesirable" broadcasts from being received in their country, legally identify themselves on CW. _____
- 7) Radio Berlin International operates from West Berlin. _____
- 8) The Voice of America is prohibited by Congress from broadcasting in any language but English. _____
- 9) There is a shortwave broadcast band allocated at 11 meters. _____
- 10) Radio Peace and Progress is a Soviet shortwave station. _____
- 11) "Suomen Yleisradio" broadcasts from Samoa. _____
- 12) SINPO is an acronym for the Special InterNational Programming Organization. _____
- 13) "The Graveyard" is the SWL's nickname for 40-meters. _____
- 14) In many countries, you have to be an SWL before you can become a ham. _____
- 15) The *International Frequency List* is a publication listing in five volumes all of the world's radio stations. _____
- 16) The "Worldwide TV-FM DX Association" is an organization specializing in VHF-UHF SWLing. _____
- 17) Some countries require SWLs to license their receivers. _____
- 18) WCC in Chatham MA, broadcasts news reports, in CW, on 6.376 MHz. _____
- 19) Many ship stations have the same type of four-letter call-signs as broadcast stations, e.g., KXXX. _____
The U.S. AM broadcast band has only 23 channels. _____

ELEMENT 5—HAM ACROSTIC

Guess the words defined and write them over the numbered dashes. Next, place each letter in the correct square in the puzzle. The black squares show word endings. The completed puzzle will form a statement relating to shortwave listening. (Illustration 2)

- A) Medium-wave antenna. 28 50 42 51
- B) "The East is Red". 65 9 41 2 67
- C) A shortwave station's "tongue". 5 13 36 8 48 16 17 46
- D) Jammers produce this. 59 18 4 15 31
- E) Old-style receiver component. 62 58 60 12

- F) Effect of Radio Moscow report about Soviet farming on listeners 19 27 32 64
- G) Element missing from Radio Moscow's news programs. . . . 10 14 1 33 63
- H) Famous army radio station. . . 53 35 49
- I) Woodpecker's alleged purpose 55 24 25 39 38
- J) SWLs throw this when a rare station is QRMed. 43 66 3
- K) Engineering society. 29 54 6 45
- L) What Germans call East Germany. 37 40 57
- M) Spanish "I". 61 20
- N) Iraq amateur prefix. 11 26
- O) Number of megahertz in SWL 90-meter band. 21 22 23 56 47
- P) RTTY press station's test letters 44 34
- Q) Your author's former call suffix 7 30 52



Illustration 2.

THE ANSWERS

Element 1:

See Illustration 1A.

Element 2:

1-J, 2-S, 3-P, 4-F, 5-M, 6-I, 7-U, 8-R, 9-A, 10-T, 11-N, 12-B, 13-O, 14-D, 15-L, 16-G, 17-Q, 18-C, 19-E, 20-H.

Element 3:

(Reading from left to right) utilities, broadcast, tropicals, clandestine; band, domestic, program, listen; music, religious, interval, language; government, propaganda, engineer, overseas; calibrate, foreign, relay, static.

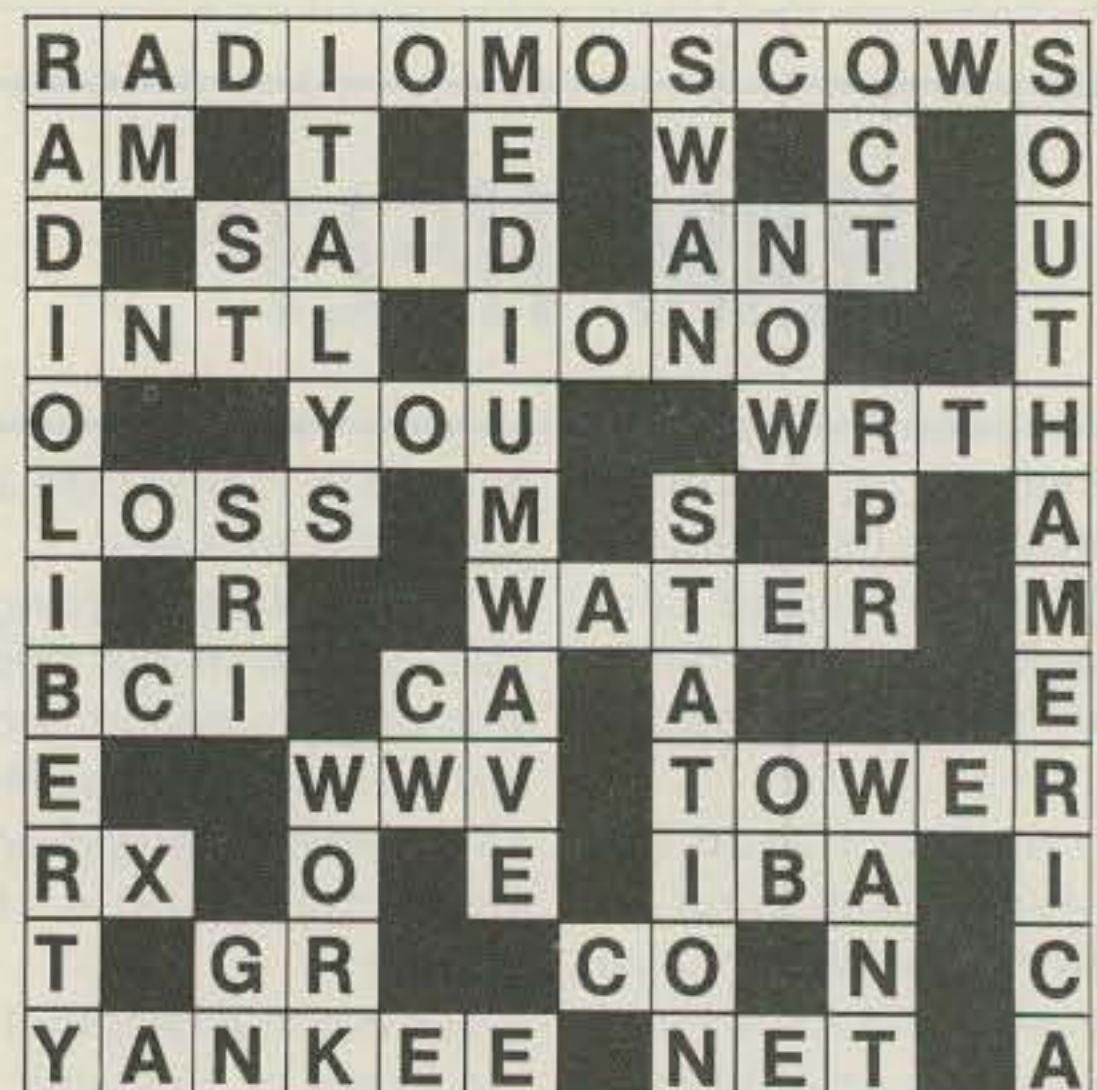


Illustration 1A.

Element 4:

- 1) True—In a series of experimental transmissions during November, 1980. More SSTV broadcasts may take place this year.
- 2) True—Aren't they thoughtful!
- 3) False—WYFR and KGEI, among others, are privately owned.
- 4) False—They're commercial stations transmitting business or safety traffic.
- 5) True—Radio energy from the giant planet can be detected at those frequencies with the proper receiving gear.
- 6) True—Ironic, isn't it?
- 7) False—East Berlin.
- 8) False—Like most international broadcasters, the VOA transmits in dozens of languages.
- 9) True—25.600-26.100 MHz. Just below you-know-what.
- 10) True—Peacefully progressing toward what?
- 11) False—It's Finnish for Radio Finland.
- 12) False—It's a reception report form, similar to the amateur RST system. The letters stand for: Signal, Interference, Noise, Propagation, and Overall merit.
- 13) False—It's the term applied to the upper end of the U.S. AM broadcast band where many low-powered stations are grouped.
- 14) True—This is especially true in many eastern European countries where SWLs must obtain a certain number of amateur QSLs before they're allowed to transmit. So answer those SWL QSLs!
- 15) False—Amateur, maritime, experimental, and a few other types of stations aren't listed, but just about everyone else is. The ITU publishes it.
- 16) True—You can write them at PO Box 97, Calumet City IL 60409.
- 17) True—As a matter of fact, most countries slap a fee on radios and TVs—a way of raising revenues to subsidize government broadcasting.
- 18) True—Great code practice.
- 19) True—Confusing, isn't it?
- 20) False—One hundred and seven channels, but more are on the way as soon as the FCC can add more by pushing existing stations closer together.

Element 5:

See Illustration 2A.



Illustration 2A.

SCORING

Element 1:

Twenty points for the completed puzzle, or 1/2 point for each question correctly answered.

Element 2:

One point for each station you matched to its QTH.

Element 3:

One point for each word unscrambled.

Element 4:

One point for each correct answer.

Element 5:

One point for each correct definition. Give yourself 10 extra points if you deciphered the message.

Rate your SWL skills as follows:

- 1-20 —You listen to shortwave on a radio purchased from a sidewalk vendor. Can sometimes hear Radio Moscow.
- 21-40 —You write weekly letters to "DX Mailbag" and are deeply thrilled when you hear your name announced on the air.
- 41-60 —You monitor Radio Warsaw while working Novices on 40.
- 61-80 —You log countries by the dozen and are the object of extreme envy from your peers.
- 80-100 + —A real pro. You're probably interviewed by Dan Rather for your interpretation of foreign broadcasts during world crises.

Next month: ARRL

HAM HELP

I am trying to locate Icom 22As, 215s, or similar radios—in working condition—that can operate just above and just below 2 meters (for MARS and similar applications).

Jim McCallum WB6INJ
10051 Perdido St.
Anaheim CA 92804

I need some help learning to speak Nynorsk, the "other language" spoken in Norway. I have some books and can get along fairly well in Riksmal, and now it's time to learn Nynorsk.

Perhaps there are amateurs living in the USA who speak this language or one of its dialects. I would like to arrange a weekly sked on 75 or 40 SSB to help get this pronunciation straight—not to mention the grammar.

Drop me a line and we'll work up a sked.

Tusin takk og paa gjensyn!

Nils R. Bull Young WB8IJN
920 Greenheart Drive
New Carlisle OH 45344

I need the manuals for and any details on converting the Heathkit HW-29A and Lafayette HE45a 6m rigs to FM. I would also like to convert a Gonset IV to FM. I will pay for all expense of copying and mailing.

Richard McCubbin
535 Church St.
Portland MI 48875

My hobby is listening to shortwave radio and DXing. I need help because I recently purchased a used Hallicrafters model SX-110 receiver, but have been unable to obtain an opera-

tor's manual. If anyone has an operator's manual, please contact me. Thank you.

Edward L. Gafford
221 Royer Court
Louisville KY 40206

I am interested in hearing from Field Day 2 owners about what kind of results the unit gives with less than perfect code, sloppy code, QSB, QRM, etc.

Berand Kirschner WB0YCQ
4439 Jupiter Drive
Riverside CA 92505

I am looking for a crystal-controlled CB rig which has 4 to 6 or more channels and separate crystals for transmit and receive, in LA or Orange counties.

Al Gordon
1726 Spreckels Lane
Redondo Beach CA 90278
(213)-372-8560

I need information and a service manual for the Heathkit® DX-100 transmitter, and would

also like to know of any modifications done on the rig. I'll pay for copying. Thanks.

John S. Lee KA4EPR
17401 NW 20 Ave.
Miami FL 33055

I'm looking for information on a Northern Radio Company, Inc., F.S. diversity converter, circa 1956. It is a type 174, model 1, serial 180. I believe that this is a terminal unit for RTTY, has a variable frequency shift, and was used in the Air Force. I would really appreciate any help on this.

Gary L. Young N3ALL
Box 129
Wise's Grove Road
New Brighton PA 15066

Does anyone have any information on building test and calibration equipment for the 2-4 and 3.7-4.2-GHz ranges? Also, what would be the lowest possible cost?

Lamar Evans II
Rte. 1, Box 87C
Anacoco LA 71403

LEAKY LINES

from page 18

proper examination. Why propose quantitative growth while running the real risk of a reduction in quality?

Why should the back door be opened for unqualified persons to slip through and get amateur privileges? No one stops any-

body from becoming an amateur. Why should a special route be opened for those who are unwilling to exert enough effort to earn the privilege?

And although the ARRL appears to be viewing the matter from the position that it will act in accordance with the wishes of the membership, it is very

clear that in raising uncertainty about it at all, instead of opposing it from the outset, it is placing ham radio in possible jeopardy. By expressing unqualified opposition at once, the League would have served notice that it believes the Commission grievously wrong. And it is about time that someone stood up to the FCC for a change. Many FCC proposals in recent years have shown rather clearly that the Commission is not overly impressed with the necessity of safeguarding the continued existence of amateur radio, at

least not as we have known it.

I believe that the digital licensing proposal is one of the most dangerous ever made, and I exhort all amateurs to ponder well what it can mean in terms of the survival of our hobby. It must be resoundingly opposed, and ARRL directors must be made aware that their constituents are solidly against it. Our League must take a position consistent with the wishes of its membership, for if it fails to do this, it no longer deserves to be considered the leading representative body in ham radio.

AWARDS

from page 44

tor Service, and radio communications throughout Australia in general. Today, thanks largely to the efforts of John Flynn, every cattle station and settlement in the Australian outback has radio communications.

Flynn spent his whole working life in the outback helping others, no matter what nationality or color. Last year was the 100th year since the birth of John Flynn, and the Alice Springs Community College Radio Club had 2,000 certificates printed in memory of this great man.

Amateur operators worldwide are encouraged to participate in recognizing the achievements of such a radio pioneer.

To qualify, all VK stations must make three contacts with Alice Springs club members; all other stations of the world must log at least two contacts with Alice Springs club members. The award is also available to SWL stations who can log at least 3 station contacts heard. There are no band or mode restrictions for the award. Listen for VK8s.

To apply, have your contacts with the VK8s of the Alice Springs club verified by at least two radio amateurs or a local club secretary. Keep in mind that the same station may be worked more than once if the contacts are separated by 24 hours.

Enclose your application along with a donation of \$3.00 to

the Awards Manager. All funds generated by this award will be given to charity. Send your application to: ASCCRC Awards Manager, PO Box 2953, Alice Springs, Northern Territory, Australia 5750.

VK8 OUTBACK AUSTRALIAN AWARD

My thanks goes to Laurie Day VK8LD for forwarding the latest details about the very popular VK8 Outback Australian Award.

To qualify for the award, applicants must make contacts with members of the Alice Springs Community College Radio Club. VK stations and SWLs must contact at least 6 club members; all others must make a minimum of 3 club member contacts. To be valid, all contacts must have been made after December 1, 1979. There are no band or mode restrictions.

A list of club members can be obtained by sending your re-

quest with 3 IRCs or \$1.00. Fees for the award are: \$2.00 for VKs; \$2.50 for DX stations. Forward your list of contacts, verified by two fellow amateurs, to The Awards Manager, VK8 Outback Australian Award, PO Box 2953, Alice Springs, Northern Territory, Australia 5750.

HAMVENTION STATION

WD8EOL and W8ILC have informed us that special-event station W8BI will be operating from the Dayton Amateur Radio Association's communications van on Hamvention days, April 24, 25, and 26, 1981. Special Dayton Hamvention certificates will be sent to anyone contacting W8BI who sends a large stamped envelope. Send QSL to W8BI (special event station), P.O. Box 44, Dayton OH 45401. Frequencies: 14.295, 7.230, and 7.125 (CW). Times: Friday, April 24, 1800—2200 UTC; Saturday, April 25, 1400—2200 UTC; and Sunday, April 26, 1400—1800 UTC.

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 8

Like anything else, if you are going to make money at gambling you should know more than the information you get in *Reader's Digest*. The fact is that there are a number of very good books on the subject of gambling... and on how to win. The further fact is that if you know how to gamble

and have some experience, you can win consistently. I'm not just talking about counting the cards at 21, which is old hat by now... I'm talking about craps.

Not having done my homework... and not really having much time... I avoided the gambling this trip.

CES has nothing whatever for the ham business. It is mostly

involved with things like hi-fi, car stereo, calculators, digital watches, radar detectors, television sets, VTRs, and dirty-movie video cassettes. They had one whole room devoted to porno cassettes!

There were a few microcomputer exhibits... such as the

new H-P personal computer system, the new color Commodore system, T.I., Atari, Mattel, Bally, NEC, Casio, Panasonic, Quasar, APF... etc. Apple wasn't there, but I did run into Steve Jobs, who recently became a multi-millionaire when the Apple stock went on the market. Every

DXPEDITION CALENDAR

To better serve our readers we are considering beginning a DXpedition Calendar. If you are interested in having your operation included in this listing, please include locations, dates, callsigns, frequencies, operating hours, QSL info, etc., along with the name of a person to contact if there are any questions about the operation.

Please send your DXpedition info to Editorial Offices, 73 Magazine, Pine Street, Peterborough NH 03458, attention: DX Calendar.

NET OPERATIONS

We would like to accumulate a list of active nets and their purposes for a possible directory. If you are interested in having your net operation listed, type or print (neatly) its particulars (purpose, dates, frequencies, etc.) along with the name of someone to contact should there be any questions. Depending on the response, a very comprehensive special-interest directory could result.

If you would like to participate, write to Editorial Offices, 73 *Magazine*, Pine Street, Peterborough NH 03458, attention: Net Operations.

HAM LICENSE CLASSES

If you or your club are giving or planning to give code and theory classes, please let us know. Include dates of each session, license classes taught, and the name of someone to contact for complete information. With this, we can perhaps direct an aspiring amateur to a nearby class. More than one ham has been asked about helping a beginner or a ham who wishes to upgrade and was unaware that the club across town was having classes.

If you would like to have your classes listed, please write to Editorial Offices, 73 *Magazine*, Pine Street, Peterborough NH 03458, attention: License Classes.

time the Apple stock drops one point he loses about \$5 million...how'd you like to be in that position?

A lot of the consumer electronics magazines were there. I got to see a recent issue of S-9...now shrunk to 72 pages, with just 12 pages of advertising...even thinner than *onComputing*, with its 15 pages of ads. *CB Magazine* is really looking good, with its increased ham ori-

entation...thus encouraging CBers to move on into hamming. Gordon West, the *CB* editor, has rebounded well after his experience with the ARRL. Apparently the shafting was discussed at length at SAROC.

WEST QUESTIONS

Since a lot of amateurs get all bent out of shape at any mention of the League, let's steer clear of that organization entirely. Besides, I'm really sick of

hearing the old saw that I am anti-League. I'm anti the bad guys, no matter where they are...in Washington, Newington, or Oregon.

Now, to cases. Gordon West, the editor of *CB Magazine*, recently ran for office in a national club and was refused the right at the last moment to have his votes counted by that club's general manager. Attempts at

getting a rational explanation of this weird and seemingly dictatorial move have so far been frustrated. Please then consider this a general call: If anyone in the readership of this magazine knows the real reason for this move, please write it up so it can be published. Please send this information to all ham magazines and let's see which have the guts to print the facts.

HAM HELP

I am in need of a service manual on military transmitter T368D/URT. I will copy and return or possibly purchase outright. Thank you.

A. K. Seput KA2AYS
258 Hillside Avenue
Palisades Park NJ 07650
(201)-461-9169 after 7:00 pm

Can anyone help me locate information on a Harrison Laboratories model 510 regulated power supply (0-36 V, 10 A)? A manual or schematic would help and I will gladly pay for reproduction costs. Many Thanks.

James O. Dickinson W4LLF
1408 Monmouth Court West
Richmond VA 23233

I need a manual for an Eico capacitance meter, model 955. I'll pay for photocopying or will copy and pay postage both ways. I also need a power transformer and/or schematic showing power transformer for a Hallicrafters SX-9 receiver. State cost of transformer in first letter, please. All letters or calls answered. Call collect.

Ernest C. Wankowski KB5OJ
5510B Follett Road
Fort Sill OK 73503
(405)-248-6630 after 1800 CST

I need a copy of the manual for the National NCX-3—an original or photocopy would be fine. I'll pay costs.

W. Dennis W1WA
Box 1103
Marblehead MA 01945

All Armenian amateur radio operators interested in getting together on the ARARAT Net, please contact me for sked and information.

Stefan Karadian N8BGD
7127 Brookridge Drive
West Bloomfield MI 48033

Wanted are any of the Collins speakers, models 312A-1, 312B-1, or 270G-3, along with a Collins gear-reduction knob like that used on the 75A series of receivers and KWS-1 transmitters. Also desperately wanted is a copy of the instruction and/or service manual for a Roberts 770X tape recorder. Will pay cash to have manual copied or would take a used book with all pages. Many thanks.

Ciano R. E. Strachan C6ANI
PO Box N4106
Nassau NP, Bahamas

I need operating manual number TM11-5820-358-10 for the

R390A military receiver. I will pay for copies or pay postage both ways. Thank you very much.

Harold Sherven KA9BPS
951 Christina Court
Plainfield IN 46168

I need information and a schematic for a Golden Falcon model 150 power amplifier. I need to know frequency ranges and any other information.

E. L. Sandefur N6DSZ
17711 Van Buren St., #E
Huntington Beach CA 92647

Is there anyone out there who can lend or copy the circuit diagram and other info for a model 830 oscilloscope-wobbulator made by Triumph Manufacturing Co., Chicago, Illinois (1950 or earlier)? Thanks.

Ladd Sajor W2KGV
767 Lomas Street
Port St. Lucie FL 33452

I am looking for schematic diagrams for the following radios: E.F. Johnson Viking Ranger (maroon and grey case), Navy type CRI-43044 (TBY-6), RT-70, and AM-65 (Mil.)

I am also looking for someone with at least a General class license who is willing to give the Novice test to 6 or 7 people. I and a few other club members do not have licenses and we have been waiting to take our tests for a long time. The school

is located in lower Manhattan near 14th St. Thank you.

Timothy O'Neill, President
Xavier High School ARC
1753 Ryder St.
Brooklyn NY 11234

I am looking for RIT mods for the Heath HW-8 CW transceiver and the Heath HW-32 20m Single Bander. I would also be interested in other mods. Thanks.

Bill Graham N8BMK
Box A223A, Rt. 5
Paris KY 40361

Any amateur who is a current or former member of the United States Army Signal Corps who has served with, or been attached to, Royal Signals is invited to become a member of the Royal Signals Amateur Radio Society. Those who wish to apply for membership should write to me for application forms and further details.

Capt. J. Cooper G3DPS
Vice-President, RSARS
"Beirnfels", Old Odiham Road
Alton, Hants
GU34 4BP, England

I need meter and maintenance instructions with parts list for a TS-375A/U vacuum-tube voltmeter. I also need an oven (Ref. S-105) with or without 5-MHz crystal for a TS-186D/UP frequency meter.

Elmer H. Melvin WA8DJY
5050 New Market Rd.
Hillsboro OH 45133

NEW PRODUCTS

from page 38

paddles and it's ready to go with automatic and programmable memories. It has iambic operation and dot-dash memory.

Five-level Baudot is transmitted at 60 wpm. RTTY and CW ID are provided via the ID button and message A. Carriage return, line feed, and letters are sent automatically on the first space after 63 characters on a line. All up and down shift is done automatically. A down shift occurs on every space to quickly clear any garbles in reception. The Baudot mode also includes all applicable features of the CW mode.

In the ASCII mode, transmission speed is 110 baud. Both upper and lower case are generated, and all the features of the Baudot mode are included here also.

Controls and keys on the 494 are positioned logically and labelled clearly; pots are used for

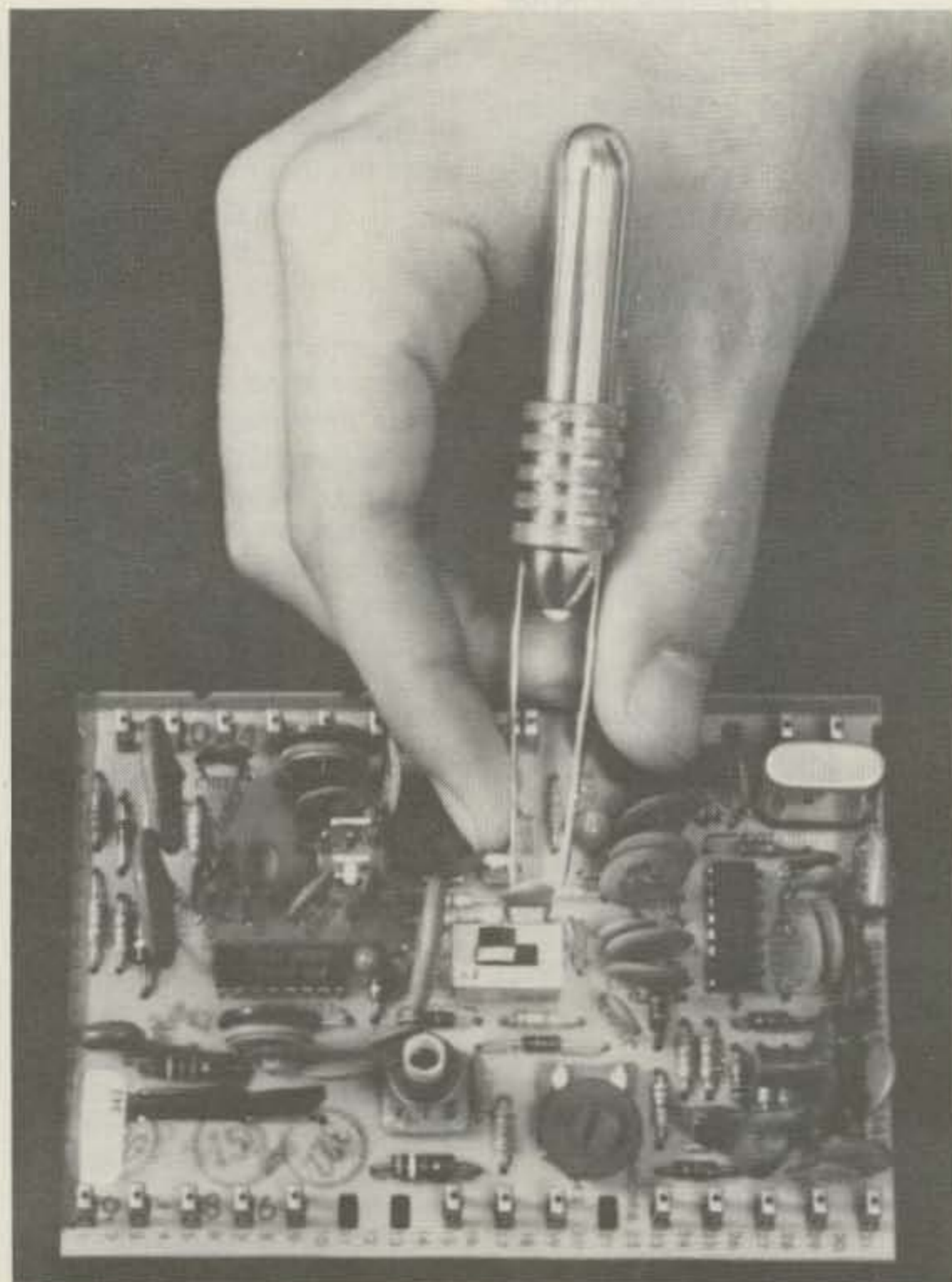
speed, volume, tone, and weight because they are easier to use than keystroke sequences and they remember your settings even if power is lost or turned off.

The MFJ-494 operates on 9-12 V dc or 110 V ac with optional ac adapter. The same keying circuit used in all MFJ keyers is used in the MFJ-494.

Available options for the keyboard include the MFJ-53 and the MFJ-54. The 53 is an AFSK plug-in module. The output of the module plugs into the mic or phone patch jack for FSK with SSB rigs and AFSK with FM or AM rigs.

The MFJ-54 loop-keying, plug-in module is a 300-V, 60-mA, loop-keying circuit that will drive your RTTY printer.

For more information, contact *MFJ Enterprises, Inc.*, PO Box 494, Mississippi State MS 39762; (601)-323-5869. Reader Service number 480.



Desco Industries' precision tweezer.

ELECTRICAL POLLUTION CONTROL

Electrical pollution drives microprocessors bananas! Power line electrical noise, hash, and spikes often cause erratic operation. In addition, severe spikes from lightning or heavy machinery may damage expensive hardware.

Electronic Specialists recently announced the Super Isolator, designed to control electrical pollution. Incorporating heavy-duty spike/surge suppression, the Super Isolator features 3 individually dual-pi-filtered ac sockets. Equipment interactions are eliminated and disruptive/damaging power-line pollution is controlled. The Super Isolator will control pollution for an 1875-Watt load. Each socket can handle a 1000-Watt load.

For more information, contact *Electronic Specialists, Inc.*, 171 South Main Street, Natick MA 01760; (617)-655-1532. Reader Service number 486.

PRECISION TWEEZER HAS BUILT-IN LIGHT

Desco Industries has added three models of battery-powered lighted tweezers to its line of electronic assembly aids. These tweezers all have stainless steel blades and are powered by a single AAA battery.

A low-cost, plastic-case model is available for working in poorly-lighted field situations. Two stainless-steel-case models are available, one with a straight tip and one with an angle tip.

For more information, contact *Desco Industries, Inc.*, 351 F Oak Place, Brea CA 92621; (714)-990-3005. Reader Service number 482.

YAESU FT-902DM

Yaesu has announced an improved version of the FT-901DM, the FT-902DM. While the 902 retains most of the features of its predecessor, several important changes have been made.

The 902 covers all present and proposed HF amateur bands, including the new WARC bands. The digital frequency readout has been improved to eliminate the need for recalibration when changing modes or bands. The built-in keyer features both dot and dash memories, and the receiver's dynamic range has been improved. Last, but not least, the vfo knob now tunes in the right direction!

For more information, contact *Yaesu Electronics Corp.*, 6851 Walthall Way, Paramount CA 90723. Reader Service number 485.

TEMPO S-4

Tempo, a pioneering manufacturer in the field of synthesized hand-held radios, has announced a new 440-MHz FM hand-held. The new S-4 is nearly identical to the other Tempo hand-helds which are offered for the 2-meter and 220-MHz bands.

Available accessories include 12- or 16-button touchtone™ pads, CTCSS tone encoder, and a leather carrying case.

For more information, contact *Henry Radio*, 2050 S. Bundy Dr., Los Angeles CA 90025. Reader Service number 481.

NEW MFJ HF WATTMETER

The new MFJ-814 HF wattmeter/swr meter has a frequency range of 1.8-30 MHz. It reads forward and reflected power on two scales (2 kW and 200 Watts) on a 2-1/2" wide x 1-1/2" high lighted meter (light



The MFJ-814 HF swr wattmeter.

requires 12 volts).

This power meter also reads swr directly and is calibrated up to 6 to 1 swr. Three push-button switches let you switch between power and swr, high and low power, and forward and reflected power.

Eggshell white with black top and sides, the meter measures 6-1/4" x 3-1/2" x 3-1/2".

For more information, contact *MFJ Enterprises, Inc.*, PO Box 494, Mississippi State MS 39762; (601)-323-5869. Reader Service number 484.

NEW MODEL FROM ALUMA TOWER

Designed especially with the ham operator in mind, Aluma Tower's new extra-heavy-duty aluminum tower meets our special needs. All uprights and cross braces are 1" seamless drawn-aluminum tubing with stainless steel aircraft cable connecting the telescoping sec-

tions. The mast is 2" diameter x 8' long and is supplied bolted in place.

Aluma Tower's telescoping construction and tilt-up style enable it to withstand any weather conditions.

For more information, contact *Aluma Tower Company*, 1639 Old Dixie Highway, Vero Beach FL 32960. Reader Service number 479.

HY-GAIN ADDS THREE NEW PRODUCTS TO TOWER LINE

Telex Communications, Inc., has announced the addition of three new products to its Telex/Hy-Gain tower line. The HG-70HD, a new 70-foot (21.3 m), self-supporting crank-up tower, is the tallest of seven towers now offered by Telex/Hy-Gain. The tower is all steel, has four sections, and features an improved guide system providing rigid, close-tolerance structural support while leaving the tube

ends open for complete surface galvanizing and unrestricted moisture drainage. This heavy-duty tower was designed for antenna loads of up to 16 square feet (1.5 sq. m) in winds of up to 60 mph (96.6 kmph). The top section is pre-drilled for thrust bearing bolts, and a rotor mounting plate is included.

Hy-Gain has also developed a new electric winch system, model HG-EW, that fits the new HG-70HD as well as the existing 54-foot (16.5 m) HG-54HD and the 52-foot (15.8 m) HG-52SS. The winch control box can be locked, which allows the tower to be secure in either the extended or retracted position. It has a limit switch which prevents a possible overload at the upper stop position. A manual crank is supplied also in the event of an electrical power failure. The HG-EW is equipped with an automatic brake which is always in positive engagement when the

winch is not operating.

This winch system can be converted at any time to remote-control operation by adding the new Hy-Gain tower control (HG-EWRC) which has been specifically designed as a modular addition to the HG-EW winch. This remote-control unit allows the operator to raise and lower the tower from a remote location such as a ham shack. The control displays upper and lower limit positions, up or down operating direction, and also provides a fail-safe sensor and indicator which automatically shuts off the winch should extreme side loads affect tower telescoping. Both the winch and the remote control are available for 110- and 220-volt operation.

For more information, contact *Hy-Gain*, 9600 Aldrich Ave. South, Minneapolis MN 55420; (612)-884-4051. Reader Service number 483.

LETTERS

from page 24

Peking, and the street next to it was full of shops. One large department store had a department selling only radio parts such as resistors, capacitors, tubes, transistors, etc., for people who wanted to repair their own radios.

They also had a black and white TV on sale for about \$1000 US.

I saw two fairly large telegraph keys but I could not find anyone who spoke English to find out what they were used for.

There was also a shop nearby which sold only TVs. Incidentally, mine in the hotel did not work.

Fred Barnes WA8PCT
Parma OH

ITS UGLY HEAD

It was interesting to read the letter in the July 73 sent to Dr. Zbigniew Brzezinski by Dave Clark K8MPF regarding his proposal to boycott stations in the USSR using the special Olympic prefixes. In the letter, Dave states, "Normal communications with the Soviet U prefixes

should be encouraged since amateur radio does provide a system of direct communication to all parts of the world regardless of political relations."

I should like to point out to your readers that in the case of the Soviet Union this is not entirely true. Since June, 1967, the Soviet authorities have forbidden their hams to communicate with Israeli amateur stations using the 4X or 4Z prefix. Although to my knowledge there has never been an official press release to this effect on the part of the USSR, it is common knowledge here, and a call to a U or an R station or what have you is almost always ignored except for the occasional station who will say "sorry, can't work you," or "no contact." For the Israeli DXer or contest fanatic, this is a serious handicap as this makes it virtually impossible to contact or confirm 19 Soviet Republics (countries) and four zones.

What is interesting is that in the last few years, amateurs visiting Israel from other countries and operating here with their own calls with a slant 4X tacked on the end find themselves besieged in pileups of Russian

amateurs calling them. This indicates that the Russians have relaxed their boycott of amateur radio in Israel to the extent of allowing contacts *only with non-Israelis operating here*. The reason for this is not clear, but it could likely be to avoid bad public relations with American and European hams visiting here.

After much deliberation on the problem, the Israel Amateur Radio Club has asked amateurs operating here with foreign call signs to avoid contacting Soviet stations until the Soviet Union rescinds its ban on contacts with Israeli stations, and to make this clear to the Soviet stations calling them.

It sure is a pity that politics raises its ugly head in this area. It should be added, however, that we have no problems contacting the other eastern European countries, but the USSR countries are all missing in the tallies of hams here who have been DXing since 1967. We are still hopeful that one day this condition will be reversed.

Hams visiting Israel are invited to use our 2-meter repeaters and meet the boys (and girls, hi) here. We use the European band plan here, and the repeaters are as follows: HAIFA—R0—145.000 in, 145.600 out (1800 Hz tone access); SAFED (upper Galilee)—R3—145.075 in, 145.675 out; BEERSHEBA—R5

—145.125 in, 145.725 out; TEL AVIV—R7—145.175 in, 145.775 out, and JERUSALEM—R9—145.225 in, 145.825 out. Only the Haifa machine requires a tone burst; all the rest are straight carrier access.

Ron Gang 4Z4MK
Kibbutz Urim, Israel

VHF CONTESTING

A short note to express my interest in the January article, "VHF Contesting." The appetizer was delicious; now when do you begin the meal? You provided a few details on equipment, antennas, spacings, and just enough to evoke, "yes, yes, go on." So... let's have more of the detail so that more of us can learn more and successfully give it a go.

Bob Munsey K6PIU
Canoga Park CA

WORK THE WOODPECKER

The January issue of 73 has a couple of items on which I would like to comment.

First is the Woodpecker. When it first came on the air, the DX fraternity on 15 and 20 had a lot of ideas of what might be done to chase it off the ham bands. The "H5H" sequence was one of them, but not very practical for those of us who

don't have keys as part of our ham station or who are essentially lazy. We don't have the power to compete with Radio Moscow to QRM them, but radar depends on receiving an echo for its results and that echo can't possibly be a match for a ham kW beamed in the right direction with a similar signal. All one has to do is tape record a few minutes of the woodpecker and play it back at them!

If all the "tuner uppers" and "pileup" participants would get

together on a "Woodpecker's Sunday" and send out the taped signal all over the band at the same time, perhaps they might get the message.

The other is your story, "Over the Hump" and the references to AC4YN. Of course, before the war AC4YN was the legendary contact that you had to work to get Zone 23. Your article mentions Reggie Fox as AC4YN, but I have reason to believe that it was a British Army group operations and that there were others

that used the call either before or after Reggie.

I served in Italy during WWII at AFHQ Italy in a combined US Signal Corps/Royal Signals operation, which has made me eligible for membership in the Royal Signals Amateur Radio Society. Currently, there are about ten U.S. hams who belong to RSARS. I got a life membership back when the pound was worth \$1.80. I get a lot of mileage out of that connection with QSOs with "G" stations. At the

time I joined, one of the officers was Sir Evan Neppan G5YN. There was quite a story on Sir Evan in the Society publication, *Mercury*. He was a career officer in the British Army, had operated from exotic spots all over the world, and had been knighted by the Queen. It appears that one of the calls he had held was AC4YN, so you figure that out! I had a nice letter from him when I joined and have worked him on the air.

**Col. Edson B. Snow, AUS Ret.
Pompano Beach FL**

REVIEW

from page 30

ed a measure of additional gain.

Our basic downconverters soon acquired an elaborate "look" which reminded us of a mini-TVRO setup, and we somehow felt we had set new DX records for solid MDS reception in this heavily wooded and mountainous area of the United States. One aspect has definitely proven true: Signal paths which are not line of sight are difficult to predict and use. Raising antenna height to acquire line of sight is often the only logical alternative.

Some additional members of our group decided to construct competitive and more expensive downconverters, reasoning that complexity and cost should provide better results. Unfortunately, we did not find that true and had to work like heck to get marginally acceptable results from those units. Our previously acquired knowledge of microwave construction techniques

was also required to supplant marginal instructions used with these units.

Fortunately, however, we all came out winners at the end and except for me, everyone is presently enjoying watching special TV programs. My particular converter works great, but I'm 20 miles, two mountains, and one dense forest from the MDS transmitter. Plans include wrestling a 3.5-foot parabolic dish/downconverter setup to the top of an 80-foot pine tree and adding a second TV tuner between the converter and the television for additional gain. We're not giving up yet!

In conclusion, the Universal Communications downconverter kits have proven their worth and are very reliable units. If you would like to get your feet wet in microwave, MDS, or weather satellite reception, these units are a good starting point. At the present time, I'm also considering the feasibility of modifying a unit for TV satellite reception.

A number of additional items also will be required, but a working system for under \$400 looks very promising.

The original downconverter board described here is available from *Universal Communications, Box 6302, Arlington TX 76011.*

**Dave Ingram K4TWJ
Birmingham AL**

DX-200 RECEIVER

The DX-200, sold by Radio Shack, is a general-coverage receiver. It tunes five bands: 150 kHz to 400 kHz, 520 kHz to 1.6 MHz, 1.55 MHz to 4.5 MHz, 4.5 MHz to 13 MHz, and 13 MHz to 30 MHz. It is designed for the reception of the three most-used forms of amplitude-modulated signals, which are double sideband with carrier (AM, or 6A3), single sideband without carrier (SSB, or 3A3j), and make-and-break radiotelegraphy (CW, or 0.1A1). The basic design is the classic single-conversion superheterodyne with an intermediate frequency (i-f) of 455 kHz. The circuit provides one stage of preselection before the frequency conversion.

To evaluate this receiver, it was compared with two others, each of recognized performance capability but of other design and in a higher cost bracket. A coaxial switch was used to switch the reference antenna among the three receivers, thereby ensuring a comparable signal to each. In addition to off-the-air signals, a URM-25D signal generator was used to make measurements of sensitivity and of image rejection.

One of the comparison receivers was a Yaesu Model FRG-7, which uses the Wadley Loop system. This involves triple conversion, with a first i-f of 55 MHz, to ensure almost total

freedom from images. The other was the receiver section of a Kenwood TS-120S. This is a single-conversion receiver with an i-f of 8.8 MHz. Unless otherwise stated, off-the-air signals were obtained from an 80-meter trapped dipole antenna mounted 50 feet above ground.

Initially, the DX-200 was tuned to the AM broadcast band. Here it performed very well indeed. Both selectivity and sensitivity were excellent, and the stability adequate. I rated it on a par with the FRG-7 with but one exception. With the rf gain control turned fully on, the set broke into oscillation, causing severe distortion. Backing off slightly on the gain control stopped the distortion. With a short indoor antenna, the rf gain could be advanced fully without distortion.

The second check was on the longwave band. The DX-200 did quite well. It is one of the very few longwave receivers I've heard that doesn't bring in local broadcast band stations almost as loudly as LF stations! There was some slight spillover but not enough to be troublesome.

In the high-frequency range, the receiver displayed varying degrees of performance. For the reception of shortwave BC stations, it did quite well over the whole spectrum, fully equaling the FRG-7 in all respects save one: Image rejection above 5 or 6 MHz is very poor. The selectivity and sensitivity were fully adequate for SWling and I didn't notice any frequency drift. Even the sponginess of the bandspread dial was not too objectionable.

For the reception of HF SSB stations, the level of performance dropped. In the MF 160-meter band and in the HF 80- and 40-meter bands, signals could be demodulated with ac-



Realistic DX-200 communication receiver.

ceptable intelligibility. As I went higher, the signal quality became much worse. On 11 and 10 meters the clarity approached zero! It appears that there is enough instability in either the HF oscillator or the beat frequency oscillator (I suspect the former) to introduce severe fuzziness. These signals were, of course, also checked on both the FRG-7 and the TS-120S to make sure that the difficulty originated in the DX-200 and not in the transmitter or in some propagation abnormality.

CW reception is a bit better than that of SSB in that one can read a T5 note with no difficulty. In fact, there are operators who prefer modulated notes over that of a pure sine wave! The sponginess of the bandspread dial makes tuning in a CW signal a bit of a job, but it can be done with practice and patience. It's a wee bit more tedious than the FRG-7; the TS-120S, of course, presents no tuning difficulties.

The next job tackled was attempting to improve the image rejection for frequencies above 5 or 6 MHz. Two passive preselectors (shown in Fig. 1) were tested. One is of a type designed to match a random-length ended antenna to a low impedance input to a receiver. The other is for low-Z to low-Z; it was used with the trapped dipole.

Both preselectors performed about the same. They helped to attenuate images in the 5- to 10-MHz range, but above 10 MHz their selectivity curves were so broad that they provided insufficient attenuation to the image. And, of course, this is the region that most needs additional image attenuation! Scratch the idea of a passive device.

An active preselector, a leftover from the day when I had a DX-150 receiver, was excavated from my junk box. Its circuit is shown in Fig. 2. In addition to providing preselection, it supplies an appreciable amount of gain. Now the DX-200 had plenty of gain, but I noticed that it performed somewhat better with its rf gain control backed off a bit from fully clockwise. From that standpoint, the additional gain from the active preselector is valuable.

Its image rejection ability was evaluated with signals from the antenna and signals from the URM-25D signal generator. For the latter, a signal was injected into the receiver at a level which

caused a predetermined deflection of the receiver's S-meter. Both that deflection and the URM-25D's microvoltmeter indication were noted. The DX-200 was carefully tuned to the signal's image and its S-meter reading noted. Next, the URM-25D's output was advanced until the referenced S-meter deflection was again reached. Reading the new value from the microvoltmeter provided an indication of the receiver's image rejection capability. Then the active preselector was introduced into the circuit. It was tuned to the URM-25D's output frequency and the whole series was repeated. The additional increase in signal generator output to return the S-meter to its referenced value gave a comparative indication of the effectiveness of the preselector. No attempt was made to tabulate absolute values; only comparisons were desired.

The results showed that neither the FRG-7 nor the TS-120S had enough image response to be recorded. Also, the active device was significantly better than either of the two passive preselectors. Above about 16 MHz, however, even the active circuit's image rejection became marginal. It added useful gain, however.

My conclusion is that it is not feasible to attempt to make significant improvement in the image rejection capability of a receiver having an i-f of 455 kHz for reception of signals above 16 MHz unless one is prepared to use at least two and probably three additional tuned circuits.

The lack of good image rejection on the higher frequency ranges does not mean that the DX-200 is not a good receiver. It is highly sensitive and is as selective as one might want for reception of AM voice and music broadcasts. It is stable enough to require no retuning

once you've centered on a station. For many decades radio listeners used receivers having the same basic circuit as the DX-200 and found such receivers quite satisfactory. The average SWL will find that the DX-200 fulfills his requirements in a satisfactory manner.

I found many things to like about the DX-200. Its bandspread is very good, the quality of the internal speaker is better than average, and there's a 1/4" headphone jack on the front panel. The external speaker jack on the rear is of the miniature type. Inspection of the schematic wiring diagram reveals that there's a resistor in series with the internal speaker and also one in series with the headphone jack, but none in series with the external speaker jack. Evidently, the audio output is higher than the internal speaker can handle, yet this speaker provides room-filling volume.

The wiring diagram makes an interesting study. The receiver's designers came up with some neat tricks—too many to comment on. They have one practice I cannot admire, though. That is designing the receiver to have its power supply activated at all times when the 117-volt power plug is inserted into the wall socket.

Still on the subject of the wiring diagram, it would appear that the set's overly-optimistic S-meter might be made more nearly realistic by adjusting resistor VR202. If its 1k range is insufficient, the addition of a series resistor might do the job. If not, you always can tame an overly-active S-meter with a shunt resistor.

The DX-200 has an owner's manual that's really outstanding. In addition to information on the receiver, it has many excellent tips on using it. I did find four items in it that irked me; all related to nomenclature. The

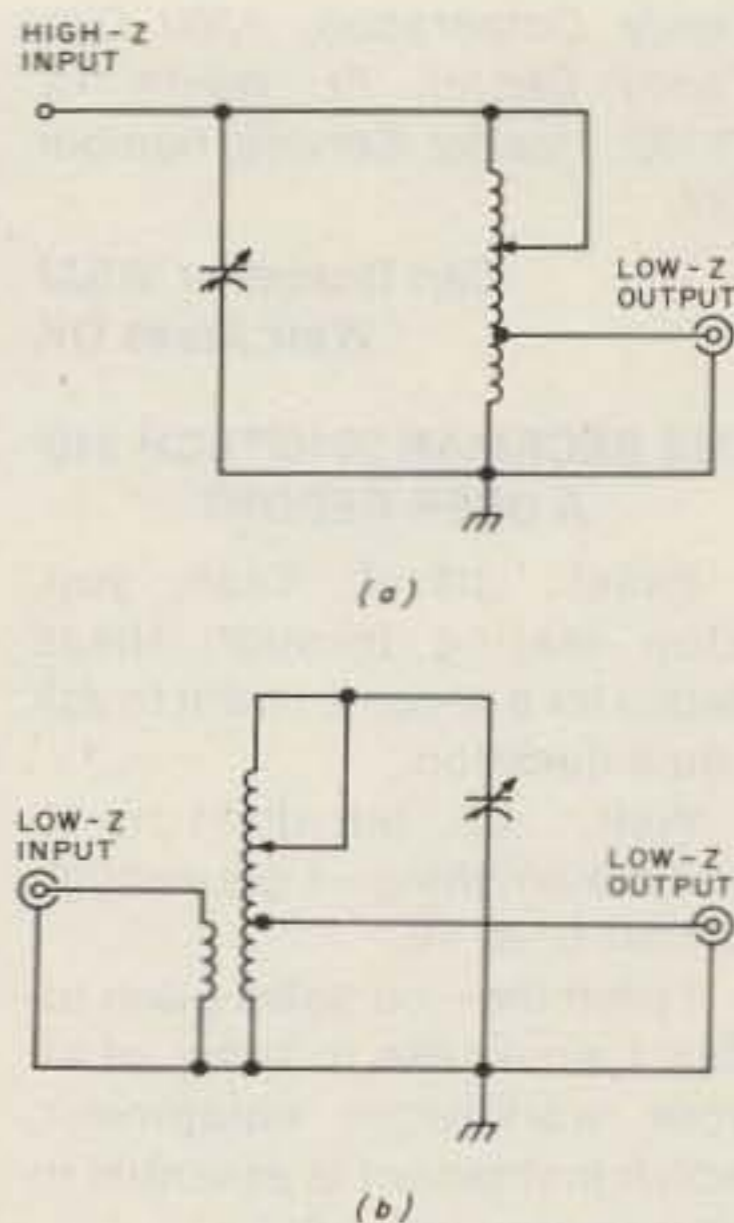


Fig. 1. Passive preselector circuits for the DX-200. (a) For random-length ended antennas. (b) For low-impedance antennas.

manual calls all random-length ended antennas "long wires," which is incorrect, as a long-wire antenna is one many wavelengths long! The other three were in the list of radio terms, which showed "73s" instead of 73, "88s" instead of 88, and XYL instead of YF. But those four glitches do not seriously detract from the overall excellence of the manual.

To sum up, the DX-200 is as good a receiver of its design as you're likely to find for the price. Its design, the classic single-conversion with an i-f of 455 kHz, has inherent limitations. Within these limitations, the DX-200 rates highly, with just two exceptions: the lack of spectral purity in the oscillator and the rubbery feeling of the bandspread tuning dial. If these were corrected, Radio Shack would have a receiver that would be difficult to fault.

For further information, contact *Radio Shack, a division of*

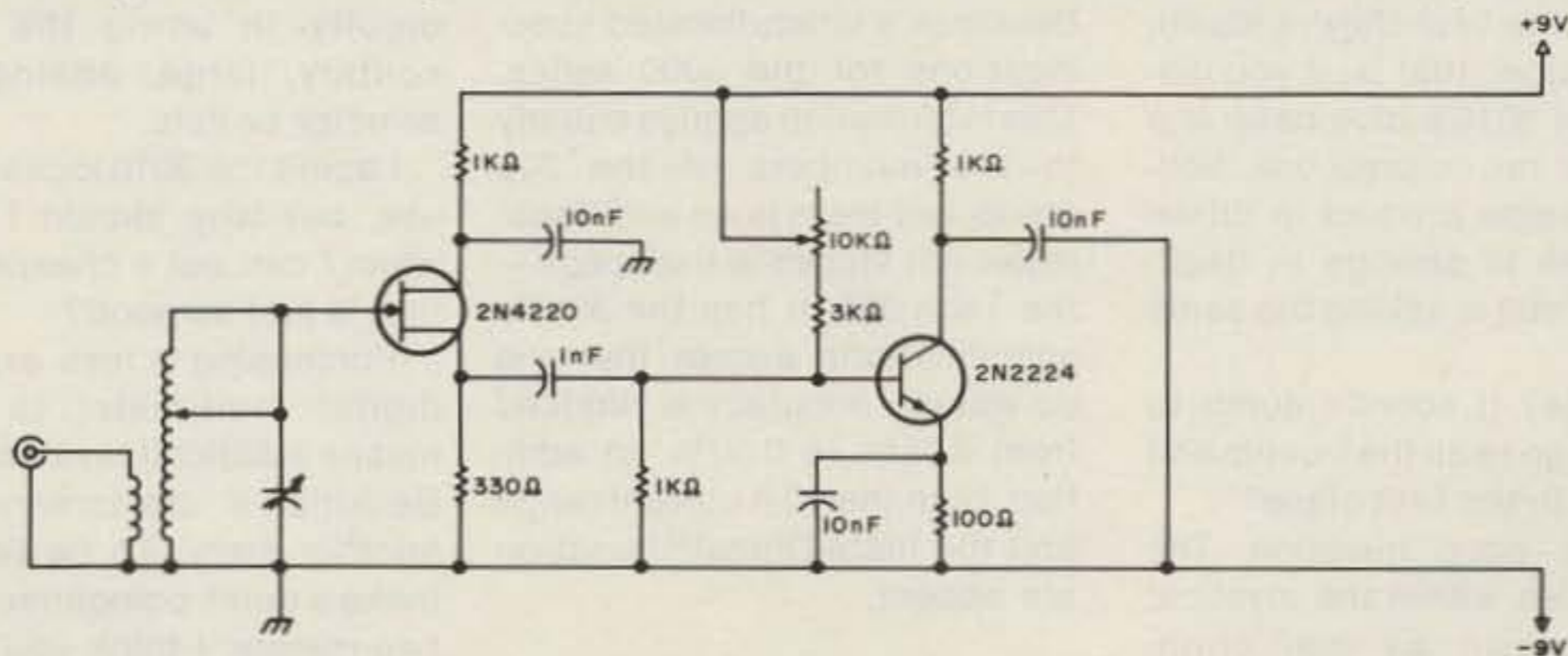


Fig. 2. Active preselector and preamplifier.

Tandy Corporation, 1300 One Tandy Center, Ft. Worth TX 76102. Reader Service number 477.

Carl Drumeller W5JJ
Warr Acres OK

THE BECKMAN 3010/TECH 310: A USER REPORT

Pssst... pssst. Yeah, you. Stop leafing through these pages for a second, I want to ask you a question.

Well... OK, but don't try to sell me anything—I get enough of that from TV.

I promise—no sales pitch today. I would like to know, of all your workbench equipment, which instrument is essential to your testing needs?

That's easy: my ohmmeter.

I agree, the multimeter is the foundation for most of our diagnostic procedures. What is the reason for its wide popularity? Why do we depend on it so much? Many test instruments have proven invaluable as troubleshooting aids, yet they enjoy little of the multimeter's success. I think that a prime factor for the analog's success is its tradition of combining versatile service with a low price tag. Today's new digital multimeters continue to carry out this fine tradition, perhaps improving upon it. One of the better of these is the Beckman Super-swing.

Hold it! Are you sure you got the name right? I've been shopping for a DMM, and I have never heard of this Superswinger.

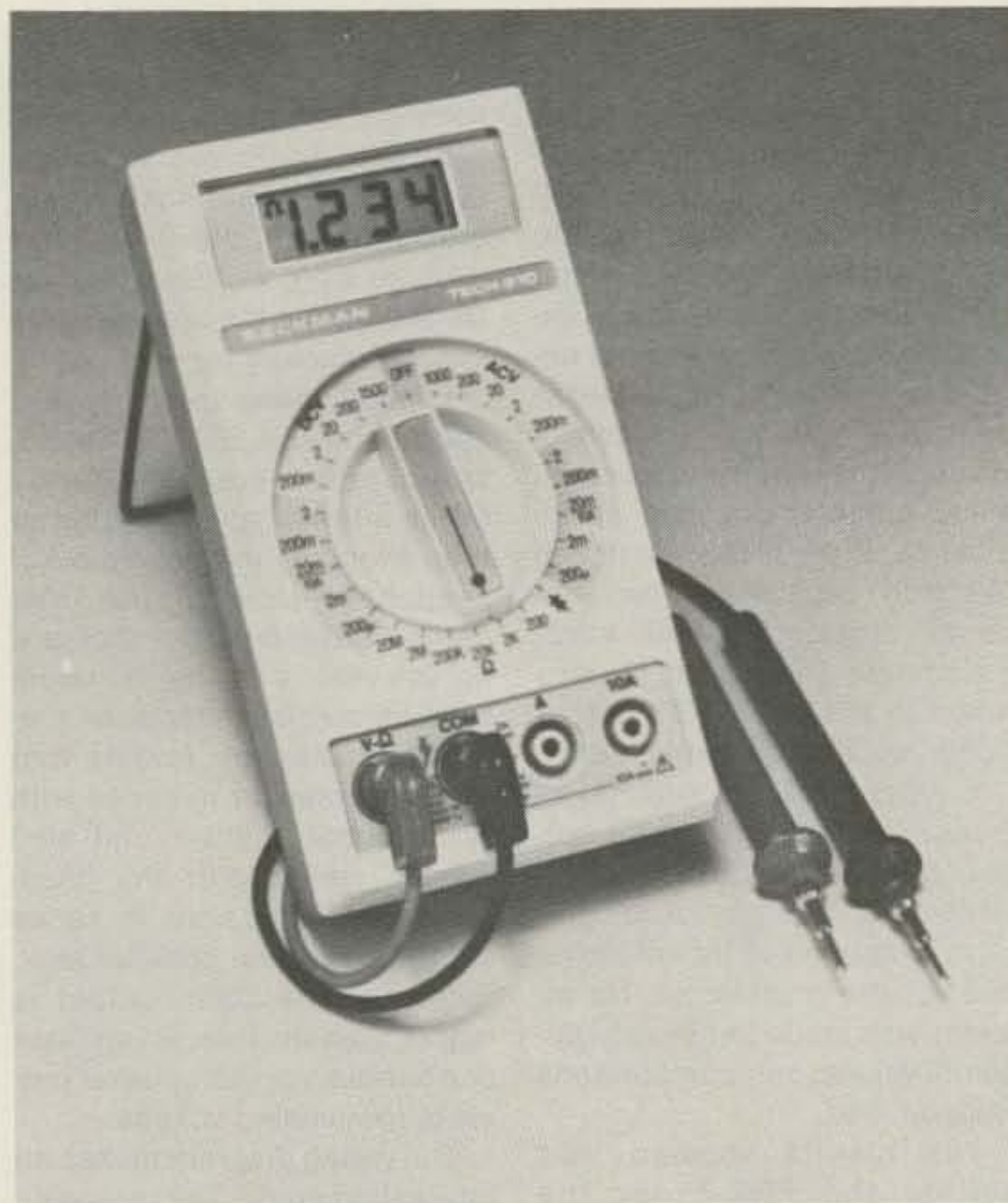
I'm positive! You see, I made up the name.

Boy, that's all I need! As if it weren't enough trouble keeping track of all the real meters, now some joker invents his own.

If you will be patient a moment, I hope to clarify the situation. I devised this designation to represent two *real* Beckman models, the Tech 310 and the 3010. A sound reason exists for merging the two: they're identical. Identical, that is, if you discount the 3010's blue case and the 310's tan-colored one. Selling the same product in different boxes is strange in itself; stranger still is asking the same price.

Strange? It sounds dumb to me. Why go to all the trouble and expense in the first place?

A very good question. The answer lies within the mystical realm known as marketing. Beckman, with logic only a



Beckman Tech 310 digital multimeter.

marketing analyst could love, elected to attack the formidable meter market with two entirely separate sales forces. The first, with the 3000 series, focuses its efforts on the large industrial user, while the 300 team tackles the end-user market. I am told that this dual-meter, dual-designation approach is invaluable for accurately gauging market penetration. While on the subject of dual designations, unless clarification is needed, I shall confine my comments solely to the 3010.

One fact stands out through all of marketing's dust and confusion: Beckman makes an incredibly good meter.

Ha! I've heard that one before. Prove it.

I will substantiate my claim with some cold, hard facts: Beckman's unadulterated specifications for the 3000 series. This information applies equally to the members of the 300 group, but there is an additional meter not shown in the specs—the Tech 300. It has the 3010's specifications except that the dc voltage accuracy is reduced from 0.25% to 0.50%. In addition, both the 10-A current range and the Insta-Ohms™ function are absent.

I like the specs, but how much

would it syphon from my bleak-looking bank account?

I'm glad you're pleased with the 3010's numbers. Nevertheless, as you must already know from examining today's market, most DMMs have attractive-looking figures. What earns the Beckman its \$140 price tag is its superior performance in the real world.

\$140! My wife would kill me.

I realize that the price tag seems a bit heavy, but the excellent quality of the 3010 with its easy, dependable, and versatile operation makes it a great buy. Take operator ease. Many users are momentarily dumbfounded when confronted by some DMMs and their rows of push-buttons or multiple switches. With the Beckman, you will never have this problem. There is positively no confusion or ambiguity in using the 3010's solitary, large, analog-styled selector switch.

I admit the 3010 looks easy to use, but why should I buy it, when I can get a cheaper DMM that is just as good?

Purchasing a less expensive digital multimeter is by no means a difficult task. Matching Beckman's craftsmanship is another story. To be fair, let's make a quick comparison of the two meters. I think you'll agree that ruggedness is a desirable

attribute in test equipment, and essential for all portable instruments. Multimeters are no exception and must endure a multitude of sins in the form of knocks, bumps, and scrapes. Some of these can be nastier than others; a fall could be fatal. If you were to accidentally knock your bargain meter off the top of your workbench, would it survive?

Ouch! I hope so. Although I do remember dropping my VOM once; it never worked the same again.

I'm afraid your bargain-basement friend will share much the same fate: dead on arrival. If you owned a 3010 in this situation, you may suffer heart failure, but the meter will remain healthy. Meeting military shock and vibration standards, the 3010 is capable of withstanding the abuse from a six-foot fall without blinking a digit. This ruggedness stems in part from the fire-retardant, high-impact ABS plastic case, but, to a larger extent, it is due to Beckman's careful engineering. This attention to detail is evident when you examine the outside. All vulnerable areas, including the 3½-digit liquid-crystal display, function switch, and test jacks, are recessed out of harm's way. Venturing inside, we find the explanation for the 3010's great strength—an unbelievable low number of parts. The credit for the fewer than forty active components goes to a custom-designed CMOS LSI multiprocessor. Helped by a CD4069 hex inverter, this LSI chip performs all the active DMM functions, which results in a small, compact, and extremely reliable digital multimeter.

Ruggedness is only a start; Beckman goes much further to ensure a reliable meter with a long and healthy life. Living in the "northwets," I appreciate the extra effort that has gone into sealing the 3010. It is well-suited for this climate, offering no easy pathways for the liquid sunshine, dirt, or other contaminants. On most multimeters, the test jacks are open gateways into the interior. Beckman closes the gate by physically dead-ending these. While an O-ring protects the selector switch, a large gasket seals the LCD display area. I have been told that the 3010 is so well sealed that it will float. You need not take your DMM swimming to avail your-

self of this added protection. A recent graphic demonstration from a skeptical friend pointed this out. He watched in helpless horror as a glass of iced tea, liberally laced with sugar, dispatched his three-month-old DMM to silicon heaven.

Beckman enhances the reliability of the 3010 further by giving each meter a 100% burn-in, followed by a complete test of each function and every range. All of this results in a digital multimeter that is trouble-free and backed by a one-year warranty under which Beckman agrees that:

If the instrument fails for any reason whatsoever, except abuse, Beckman will (at its election) repair or replace the multimeter with a new or reconditioned unit of equivalent quality.

That sounds too good. Service must take forever!

Wrong. There is only one word that can describe Beckman's service: phenomenal! You will get no excuses or interminable delays when you have an ailing meter. Instead, within one working day from the receipt of the meter at a service center, a new or reconditioned unit will be *air* shipped to you.

The 3010 certainly seems well built. Yet, that price still scares me a little.

Your reservations will fade after getting to know some of the 3010's features better. The same custom CMOS chip that helps make the 3010 so tough also contributes other useful traits. The CMOS construction in conjunction with the low-power LCD display ensures a long battery life. A 9-volt alkaline battery supplies 2000 hours of *continuous* operation. Under normal operating conditions you can expect two years of service from a single battery. That's ten times longer than other hand-held 3½-digit meters provide. Couple this longevity with a low-battery warning that signals for the last 200 hours of operation and you have erased any excuse for a dead battery. This low power drain also frees the user from external power sources, adapters, and chargers which add unnecessary weight. The 3010 weighs in at a modest 16 ounces.

In the world of micro-electronics, where minute voltages and infinitesimal currents are precariously balanced, outside disturbance from low-impedance

sources can be disastrous. The 3010's high input impedance of 22 megohms babies delicate circuitry with less than half the loading of the conventional DMM's 10-megohm impedance. In fact, this meter's load factor is far lower than most VOMs.

A baby around delicate equipment, the 3010 does not play nursery games when it comes to life's crueler realities—destructive overloads. The meter will tolerate transgression as high as 1500 V dc/1000 V rms on the voltage inputs, and the resistance area is protected to 300 V dc/rms. Both can ward off evil transients up to 6000 volts in size. The 2-A current range is fused against overloads, but the 10-A range is vulnerable. Making use of an internal, 0.001-Ohm resistor, this 10-A function is totally defenseless, lacking the most paltry of fuses. A glaring omission on Beckman's part? In a way, yes, because this does open the door to operator abuse. On the other hand, by being aware of the potential danger and by observing a 30-second time limit, one can extend the upper current boundary to 20 Amps. I have successfully made measurements in excess of 17 Amperes with no ill effects. However, I cannot stress strongly enough the need to strictly adhere to the 30-second limitation!

Another feature worth mentioning is the in-circuit diode/transistor test function. One aspect of the 3010 is that all the resistance ranges are low powered, and as such cannot forward-bias a semiconductor. This necessitates that a separate test function be added to the meter. As usual, Beckman goes first class by employing a dedicated constant-current source, which, when in operation, shows the actual voltage dropped across a semiconductor junction, eliminating all guess work. The test, if performed in-circuit with a parallel resistance greater than 200 Ohms, is completely transparent.

I like all of the 3010's fine features, but my favorite is Insta-Ohms, Beckman's fast, versatile continuity indicator. At the moment of continuity detection, an Ohm symbol is displayed in the upper left-hand corner of the LCD display. With its virtually instantaneous operation, Insta-Ohms has created a

wealth of tests never before feasible on a purely digital multimeter, including those with audible indicators. Prompt detection (less than 100 milliseconds) allows the 3010 to accomplish analog-style tests such as checking a capacitor's ability to accept and hold a charge. In this case, the analog needle is replaced by the Insta-Ohms symbol, which appears quickly as the test begins. The charging capacitor's apparent resistance falls within twice the maximum of the selected range.

A readout of the resistance follows almost immediately. The cap's steadily building charge swings the reading upward toward infinity, until a point is reached where one of two things will happen. Depending on the selected resistance range, either the readout and Insta-Ohms will overflow, or a final breakdown value for the capacitor will be found. The necessity for fast electronics in this test becomes obvious when you involve small value caps with their short time constants. The Insta-Ohms speed is such that I have had no problem checking 2.2- μ F and smaller tantalums.

Insta-Ohms has several important advantages over ohmmeters and audible continuity indicators. First, with the overload protection of 300 V dc/rms, you don't have to worry about a damaged meter movement or bent and broken needles. Second, as part of the liquid-crystal display, the indicator uses little power, contributing greatly to the meter's two-year battery life. Finally, because it isn't limited to one or two resistance ranges, Insta-Ohms is useful in tracking down high-impedance "shorts." You also have the blessing of not having to use an override switch on large jobs to kill the incessant buzz that drives fellow workers up the wall.

I'm impressed. I think I'll spend the extra bucks.

In that case, you should be glad to hear that the 3010 comes ready to use, having a battery, spare fuse, safety test leads, and operator manual. Beckman's attention to detail and quality carries into their excellent accessories. The awkward-looking test probes are actually comfortable to use. So much so that I never gave them much thought. Nonetheless, they exerted an influence on me, however subtle.

This influence became evident when I had the occasion to use a regular pair of test leads on a 240-volt power supply. I was distinctly apprehensive at the time, and the reason why eluded me. I now know the reason: Subconsciously, I missed the added security imparted by the knobby node end of Beckman's safety test leads.

This brings us to the 3010's operator manual. It is one of the best I've seen. Unlike the scant, inept papers some manufacturers try to pawn off as manuals, the Beckman manual is an in-depth, comprehensive guide to the understanding and use of the 3010. Although faulted as being too long, a premise I do not share, the manual is worth the reading effort.

OK, OK, I'm convinced. Well, almost. There has got to be a zinger—you haven't mentioned one bad word about the meter!

Zinger? I don't know if you could classify them as such, but there are a couple of items that I'm a little less than thrilled about. One, and the brunt of my dissatisfaction must fall upon it, is the 3010's built-in tilt-bail. Conceived as a dual-purpose hanger/bench support, the wire bail is all too flimsy for hanging the meter. Its most unforgivable sin of sins is the metal construction which makes it a great conductor and, thus, dangerous.

The only other fault with the 3010 is that you cannot zero the resistance function. This becomes a factor only when using the lowest range, and the resistance of the test probes is displayed. Less than 0.2 of an Ohm in value, my objection centers on the fact that no means of zeroing this reading is provided.

You've made a sale! I can contend with those easily.

Fine—my sentiment exactly. If you want to hunt exotic non-sinusoidal waveforms like triangles and ramps, look into Beckman's RMS 3030—currently the only hand-held DMM with true-rms measurement capability.

For more information, contact *Advanced Electro-Products Division, Beckman Instruments, Inc., 2500 Harbor Blvd., Fullerton CA 82634; (714)-871-4848, ext. 3651.* Reader Service number 476.

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DATA IS INCLUDED WITH KITS OR MAY BE PURCHASED SEPARATELY	\$15.00

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HOWARD/COLEMAN TVRO CIRCUIT BOARDS

DUAL CONVERSION BOARD

This board provides conversion from the 3.7-4.2 band first to 900 MHz where gain and bandpass filtering are provided and, second, to 70 MHz. The board contains both local oscillators, one fixed and the other variable, and the second mixer. Construction is greatly simplified by the use of Hybrid IC amplifiers for the gain stages. Bare boards cost \$25 and it is estimated that parts for construction will cost \$270. (Note: The two Avantek VTO's account for \$225 of this cost.)

47 pF CHIP CAPACITORS

For use with dual conversion board. Consists of 6-47 pF.

70 MHz IF BOARD

This circuit provides about 43 dB gain with 50 ohm input and output impedance. It is designed to drive the HOWARD/COLEMAN TVRO Demodulator. The on-board band pass filter can be tuned for bandwidths between 20 and 35 MHz with a passband ripple of less than 1/2 dB. Hybrid ICs are used for the gain stages. Bare boards cost \$25. It is estimated that parts for construction will cost less than \$40.

.01 pF CHIP CAPACITORS

For use with 70 MHz IF Board. Consists of 7-.01 pF.

DEMODULATOR BOARD

This circuit takes the 70 MHz center frequency satellite TV signals in the 10 to 200 millivolt range, detects them using a phase locked loop, deemphasizes and filters the result and amplifies the result to produce standard NTSC video. Other outputs include the audio subcarrier, a DC voltage proportional to the strength of the 70 MHz signal, and AFC voltage centered at about 2 volts DC. The bare board cost \$40 and total parts cost less than \$30.

SINGLE AUDIO

This circuit recovers the audio signals from the 6.8 MHz frequency. The Miller 9051 coils are tuned to pass the 6.8 MHz subcarrier and the Miller 9052 coil tunes for recovery of the audio.

DUAL AUDIO

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DC CONTROL

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11C91DC	650 MHz Prescaler Divide by 5/6	16.50
11C83DC	1 GHz Divide by 248/256 Prescaler	29.90
11C70DC	600 MHz Flip/Flop with reset	12.30
11C58DC	ECL VCM	4.53
11C44DC/MC4044	Phase Frequency Detector	3.82
11C24DC/MC4024	Dual TTL VCM	3.82
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11C05DC	1 GHz Counter Divide by 4	50.00
11C01FC	High Speed Dual 5-4 input NO/NOR Gate	15.40

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2N3301	1.04	2N5945	12.38	MMT2857	2.63
2N3302	1.05	2N5946	14.69	MRF245	33.30
2N3304	1.48	2N6080	7.74	MRF247	33.30
2N3307	12.60	2N6081	10.05	MRF304	43.45
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4.7pf	82pf	390pf	3900pf
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6.8pf	110pf	470pf	5600pf
8.2pf	120pf	510pf	6800pf
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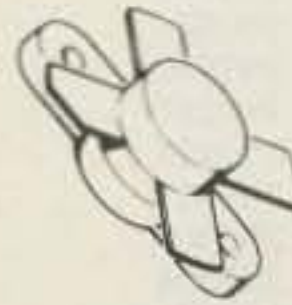
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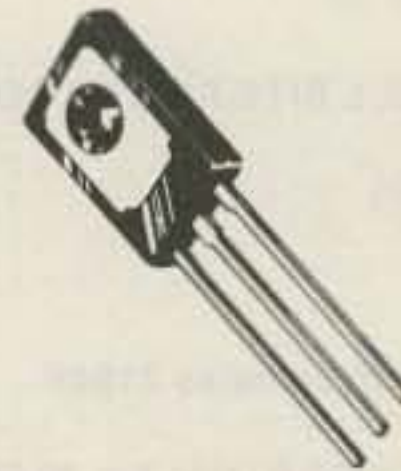
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 - Efficiency = 65% Typical



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MHW710 - 2

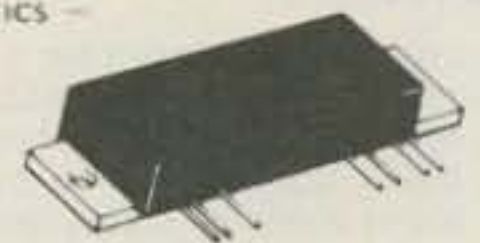
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2716/2516	2K x 8 EPROM 5Volt Single Supply	20.00
2114/9114	1K x 4 Static RAM 450ns	6.99
2114L2	1K x 4 Static RAM 250ns	6.99
2114L3	1K x 4 Static RAM 350ns	7.99
4027	4K x 1 Dynamic RAM	3.99
4060/2107	4K x 1 Dynamic RAM	3.99
4050/9050	4K x 1 Dynamic RAM	3.99
2111A-2/8111	256 x 4 Static RAM	3.99
2112A-2	256 x 4 Static RAM	3.99
2115AL-2	1K x 1 Static RAM 55ns	4.99
6104-3/4104	4K x 1 Static RAM 320ns	14.99
7141-2	4K x 1 Static RAM 200ns	14.99
MCM6641L20	4K x 2 Static RAM 200ns	14.99
9131	1K x 1 Static RAM 300ns	10.99

C.P.U.'s ECT.

MC6800L	Microprocessor	13.80
MCM6810AP	128 x 8 Static RAM 450ns	3.99
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MC6820P	PIA	8.99
MC6820L	PIA	9.99
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MC6862L	2400 BPS Modem	14.99
MK3850N-3	F8 Microprocessor	9.99
MK3852P	F8 Memory Interface	16.99
MK3852N	F8 Memory Interface	9.99
MK3854N	F8 Direct Memory Access	9.99
8008-1	Microprocessor	4.99
8080A	Microprocessor	8.99
Z80CPU	Microprocessor	14.99
6520	PIA	7.99
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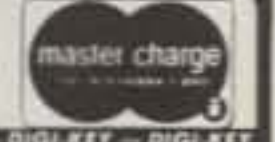
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7400 TTL	74000 LS	CMOS	LSI	LSI
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7402	74002	7402	7402	7402
7403	74003	7403	7403	7403
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7412	74012	7412	7412	7412
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 • (Minimum of 10 sockets per lot per socket)

100 INFLAY SOLDER TAIL No. 100 Microcircuits Tin

Part No.	Description	1" 100	1" 500
100-01	100 pin inlay solder tail	100	500
100-02	100 pin inlay solder tail	100	500
100-03	100 pin inlay solder tail	100	500
100-04	100 pin inlay solder tail	100	500
100-05	100 pin inlay solder tail	100	500
100-06	100 pin inlay solder tail	100	500
100-07	100 pin inlay solder tail	100	500
100-08	100 pin inlay solder tail	100	500
100-09	100 pin inlay solder tail	100	500
100-10	100 pin inlay solder tail	100	500
100-11	100 pin inlay solder tail	100	500
100-12	100 pin inlay solder tail	100	500
100-13	100 pin inlay solder tail	100	500
100-14	100 pin inlay solder tail	100	500
100-15	100 pin inlay solder tail	100	500
100-16	100 pin inlay solder tail	100	500
100-17	100 pin inlay solder tail	100	500
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100-19	100 pin inlay solder tail	100	500
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100-24	100 pin inlay solder tail	100	500
100-25	100 pin inlay solder tail	100	500
100-26	100 pin inlay solder tail	100	500
100-27	100 pin inlay solder tail	100	500
100-28	100 pin inlay solder tail	100	500
100-29	100 pin inlay solder tail	100	500
100-30	100 pin inlay solder tail	100	500
100-31	100 pin inlay solder tail	100	500
100-32	100 pin inlay solder tail	100	500
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100-39	100 pin inlay solder tail	100	500
100-40	100 pin inlay solder tail	100	500
100-41	100 pin inlay solder tail	100	500
100-42	100 pin inlay solder tail	100	500
100-43	100 pin inlay solder tail	100	500
100-44	100 pin inlay solder tail	100	500
100-45	100 pin inlay solder tail	100	500
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THE NEW MODULAR CIRCUIT BUILDING SYSTEM

BASIC INTEGRATED CIRCUIT STARTER PACK
 This Starter Pack includes four integrated circuits, two power resistors and a 100V 100mA power supply. It's ready to use in a 100-hole breadboard. The Hobby-Blox system is a unique, simple, and easy-to-use system for building modular circuits. It's perfect for the hobbyist, student, or professional alike. Includes: 1. 7400 (NAND), 2. 7401 (NAND), 3. 7402 (NAND), 4. 7403 (NAND), 5. 100V 100mA Power Supply, 6. 10K Resistor, 7. 100 Ohm Resistor, 8. 1K Resistor, 9. 10K Potentiometer, 10. 100 Ohm Potentiometer, 11. 1K Potentiometer, 12. 10K Variable Resistor, 13. 100 Ohm Variable Resistor, 14. 1K Variable Resistor, 15. 10K Resistor Network, 16. 100 Ohm Resistor Network, 17. 1K Resistor Network, 18. 10K Potentiometer Network, 19. 100 Ohm Potentiometer Network, 20. 1K Potentiometer Network, 21. 10K Resistor Network, 22. 100 Ohm Resistor Network, 23. 1K Resistor Network, 24. 10K Potentiometer Network, 25. 100 Ohm Potentiometer Network, 26. 1K Potentiometer Network, 27. 10K Resistor Network, 28. 100 Ohm Resistor Network, 29. 1K Resistor Network, 30. 10K Potentiometer Network, 31. 100 Ohm Potentiometer Network, 32. 1K Potentiometer Network, 33. 10K Resistor Network, 34. 100 Ohm Resistor Network, 35. 1K Resistor Network, 36. 10K Potentiometer Network, 37. 100 Ohm Potentiometer Network, 38. 1K Potentiometer Network, 39. 10K Resistor Network, 40. 100 Ohm Resistor Network, 41. 1K Resistor Network, 42. 10K Potentiometer Network, 43. 100 Ohm Potentiometer Network, 44. 1K Potentiometer Network, 45. 10K Resistor Network, 46. 100 Ohm Resistor Network, 47. 1K Resistor Network, 48. 10K Potentiometer Network, 49. 100 Ohm Potentiometer Network, 50. 1K Potentiometer Network.

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Digital LCD Clock Module

- Operates from a single 1.5V Battery
- 0.3" LCD Display



Instructions included in All Orders

- User selectable 12 or 24 hour mode
- 24-hour alarm with ON-OFF control
- Programmable 15-minute sleep timer with reset to sleep
- 7 minute snooze timer
- Fast/Slow setting controls
- Secondary display
- 10 sec. battery will typically last one year
- Minimum external parts required for bread board
- Secondary Display

MA1032M LCD Clock Module only **\$24.95**
 MA1032C Switch for MA1032M **\$ 2.85**
 MA1032E MA1032M, MA1032C, & AA battery holder **\$28.20**

PANASONIC ELECTROLYTIC CAPACITORS

Value	WV	1	10	100	1	10	100
10	50	1.5	1.5	1.5	1.5	1.5	1.5
22	50	1.5	1.5	1.5	1.5	1.5	1.5
47	50	1.5	1.5	1.5	1.5	1.5	1.5
100	50	1.5	1.5	1.5	1.5	1.5	1.5
220	50	1.5	1.5	1.5	1.5	1.5	1.5
470	50	1.5	1.5	1.5	1.5	1.5	1.5
1000	50	1.5	1.5	1.5	1.5	1.5	1.5
2200	50	1.5	1.5	1.5	1.5	1.5	1.5
4700	50	1.5	1.5	1.5	1.5	1.5	1.5
10000	50	1.5	1.5	1.5	1.5	1.5	1.5
22000	50	1.5	1.5	1.5	1.5	1.5	1.5
47000	50	1.5	1.5	1.5	1.5	1.5	1.5
100000	50	1.5	1.5	1.5	1.5	1.5	1.5
220000	50	1.5	1.5	1.5	1.5	1.5	1.5
470000	50	1.5	1.5	1.5	1.5	1.5	1.5
1000000	50	1.5	1.5	1.5	1.5	1.5	1.5
2200000	50	1.5	1.5	1.5	1.5	1.5	1.5
4700000	50	1.5	1.5	1.5	1.5	1.5	1.5
10000000	50	1.5	1.5	1.5	1.5	1.5	1.5
22000000	50	1.5	1.5	1.5	1.5	1.5	1.5
47000000	50	1.5	1.5	1.5	1.5	1.5	1.5
100000000	50	1.5	1.5	1.5	1.5	1.5	1.5
220000000	50	1.5	1.5	1.5	1.5	1.5	1.5
470000000	50	1.5	1.5	1.5	1.5	1.5	1.5
1000000000	50	1.5</					

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the first name in Counters!



9 DIGITS 600 MHz \$129⁹⁵ WIRED

PRICES:

CT-90 wired, 1 year warranty	\$129.95
CT-90 Kit, 90 day parts warranty	109.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC Adapter/Charger	12.95
OV-1, Micro-power Oven time base	49.95
External time base input	14.95

The CT-90 is the most versatile, feature packed counter available for less than \$300.00! Advanced design features include: three selectable gate times, nine digits, gate indicator and a unique display hold function which holds the displayed count after the input signal is removed! Also, a 10MHz TCXO time base is used which enables easy zero beat calibration checks against WWV. Optionally, an internal nicad battery pack, external time base input and Micro-power high stability crystal oven time base are available. The CT-90, performance you can count on!

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 10 MV to 150 MHz Less than 50 MV to 500 MHz
Resolution:	0.1 Hz (10 MHz range) 1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	9 digits 0.4" LED
Time base:	Standard-10.000 MHz, 1.0 ppm 20-40°C. Optional Micro-power oven-0.1 ppm 20-40°C
Power:	8-15 VAC @ 250 ma

7 DIGITS 525 MHz \$99⁹⁵ WIRED



SPECIFICATIONS:

Range:	20 Hz to 525 MHz
Sensitivity:	Less than 50 MV to 150 MHz Less than 150 MV to 500 MHz
Resolution:	1.0 Hz (5 MHz range) 10.0 Hz (50 MHz range) 100.0 Hz (500 MHz range)
Display:	7 digits 0.4" LED
Time base:	1.0 ppm TCXO 20-40°C
Power:	12 VAC @ 250 ma

The CT-70 breaks the price barrier on lab quality frequency counters. Deluxe features such as; three frequency ranges - each with pre-amplification, dual selectable gate times, and gate activity indication make measurements a snap. The wide frequency range enables you to accurately measure signals from audio thru UHF with 1.0 ppm accuracy - that's .0001%! The CT-70 is the answer to all your measurement needs, in the field, lab or ham shack.

PRICES:

CT-70 wired, 1 year warranty	\$99.95
CT-70 Kit, 90 day parts warranty	84.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC adapter/charger	12.95

7 DIGITS 500 MHz \$79⁹⁵ WIRED

PRICES:

MINI-100 wired, 1 year warranty	\$79.95
MINI-100 Kit, 90 day part warranty	59.95
AC-Z Ac adapter for MINI-100	3.95
BP-Z Nicad pack and AC adapter/charger	12.95

Here's a handy, general purpose counter that provides most counter functions at an unbelievable price. The MINI-100 doesn't have the full frequency range or input impedance qualities found in higher price units, but for basic RF signal measurements, it can't be beat! Accurate measurements can be made from 1 MHz all the way up to 500 MHz with excellent sensitivity throughout the range, and the two gate times let you select the resolution desired. Add the nicad pack option and the MINI-100 makes an ideal addition to your tool box for "in-the-field" frequency checks and repairs.

SPECIFICATIONS:

Range:	1 MHz to 500 MHz
Sensitivity:	Less than 25 MV
Resolution:	100 Hz (slow gate) 1.0 KHz (fast gate)
Display:	7 digits, 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	5 VDC @ 200 ma

8 DIGITS 600 MHz \$159⁹⁵ WIRED



SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 25 mv to 150 MHz Less than 150 mv to 600 MHz
Resolution:	1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	8 digits 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	110 VAC or 12 VDC

The CT-50 is a versatile lab bench counter that will measure up to 600 MHz with 8 digit precision. And, one of its best features is the Receive Frequency Adapter, which turns the CT-50 into a digital readout for any receiver. The adapter is easily programmed for any receiver and a simple connection to the receiver's VFO is all that is required for use. Adding the receiver adapter in no way limits the operation of the CT-50, the adapter can be conveniently switched on or off. The CT-50, a counter that can work double-duty!

PRICES:

CT-50 wired, 1 year warranty	\$159.95
CT-50 Kit, 90 day parts warranty	119.95
RA-1, receiver adapter kit	14.95
RA-1 wired and pre-programmed (send copy of receiver schematic)	29.95

DIGITAL MULTIMETER \$99⁹⁵ WIRED



PRICES:

DM-700 wired, 1 year warranty	\$99.95
DM-700 Kit, 90 day parts warranty	79.95
AC-1, AC adaptor	3.95
BP-3, Nicad pack + AC adapter/charger	19.95
MP-1, Probe kit	2.95

The DM-700 offers professional quality performance at a hobbyist price. Features include; 26 different ranges and 5 functions, all arranged in a convenient, easy to use format. Measurements are displayed on a large 3 1/2 digit, 1/2 inch LED readout with automatic decimal placement, automatic polarity, overrange indication and overload protection up to 1250 volts on all ranges, making it virtually goof-proof! The DM-700 looks great, a handsome, jet black, rugged ABS case with convenient retractable tilt bail makes it an ideal addition to any shop.

SPECIFICATIONS:

DC/AC volts:	100uV to 1 KV, 5 ranges
DC/AC current:	0.1uA to 2.0 Amps, 5 ranges
Resistance:	0.1 ohms to 20 Megohms, 6 ranges
Input impedance:	10 Megohms, DC/AC volts
Accuracy:	10.1% basic DC volts
Power:	4 'C' cells

AUDIO SCALER

For high resolution audio measurements, multiplies UP in frequency.

- Great for PL tones
- Multiplies by 10 or 100
- 0.01 Hz resolution!

\$29.95 Kit \$39.95 Wired

ACCESSORIES

Telescopic whip antenna - BNC plug	\$ 7.95
High impedance probe, light loading	15.95
Low pass probe, for audio measurements	15.95
Direct probe, general purpose usage	12.95
Tilt bail, for CT 70, 90, MINI-100	3.95
Color burst calibration unit, calibrates counter against color TV signal	14.95

COUNTER PREAMP

For measuring extremely weak signals from 10 to 1,000 MHz. Small size, powered by plug transformer-included.

- Flat 25 db gain
- BNC Connectors
- Great for sniffing RF with pick-up loop

\$34.95 Kit \$44.95 Wired

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TERMS

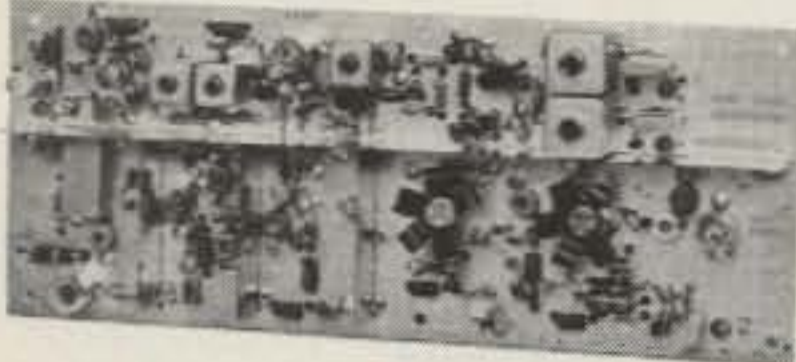
Satisfaction guaranteed - examine for 10 days. If not pleased, return in original form for refund. Add 5% for shipping insurance to a maximum of \$10. Overseas add 15%. COD add \$2. Orders under \$10 add \$1.50. NY residents add 7% tax.

Quality VHF/UHF Kits at Affordable Prices -

These Low Cost SSB TRANSMITTING CONVERTERS

Let you use inexpensive recycled 10M or 2M SSB exciters on UHF & VHF!

- Linear Converters for SSB, CW, FM, etc.
- A fraction of the price of other units; no need to spend \$300 - \$400!
- Use with any exciter; works with input levels as low as 1 mW.
- Use low power tap on exciter or simple resistor attenuator pad (instructions included).
- Link osc with RX converter for transceive.



XV4 UHF KIT — ONLY \$99.95

28-30 MHz in, 435-437 MHz out; 1W p.e.p. on ssb, up to 1½W on CW or FM. Has second oscillator for other ranges. Atten. supplied for 1 to 500 mW input, use external attenuator for higher levels.

Extra crystal for 432-434 MHz range.....\$5.95
XV4 Wired and tested\$149.95

XV2 VHF KIT - ONLY \$69.95

2W p.e.p. output with as little as 1mW input. Use simple external attenuator. Many freq. ranges available.

MODEL	INPUT (MHz)	OUTPUT (MHz)
XV2-1	28-30	50-52
XV2-2	28-30	220-222
XV2-4	28-30	144-146
XV2-5	28-29 (27-27.4 CB)	145-146 (144-144.4)
XV2-7	144-146	50-52

XV2 Wired and tested\$109.95

XV28 2M ADAPTER KIT - \$24.95

Converts any 2M exciter to provide the 10M signal required to drive above 220 or 435 MHz units.



NEW! COMPLETE TRANSMITTING CONVERTER AND PA IN ATTRACTIVE CABINET

Far less than the cost of many 10W units!

Now, the popular Hamtronics® Transmitting Converters and heavy duty Linear Power Amplifiers are available as complete units in attractive, shielded cabinets with BNC receptacles for exciter and antenna connections. Perfect setup for versatile terrestrial and OSCAR operations! Just right for phase 3! You save \$30 when you buy complete unit with cabinet under cost of individual items. Run 40-45 Watts on VHF or 30-40 Watts on UHF with one integrated unit! Call for more details.

MODEL	KIT	WIRED and TESTED
XV2/LPA2-45/Cabt (6, 2, or 220)	\$199.95	\$349.95
XV4/LPA4-30/Cabt (for UHF)	\$229.95	\$399.95

Easy to Build FET RECEIVING CONVERTERS

Let you receive OSCAR and other exciting VHF and UHF signals on your present HF or 2M receiver



- NEW LOW-NOISE DESIGN
- ATTRACTIVE WOODGRAIN CASE
- Less than 2dB noise figure, 20dB gain

MODEL	RF RANGE	OUTPUT RANGE
CA28	28-32 MHz	144-148 MHz
CA50	50-52	28-30
CA50-2	50-54	144-148
CA144	144-146	28-30
CA145	145-147-or-144-144.4	28-30 27-27.4 (CB)
CA146	146-148	28-30
CA220	220-222	28-30
CA220-2	220-224	144-148
CA110	Any 2MHz of Aircraft Band	26-28 or 28-30
CA432-2	432-434	28-30
CA432-5	435-437	28-30
CA432-4	432-436	144-148

Easily modified for other rf and if ranges.

STYLE	VHF	UHF
Kit less case	\$34.95	\$49.95
Kit with case	\$39.95	\$54.95
Wired/Tested in case	\$54.95	\$64.95

Professional Quality VHF/UHF FM/CW EXCITERS

- Double tuned circuits for spurious suppression
- Easy to align with built-in test aids



T51-30	10 Meter, 2W Kit.....	\$44.95
T51-50	6 Meter, 2W Kit.....	\$44.95
T51-150	2 Meter, 2W Kit.....	\$44.95
T51-220	220 MHz, 2W Kit.....	\$44.95
T450	450 MHz, 3/4W Kit....	\$44.95
T451	450 MHz, 3 W Kit.....	\$59.95
A14T	5 Chan Adapter (T51&T451)	\$9.95

See our Complete Line of VHF & UHF Linear PA's

- Use as linear or class C PA
- For use with SSB Xmtg Converters, FM Exciters, etc.

LPA2-15	6M, 2M, 220; 15 to 20W.....	\$59.95
LPA2-30	6M, 2m; 25 to 30W.....	\$89.95
LPA2-40	220 MHz; 30 to 40W.....	\$119.95
LPA2-45	6M, 2M; 40 to 45W.....	\$119.95
LPA4-10	430MHz; 10 to 14W.....	\$79.95
LPA4-30	430MHz; 30-40W.....	\$119.95

See catalog for complete specifications

FAMOUS HAMTRONICS PREAMPS

Let you hear the weak ones too!
Great for OSCAR, SSB, FM, ATV. Over 14,000 in use throughout the world on all types of receivers.



- NEW LOW-NOISE DESIGN
- Less than 2 dB noise figure, 20 dB gain
- Case only 2 inches square
- Specify operating frequency when ordering

MODEL P-30 VHF PREAMP, available in many versions to cover bands 28-300 MHz.

MODEL P432 UHF PREAMP, available in versions to cover bands 300-650 MHz.

STYLE	VHF	UHF
Kit less case	\$12.95	\$18.95
Kit with case	\$18.95	\$26.95
Wired/Tested in Case	\$27.95	\$32.95

NEW VHF/UHF FM RCVRs

Offer Unprecedented Range of Selectivity Options

- New generation
- More sensitive
- More selective
- Low cross mod
- Uses crystal filters
- Smaller
- Easy to align



R75A* VHF Kit for monitor or weather satellite service. Uses wide L-C filter. -60dB at ± 30 kHz..... \$69.95

R75B* VHF Kit for normal nbfm service. Equivalent to most transceivers. -60dB at ± 17 kHz, -80dB at ± 25 kHz... \$74.95

R75C* VHF Kit for repeater service or high rf density area. -60dB at ± 14kHz, -80dB ± 22kHz, -100dB ± 30kHz.... \$84.95

R75D* VHF Kit for split channel operation or repeater in high density area. Uses 8-pole crystal filter. -60dB at ± 9kHz, -100dB at ± 15 kHz. The ultimate receiver!... \$99.95

* Specify band: 10M, 6M, 2M, or 220 MHz. May also be used for adjacent commercial bands. Use 2M version for 137 MHz WX satellites.

R450() UHF FM Receiver Kits, similar to R75, but for UHF band. New low-noise front end. Add \$10 to above prices. (Add selectivity letter to model number as on R75.)

A14 5 Channel Adapter for Receivers..... \$9.95

NEW R110 VHF AM RCVR

AM monitor receiver kit similar to R75A, but AM. Available for 10-11M, 6M, 2M, 220 MHz, and 110-130 MHz aircraft band \$74.95. (Also available in UHF version.)

IT'S EASY TO ORDER!

- Write or phone 716-392-9430 (Electronic answering service evenings & weekends)
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MEMORY

	Description	Price
2708	1K x 8 Eprom	\$ 5.00
2716/2516	2K x 8 5V single supply	9.99
2114/9114	1K x 4 Static	5.00
4027	4K x 1 Dynamic Ram	2.99
2117/4116	16K x 1 Dynamic Ram	5.00
2732-6	32K Eprom	39.95

C.P.U.'s, Etc.

MC6800P	Microprocessor	9.99
MC68B21P	PIA	6.99
MC6845P	CRT Controller	25.00
MC6850P	ACIA	4.99
MC6852P	SSDA	5.00
8008-1	Microprocessor	5.00
8080A	Microprocessor	5.00
Z80A	Microprocessor	10.99
Z80	Microprocessor	8.99
Z80A	PIO	9.99
Z80	SIO/O	22.50
Z80	SIO/I	22.50
8212	8 Bit input/output part	3.99
8251	Communication Interface	6.99
TR1602/AY5-1013	UART	6.99
TMS1000NL	Four Bit Microprocessor	4.99
PT1482B	PSAT	5.99
8257	DMA Controller	8.99
3341	64 x 4 FIFO	3.00
MM5316/F3817	Clock with alarm	5.99
8741		60.00
8748	8 Bit Microcomputer with programmable/erasable EPROM	60.00
MC1408L/6	6 Bit D/A	3.25
COM2502		9.99
COM2601		9.99

CRYSTAL FILTERS

TYCO 001-19880 Same as 2194F
 10.7 MHz narrow band
 3 dB bandwidth 15 KHz min.
 20 dB bandwidth 60 KHz min.
 40 dB bandwidth 150 KHz min.
 Ultimate 50 dB insertion loss 1 dB max.
 Ripple 1 dB max. Ct. 0+/-5 pf 3600 Ohms
 \$3.99 each

MRF454, same as MRF458 12.5 VDC, 3-30 MHz
 30 Watts output, 12 dB gain \$17.95 each

MRF472

12.5 VDC, 27 MHz
 4 Watts output, 10 dB gain
 \$1.69 each

CARBIDE CIRCUIT BOARD DRILL BITS
 for PCB Boards
 5 mix for \$5.00

MURATA CERAMIC FILTERS

SFD 455D	455 KHz	\$2.00
SFB 455D	455 KHz	1.60
CFM 455E	455 KHz	5.50
SFE 10.7 MA	10.7 MHz	2.99

ATLAS CRYSTAL FILTERS FOR ATLAS

HAM GEAR
 5.52 - 2.7/8
 5.595 - 2.7/8/U
 5.645 - 2.7/8
 5.595 - .500/4/CW YOUR CHOICE
 5.595 - 2.7 USB \$12.99 each
 5.595 - 2.7/8/L
 5.595 - 2.7 LSB
 9.0 - USB/CW

J310 N-CHANNEL J-FET 450 MHz
 Good for VHF/UHF Amplifier,
 Oscillator and Mixers 3/\$1.00

AMPHENOL COAX RELAY

26 VDC Coil SPDT #360-11892-13
 100 Watts Good up to 18 GHz
 \$19.99 each

78M05 Same as 7805 but only 1/2 Amp @
 5 VDC 49¢ each or 10/\$3.00

NEW TRANSFORMERS

F-18X	6.3 VCT @ 6 Amps	\$6.99 ea.
F-46X	24 V @ 1 Amp	5.99 ea.
F-41X	25.2 VCT @ 2 Amps	6.99 ea.
P-8380	10 VCT @ 3 Amps	7.99 ea.
P-8604	20 VCT @ 1 Amp	4.99 ea.
P-8130	12.6 VCT @ 2 Amps	4.99 ea.
K-32B	28 VCT @ 100 MA	4.99 ea.
E30554	Dual 17V @ 1Amp ea.	6.99 ea.

EIMAC FINGER STOCK #Y-302
 36 in. long x 1/2 in. \$4.99 each

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MRF203	\$P.O.R.	BFW92A	\$ 1.00
MRF216	19.47	BFW92	.79
MRF221	8.73	MMCM913	14.30
MRF226	10.20	MMCM2222	15.65
MRF227	2.13	MMCM2369	15.00
MRF238	10.00	MMCM2484	15.25
MRF240	14.62	MMCM3960A	24.30
MRF245	28.87	MWA110	6.92
MRF247	28.87	MWA120	7.38
MRF262	6.25	MWA130	8.08
MRF314	12.20	MWA210	7.46
MRF406	11.33	MWA220	8.08
MRF412	20.65	MWA230	8.62
MRF421	27.45	MWA310	8.08
MRF422A	38.25	MWA320	8.62
MRF422	38.25	MWA330	9.23
MRF428	38.25		
MRF428A	38.25	TUBES	
MRF426	8.87	6KD6	\$ 5.00
MRF426A	8.87	6LQ6/6JE6	6.00
MRF449	10.61	6MJ6/6LQ6/6JE6C	6.00
MRF449A	10.61	6LF6/6MH6	5.00
MRF450	11.00	12BY7A	4.00
MRF450A	11.77	2E26	4.69
MRF452	15.00	4X150A	29.99
MRF453	13.72	4CX250B	45.00
MRF454	21.83	4CX250R	69.00
MRF454A	21.83	4CX300A	109.99
MRF455	14.08	4CX350A/8321	100.00
MRF455A	14.08	4CX350F/J/8904	100.00
MRF472	2.50	4CX1500B/8660	300.00
MRF474	3.00	811A	20.00
MRF475	2.90	6360	4.69
MRF476	2.25	6939	7.99
MRF477	10.00	6146	5.00
MRF485	3.00	6146A	5.69
MRF492	20.40	6146B/8298	7.95
MRF502	.93	6146W	12.00
MRF604	2.00	6550A	8.00
MRF629	3.00	8908	9.00
MRF648	26.87	8950	9.00
MRF901	3.99	4-400A	71.00
MRF902	9.41	4-400C	80.00
MRF904	3.00	572B/T160L	44.00
MRF911	4.29	7289	9.95
MRF5176	11.73	3-1000Z	229.00
MRF8004	1.39	3-500Z	129.99
BFR90	1.00		
BFR91	1.25	TO-3 TRANSISTOR SOCKETS	
BFR96	1.50	Phenolic type 6/\$1.00	

UHF/VHF RF POWER TRANSISTORS
 CD2867/2N6439
 60 Watts output
 Reg. Price \$45.77
 SALE PRICE \$19.99

1900 MHz to 2500 MHz DOWNCONVERTERS
 Intended for amateur radio use
 Tunable from channel 2 thru 6
 34 dB gain 2.5 - 3 dB noise
 Warranty for 6 months
 Model HMR II with dish antenna
 Complete Receiver and Power Supply
 \$225.00 (does not include coax)
 4 foot Yagi antenna only
 \$39.99

Downconverter Kit - PCB and parts
 \$69.95

Power Supply Kit - Box, PCB and parts
 \$49.99

Downconverter assembled
 \$79.99

Power Supply assembled
 \$59.99

Complete Kit with Yagi antenna
 \$109.99

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MRF901 \$ 3.99

MBD101 1.29

.001 Chip Caps 1.00

Power supply PCB 4.99

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Bogner down converter, industrial version. 1
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86 PIN MOTOROLA BUS EDGE CONNECTORS
 Gold plated contacts
 Dual 43/86 pin .156 spacing
 Solder tail for PCB \$3.00 each

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12 VDC \$2.00 each

110 VAC MUFFIN FANS

New \$11.95 Used \$5.95

PL-259 TERMINATION 52 Ohm 5 Watts
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2N3866JAN	2.50	40282/2N3927	10.48
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2N3925	10.00	NE555V TIMERS	
2N3948	2.00	39¢ each or 10/\$3.00	
2N3950	25.00		
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2N3960JANTX	10.00	69¢ each or	
2N4072	1.60	10/\$5.00	
2N4427	1.10		
2N4429	7.00	HEP170 1000 PIV	
2N4877	1.00	2.5 Amps 25¢ each or	
2N4959	2.00	100/\$15.00	
2N4976	15.00		
2N5070	8.00	HIGH VOLTAGE CAPS	
2N5071	15.00	420 MFD @ 400 VDC OR	
2N5108	4.00	600 MFD @ 400 VDC	
2N5109	1.50	\$6.99 each	
2N5179	1.00		
2N5583	4.00	NEW ROTRON BISCUIT FANS	
2N5589	6.00	Model BT2A1 115 VAC	
2N5590	8.00	\$12.99 each	
2N5591	11.00		
2N5635	5.44	TORIN TA700 FANS NEW	
2N5636	11.60	Model A30340	
2N5637	20.00	230 VAC @ .78 Amps	
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2N5643	14.00	\$29.99 each	
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2N5849	20.00	470 pf @ 15 KV \$3.99 each	
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2N5862	50.00	800 pf @ 15 KV 3.99 each	
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2N6082	11.00		
2N6083	13.00	NEW & USED BCD SWITCHES	
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2N6095	11.00	New \$8.99	
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Check, money order, or credit cards welcome. (Mastercharge and VISA only) No personal checks or certified personal checks for foreign countrys accepted. Money order or cashiers check in U.S. funds only. Letters of credit are not acceptable.

Minimum shipping by UPS is \$2.35 with insurance. Please allow extra shipping charges for heavy or long items.

All parts returned due to customer error will be subject to a 15% restock charge.

If we are out of an item ordered, we will try to replace it with an equal or better part unless you specify not to, or we will back order the item, or refund your money.

PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE. Prices superseade all previously published. Some items offered are limited to small quantities and are subject to prior sale.

We now have a toll free number but we ask that it be used for CHARGE ORDERS ONLY. If you have any questions please use our other number. We are open from 8:00 a.m. - 5:00 p.m. Monday thru Saturday.

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JUMBO LED's		MEDIUM LED's	
Red	8/\$1.00	Red	6/\$1.00
Clear	6/\$1.00	Green	6/\$1.00
Yellow	6/\$1.00		
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NEW G.E. OPTO COUPLERS 4N26
69¢ each or 10/\$5.00

MICRO-MINI WATCH CRYSTALS
32.768 Hz \$3.00 each

NEW 2 inch ROUND SPEAKERS
100 Ohm coil 99¢ each

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INTRODUCING SONY'S NEW DIGITAL DIRECT ACCESS RECEIVER!



only **\$299⁹⁵** plus \$5.00 shipping

Revolutionary Instant Access Digital Shortwave Scanner

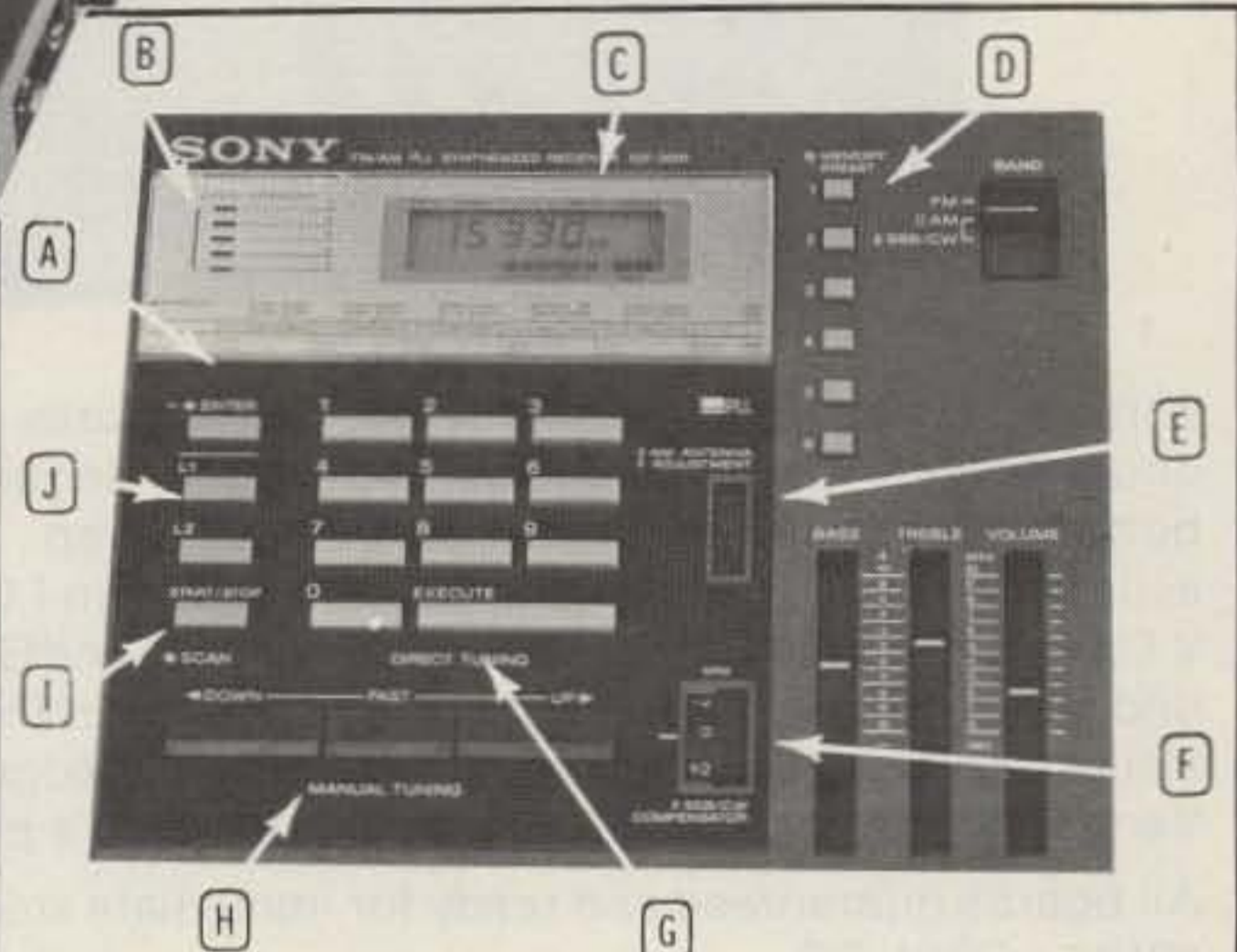
- Continuous Scanning of LW, MW, SW, & FM Bands
- Instant Fingertip Tuning—No More Knobs!
- 6 Memories for Any Mode (AM,SSB/CW, & FM)
- Dual PLL Frequency Synthesized—No Drift!

A WHOLE NEW BREED OF RADIO IS HERE NOW! No other short wave receiver combines so many advanced features for both operating convenience and high performance as does the new Sony ICF-2001. Once you have operated this exciting new radio, you'll be spoiled forever! Direct access tuning eliminates conventional tuning knobs and dials with a convenient digital keyboard and Liquid Crystal Display (LCD) for accurate frequency readout to within 1 KHz. Instant fingertip tuning, up to 8 memory presets, and continuous scanning features make the ICF-2001 the ultimate in convenience.

Compare the following features against any receiver currently available and you will have to agree that the Sony ICF 2001 is the best value in shortwave receivers today:

DUAL PLL SYNTHESIZER CIRCUITRY covers entire 150 KHz to 29.999 MHz band. PLL₁ circuit has 100 KHz step while PLL₂ handles 1 KHz step, both of which are controlled by separate quartz crystal oscillators for precise, no-drift tuning. **DUAL CONVERSION SUPERHETERODYNE** circuitry assures superior AM reception and high image rejection characteristics. The 10.7 MHz IF of the FM band is utilized as the 2nd IF of the AM band. A new type of crystal filter made especially for this purpose realizes clearer reception than commonly used ceramic filters. **ALL FET FRONT END** for high sensitivity and interference rejection. Intermodulation, cross modulation, and spurious interference are effectively rejected. **FET RF AMP** contributes to superior image rejection, high sensitivity, and good signal to noise ratio. Both strong and weak stations are received with minimal distortion.

EXTENDED SPECTRUM CONTINUOUS TUNING



- | | |
|-----------------------------|-------------------------------|
| A Enter Button | F SSB/CW Compensator |
| B Signal Strength Indicator | G Execute Bar |
| C Liquid Crystal Display | H Manual Tuning Buttons |
| D Memory Preset Buttons | I Scan Button |
| E Antenna Adjustment | J High/Low Limit Buttons Dial |

OPERATIONAL FEATURES

INSTANT FINGERTIP TUNING with the calculator-type key board enables the operator to have instant access to any frequency in the LW, MW, SW, and FM bands. And the LCD digital frequency display confirms the exact, drift-free signal being received. **AUTOMATIC SCANNING** of the above bands. Continuous scanning of any desired portion of the band is achieved by setting the "L₁" and "L₂" keys to define the range to be scanned. The scanner can stop automatically on strong signals, or it can be done manually. **MANUAL SEARCH** is similar to the manual scan mode and is useful for quick signal searching. The "UP" and "DOWN" keys let the tuner search for you. The "FAST" key increases the search rate for faster signal detection. **MEMORY PRESETS.** Six memory keys hold desired stations for instant one-key tuning in any mode (AM, SSB/CW, and FM), and also, the "L₁" and "L₂" keys can give you two more memory slots when not used for scanning. **OTHER FEATURES:** Local, normal, DX sensitivity selector for AM; SSB/CW compensator; 90 min. sleep timer; AM Ant. Adjust.

SPECIFICATIONS

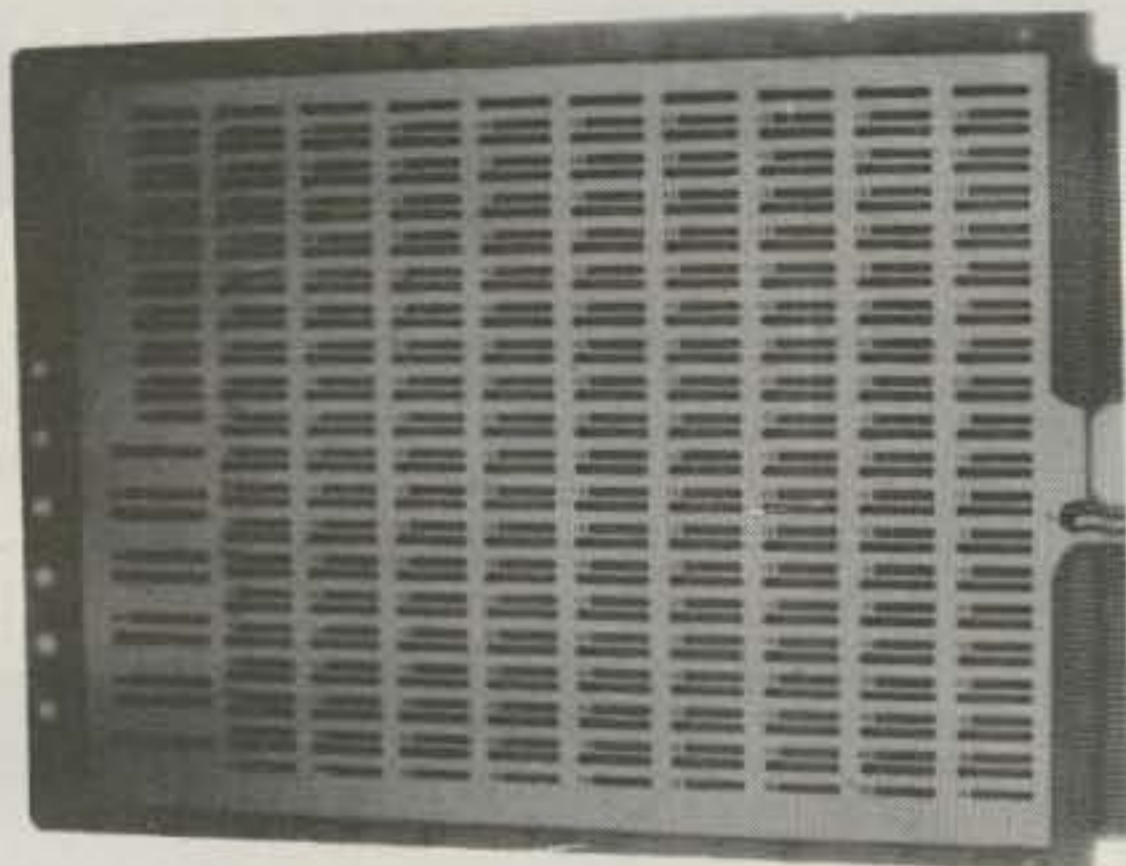
CIRCUIT SYSTEM: Fm Superheterodyne; AM Dual conversion superheterodyne. **SIGNAL CIRCUITRY:** 4 IC's, 11 FET's, 23 Transistors, 16 Diodes. **AUXILIARY CIRCUITRY:** 5 IC's, 1 LSI, 5 LED's, 25 Transistors, 9 Diodes. **FREQUENCY RANGE:** FM 76-108 MHz; AM 150-29,999 KHz. **INTERMEDIATE FREQUENCY:** FM 10.7 MHz.; AM 1st 66.35 MHz., 2nd 10.7 MHz. **ANTENNAS:** FM telescopic, ext. ant. terminal; AM telescopic, built-in ferrite bar, ext. ant. terminal. **POWER:** 4.5 VDC/120 VAC **DIMENSIONS:** 12¼ (W) X 2¼ (H) X 6¾ (D). **WEIGHT:** 3 lb. 15 oz. (1.8 kg)



SPECTRONICS, INC.
1009 GARFIELD ST. OAK PARK, IL. 60304

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(312)848-6777





AUGAT

Wire wrap prototyping board. Board measures 17½ by 11½ double sided 1/16 inch glass epoxy. Silk screened top and bottom with all pins numbered on wrap side. Board accommodates 2 - 24 Pin and 326 - 14 or 16 Pin I.C.'s. Separate V.C.C. and Ground Pin above each I.C. (V.C.C. and Ground are not dedicated, therefore, you may use 16, 14, 8 Pin Dips.) All inner sleeves gold plated as are the two dual 86 Pin edge connectors. Very limited stock so please order NOW. DRC's price **\$19.95**.

All boards guaranteed and ready for immediate shipment. Augat #8136-LG761-TG.

Blank board (same as above) with V.C.C., ground plane, edge connectors, no wire wrap pins. Insert your own wire wrap sockets.

\$8.50

GOLD WIRE WRAP SOCKETS

Fit panel above. Not gold inlay as sold by others. Super 3 level gold wire wrap.

14 Pin — 10/\$3.95 25/\$8.75
16 Pin — 10/\$4.95 25/\$11.25



SUPER CUSTOM IC #17564-4

Has a C-MOS oscillator, Decade Counter Decoder/Driver. At the push of a button will flash a LED 24 times. At the end of which it will display the number of times it has gone through the cycle, up to 99. Variable speed pulses - Perfect for timing. FULL DATA — **\$1.00**

PUSH BUTTON SWITCH
Normally Closed
6/\$1.25

MICROWAVE DIODE

For Down Converters

5082 - 2835 **\$1.50 or 5 For \$6.00**

LAB-BENCH VARIABLE POWER SUPPLY KIT **\$12.00 KIT**
SUPER SALE
5 to 20 VDC at 1 AMP. Short circuit protected by current limit. Uses IC regulator and 10 AMP Power Darlington. Very good regulation and low ripple. Kit includes PC Board, all parts, large heatsink and shielded transformer. 50 MV. TYP. Regulation.

RCA SENSITIVE GATE TRIAC
TO-5 CASE. HOUSE #40531
ALSO SAME AS T2300D.
2.5 AMPS 400 PIV

5/\$1.19

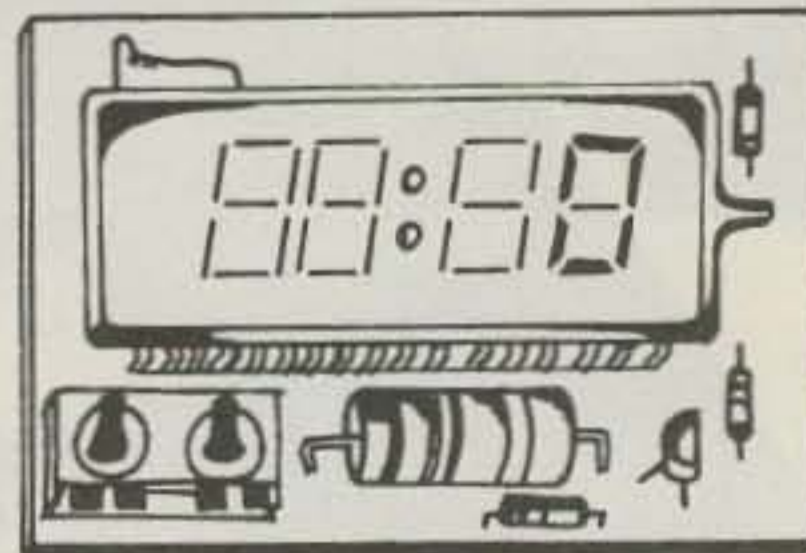
Perfect for Dimmers, Color Organs, etc. PC LEADS



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Digital Research Exclusive 4 DIGIT FLUORESCENT CLOCK MODULE

A super fantastic car clock module, or desk clock. Four bright, blue-green digits .33 inches tall and very pleasing to the eye.

FEATURES:

- CMOS - 3MA Max. Current
- Display can be dimmed
- Display Off, but clock continues to count
- Crystal controlled accuracy
- Small physical size 2½ x 2 x 5/8
- On-Board hours and minute set switches

All you need to make this exceptional time piece work is + 12VDC.

12 Hour Model - \$5.95 or 3/\$15.00

24 Hour Model - \$6.95 or 3/\$18.00

REPEAT OF A SELL-OUT

4558 - Dual 741 in 8 Pin Mini Dip
4 for \$1.20



JFET OP AMP

Super High Input Impedance (10¹² OHMS) — High Frequency Response. TO 4 MHZ. Large DC Voltage Gain 106 DB — New Generation OP-AMP with Vastly Superior Features!
LF356BH - 75¢ or 3/\$2.00 By National

\$4.95

60 Hz CRYSTAL TIME BASE
(Complete Kit)
Uses MM5369 CMOS divider IC with high accuracy 3.579545 MHZ Crystal. Use with all MOS Clock Chips or Modules. Draws only 1.5 MA. All parts, data and PC Board included. 100 Hz, same as above, except \$5.95.

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6-12 VDC
Like Used In
Smoke Alarms.
FANTASTIC SAVINGS.
Compare this true value.
.60 ea. 4 For \$2.00

PMD-11K-60 (Darlington)
60 Volts. HFE 800-20K
12 Amps. PNP TO-3
150 Watts. By Lambda.
\$1.50

BRAND NEW!

BRAND NEW!
NE555V
3/\$1.25
10/\$3.30

TIP 29C Power Transistor TO - 220 Case

1 Amp 30 Watts 100 Volt NPN
LIMITED QUANTITY 3/\$1.25

TERMS: Add 50¢ postage, we pay balance. Orders under \$15 add 75¢ handling. No C.O.D. We accept Visa, MasterCard and American Express cards. Tex. Res. add 5% Tax. Foreign orders (except Canada) add 20% P&H. 90 Day Money Back Guarantee on all items.

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TERMS: Satisfaction guaranteed or money refunded. C.O.D. add \$2.00. Minimum order \$6.00. Orders under \$10.00 add \$1.50. Add 5% for postage, insurance, handling. Overseas add 15%. N.Y. residents add 7% tax.

**MINI KITS - YOU HAVE SEEN THESE BEFORE NOW
HERE ARE OLD FAVORITE AND NEW ONES TOO.
GREAT FOR THAT AFTERNOON HOBBY.**

FM MINI MIKE



A super high performance FM wireless mike kit! Transmits a stable signal up to 300 yards with exceptional audio quality by means of its built in electret mike. Kit includes case, mike, on-off switch, antenna, battery and super instructions. This is the finest unit available.

FM-3 Kit **\$14.95**
FM-3 Wired and Tested **19.95**

Color Organ

See music come alive! 3 different lights flicker with music. One light each for high, mid-range and lows. Each individually adjustable and drives up to 300 W. runs on 110 VAC.

Complete kit, ML-1 **\$8.95**

Video Modulator Kit
Converts any TV to video monitor. Super stable, tunable over ch. 4-6. Runs on 5-15V, accepts std. video signal. Best unit on the market! Complete kit, VD-1 **\$7.95**

Led Blinky Kit
A great attention getter which alternately flashes 2 jumbo LEDs. Use for name badges, buttons, warning panel lights, anything! Runs on 3 to 15 volts. Complete kit, BL-1 **\$2.95**

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. Complete kit, BN-9 **\$5.95**

CPO-1
Runs on 3-12 Vdc 1 watt out. 1 KHZ good for CPO, Alarm, Audio Oscillator. Complete kit **\$2.95**

CLOCK KITS

Your old favorites are here again. Over 7,000 Sold to Date. Be one of the gang and order yours today!

Try your hand at building the finest looking clock on the market. Its satin finish anodized aluminum case looks great anywhere, while six .4" LED digits provide a highly readable display. This is a complete kit, no extras needed, and it only takes 1-2 hours to assemble. Your choice of case colors: silver, gold, black (specify).

Clock kit, 12/24 hour, DC-5 **\$24.95**
Clock with 10 min. ID timer, 12/24 hour, DC-10 **\$29.95**
Alarm clock, 12 hour only, DC-8 **\$29.95**
12V DC car clock, DC-7 **\$29.95**

For wired and tested clocks add \$10.00 to kit price. SPECIFY 12 OR 24 HOUR FORMAT

FM Wireless Mike Kit



Transmits up to 300' to any FM broadcast radio, uses any type of mike. Runs on 3 to 9V. Type FM-2 has added sensitive mike preamp stage.

FM-1 kit **\$3.95** FM-2 kit **\$4.95**

Whisper Light Kit

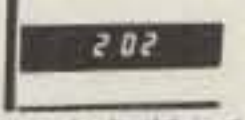
An interesting kit, small mike picks up sounds and converts them to light. The louder the sound, the brighter the light. Includes mike, controls up to 300 W, runs on 110 VAC. Complete kit, WL-1 **\$6.95**

Tone Decoder

A complete tone decoder on a single PC board. Features: 400-5000 Hz adjustable range via 20 turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts. Complete kit, TD-1 **\$5.95**

Car Clock

The UN-KIT, only 5 solder connections



Here's a super looking, rugged and accurate auto clock, which is a snap to build and install. Clock movement is completely assembled - you only solder 3 wires and 2 switches (takes about 15 minutes). Display is bright green with automatic brightness control photocell - assures you of a highly readable display, day or night. Comes in a satin finish anodized aluminum case which can be attached 5 different ways using 2 sided tape. Choice of silver, black or gold case (specify).

DC-3 kit, 12 hour format **\$22.95**
DC-3 wired and tested **\$29.95**

Universal Timer Kit

Provides the basic parts and PC board required to provide a source of precision timing and pulse generation. Uses 555 timer IC and includes a range of parts for most timing needs.

UT-5 Kit **\$5.95**

Mad Blaster Kit

Produces LOUD ear shattering and attention getting siren like sound. Can supply up to 15 watts of obnoxious audio. Runs on 6-15 VDC. Complete kit, MB-1 **\$4.95**

Siren Kit

Produces upward and downward wail characteristic of a police siren. 5 W peak audio output, runs on 3-15 volts, uses 3-45 ohm speaker. Complete kit, SM-3 **\$2.95**

50 Hz Time Base
Runs on 5-15 VDC. Low current (25ma). 1 min-month accuracy. TB-7 Kit **\$5.50**
TB-7 Assy **\$9.95**

Calendar Alarm Clock

The clock that's got it all. 6-5" LEDs, 12/24 hour, snooze, 24 hour alarm, 4 year calendar, battery backup and lots more. The super 7001 chip is used. Size: 5x4x2 inches. Complete kit, less case (not available) DC-9 **\$34.95**

Under Dash Car Clock

12/24 hour clock in a beautiful plastic case features 6 jumbo RED LEDs, high accuracy (.001%), easy 3 wire hookup, display blanks with ignition and super instructions. Optional dimmer automatically adjusts display to ambient light level.

DC-11 clock with mtg. bracket **\$27.95 kit**
DM-1 dimmer adapter **\$2.50**
Add \$10.00 Assy. and Test

Video Terminal

A completely self-contained, stand alone video terminal card. Requires only an ASCII keyboard and TV set to become a complete terminal unit. Features are: single 5V supply, XTAL controlled sync and baud rates (to 9600), complete computer and keyboard control of cursor. Parity error control and display. Accepts and generates serial ASCII plus parallel keyboard input. The 6416 is 64 char by 16 lines, with scrolling, upper and lower case (optional) and has RS-232 and 20ma loop interfaces on board. Kits include sockets and complete documentation.

RE 6416 terminal card kit (add \$60.00 for wired unit) **\$189.95**
Lower Case option **\$13.95**
Power Supply **\$14.95**
RF Modulator kit **\$7.95**

PARTS PARADE

IC SPECIALS

LINEAR

301 **\$.35**
324 **\$1.50**
380 **\$1.50**
555 **\$.45**
556 **\$1.00**
565 **\$1.00**
566 **\$1.00**
567 **\$1.25**
741 **10/\$2.00**
1458 **\$.50**
3900 **\$.50**
3914 **\$2.95**
8038 **\$2.95**

TTL

74S00 **\$.40**
7447 **\$.65**
7475 **\$.50**
7490 **\$.50**
74196 **\$1.35**

SPECIAL

11C90 **\$15.00**
10116 **\$1.25**
7208 **\$17.50**
7207A **\$5.50**
7216D **\$21.00**
7107C **\$12.50**
5314 **\$2.95**
5375AB/G **\$2.95**
7001 **\$6.50**

CMOS

4011 **\$.50**
4013 **\$.50**
4046 **\$1.85**
4049 **\$.50**
4059 **\$9.00**
4511 **\$2.00**
4518 **\$1.35**
5639 **\$1.75**

Resistor Ass't
Assortment of Popular values - 1/4 watt. Cut lead for PC mounting. 1/2" center, 1/2" leads, bag of 300 or more. **\$1.50**

Switches
Mini toggle SPDT **\$1.00**
Red Pushbuttons N.O. **3/\$1.00**

Earphones
3" leads, 8 ohm, good for small tone speakers, alarm clocks, etc. 5 for \$1.00

Mini 8 ohm Speaker
Approx. 2 1/4" diam Round type for radios, mike etc. 3 for \$2.00

Slug Tuned Coils
Small 3/16" Hex Slugs turned coil. 3 turns 10 for \$1.00

CAPACITORS

TANTALUM	ALUMINUM	DISK CERAMIC
Dipped Epoxy	Electrolytic	01 16V disk 20/\$1.00
1.5 uF 25V 3/\$1.00	1000 uF 16V Radial \$.50	1 16V 15/\$1.00
1.8 uF 25V 3/\$1.00	500 uF 20V Axial \$.50	001 16V 20/\$1.00
22 uF 25V 3/\$1.00	150 uF 16V Axial 5/\$1.00	100 pF 20/\$1.00
	10 uF 15V Radial 10/\$1.00	047 16V 20/\$1.00

Crystals

3.579545 MHZ **\$1.50**
10.00000 MHZ **\$5.00**
5.248800 MHZ **\$5.00**

AC Adapters
Good for clocks, nicad chargers, all 110 VAC plug one end

8.5 vdc @ 20 mA **\$1.00**
16 vac @ 160mA **\$2.50**
12 vac @ 250mA **\$3.00**

Solid State Buzzers
small buzzer 450 Hz, 86 dB, sound output on 5-12 vdc at 10-30 mA TTL compatible. **\$1.50**

AC Outlet
Panel Mount with Leads **4/\$1.00**

Audio Prescaler

Make high resolution audio measurements, great for musical instrument tuning, PL tones, etc. Multiplies audio UP in frequency, selectable x10 or x100, gives 01 Hz resolution with 1 sec. gate time! High sensitivity of 25 mv, 1 meg input z and built-in filtering gives great performance. Runs on 9V battery, all CMOS.

PS-2 kit **\$29.95**
PS-2 wired **\$39.95**

600 MHz PRESCALER



Extend the range of your counter to 600 MHz. Works with all counters. Less than 150 mv sensitivity, specify -10 or -100

Wired, tested, PS-1B **\$59.95**
Kit, PS-1B **\$44.95**

READOUTS

FND 359 4" C.C. **\$1.00**
FND 507/510 5" C.A. **1.00**
MAN 72/HF7730 33" C.A. **1.00**
HP 7651 43" C.A. **2.00**

DC-DC Converter
+5 vdc input prod. -9 vdc @ 30ma
+9 vdc produces -15 vdc @ 35ma **\$1.25**

25K 20 Turn Trim Pot **\$1.00**
1K 20 Turn Trim Pot **\$.50**

Ceramic IF Filters
Mini ceramic filters 7 kHz B.W. 455 kHz **\$1.50 ea.**

Trimmer Caps
Sprague - 3-40 pf Stable Polypropylene .50 ea.

30 Watt 2 mtr PWR AMP

Simple Class C power amp features 8 times power gain. 1 W in for 8 out, 2 W in for 15 out, 4W in for 30 out. Max output of 35 W. incredible value, complete with all parts, less case and T-R relay.

PA-1, 30 W pwr amp kit **\$22.95**
TR-1, RF sensed T-R relay kit **6.95**

Power Supply Kit

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

Complete kit, PS-3LT **\$6.95**

TRANSISTORS

2N3904 NPN C-F **15/\$1.00**
2N3906 PNP C-F **15/\$1.00**
2N4403 PNP C-F **15/\$1.00**
2N4410 NPN C-F **15/\$1.00**
2N4916 FET C-F **4/\$1.00**
2N5401 PNP C-F **5/\$1.00**
2N6028 C-F **4/\$1.00**
2N3771 NPN Silicon **\$.50**
2N5179 UHF NPN **3/\$2.00**
Power Tab NPN 40W **3/\$1.00**
Power Tab PNP 40W **3/1.00**
MPF 102/2N5484 **\$.50**
NPN 3904 Type T-R **50/\$2.50**
PNP 3906 Type T-R **50/\$2.50**
2N3055 **\$.80**
2N2946 UJT **3/\$2.00**

Diodes

5.1 V Zener **20/\$1.00**
1N914 Type **50/\$1.00**
1KV 2Amp **8/\$1.00**
100V 1Amp **15/\$1.00**

25 AMP 100V Bridge \$1.50 each

Mini-Bridge 50V 1 AMP 2 for \$1.00

Crystal Microphone
Small 1" diameter 1/4" thick crystal mike cartridge **\$.75**

Coax Connector
Chassis mount BNC type **\$1.00**

9 Volt Battery Clips
Nice quality clips 5 for \$1.00
1/4" Rubber Grommets 10 for \$1.00

Parts Bag
Ass't of chokes, disc caps, tant. resistors, transistors, diodes, MICA caps etc. sm. bag (100 pc) **\$1.00** lg. bag (300 pc) **\$2.50**

Connectors
6 pin type gold contacts for mA-1003 car clock module price **.75 ea.**

Leds - your choice, please specify
Mini Red, Jumbo Red, High Intensity Red, Illuminator Red **8/\$1**
Mini Yellow, Jumbo Yellow, Jumbo Green **6/\$1**

Varactors
Motorola MV 2209 30 PF Nominal cap 20-80 PF - Tunable range - **.50 each or 3/\$1.00**

Mini RG-174 Coax 10 ft. for \$1.00

RF actuated relay senses RF (1W) and closes DPDT relay. For RF sensed T-R relay TR-1 Kit \$6.95

OP-AMP Special

BI-FET LF 13741 - Direct pin for pin 741 compatible, but 500,000 MEG input z, super low 50 pa input current, low power drain

50 for only **\$9.00** 10 for **\$2.00**

Regulators

78MG **\$1.25**
79MG **\$1.25**
723 **\$.50**
309K **\$1.15**
7805 **\$1.00**

Shrink Tubing Nubs
Nice precut pcs of shrink size: 1" x 1/4" - shrink to 1/8" Great for splices **50/\$1.00**

Mini TO-92 Heat Sinks
Thermalloy Brand 5 for \$1.00
To-220 Heat Sinks 3 for \$1.00

Opto Isolators - 4N28 type \$1.50 ea.
Opto Reflectors - Photo diode + LED \$1.00 ea.

Molex Pins
Molex already precut in length of 7. Perfect for 14 pin sockets. **20 strips for \$1.00**

CDS Photocells
Resistance varies with light, 250 ohms to over 3 meg **3 for \$1.00**

Save on Scanners! NEW Rebates!

Communications Electronics™, the world's largest distributor of radio scanners, celebrates Father's Day early with big savings on Bearcat scanners. Electra Company, the manufacturers of Bearcat scanners is offering consumer rebates on their great line of scanners, when purchased between April 1 and May 15, 1981.

With a scanner, you can monitor the exciting two-way radio conversations of police and fire departments, intelligence agencies, mobile telephones, energy/oil exploration crews, and more. Some scanners can even monitor aircraft transmissions! You can actually hear the news *before* it's news. If you do not own a scanner yourself, now's the time to buy your scanner from Communications Electronics. Choose the scanner that's right for you, then call our toll-free number to place your order with your Visa or Master Charge.

We give you excellent service because CE distributes more scanners worldwide than anyone else. Our warehouse facilities are equipped to process thousands of scanner orders every week. We also export scanners to over 300 countries and military installations. Almost all items are in stock for quick shipment, so if you're a person who prefers fact to fantasy and who needs to know what's *really* happening around you, order your scanner today from CE!

NEW! Bearcat® 350

The Ultimate Synthesized Scanner!

Allow 120-240 days for delivery after receipt of order due to the high demand for this product. List price \$599.95/CE price \$419.00

4-Band, 50 Channel • Alpha-Numeric • No-crystal scanner • AM Aircraft and Public Service bands. • Priority Channel • AC/DC Bands: 30-50, 118-136 AM, 144-174, 421-512 MHz. The new Bearcat 350 introduces an incredible breakthrough in synthesized scanning: Alpha-Numeric Display. Push a button—and the Vacuum Fluorescent Display switches from "numeric" to word descriptions of what's being monitored. 50 channels in 5 banks. Plus, Auto & Manual Search, Search Direction, Limit & Count. Direct Channel Access. Selective Scan Delay. Dual Scan Speeds. Automatic Lockout. Automatic Squelch. Non-Volatile Memory. Reserve your Bearcat 350 today!

Bearcat® 300

List price \$549.95/CE price \$349.00/\$25.00 rebate
Your final cost is a low \$324.00

4-Band, 50 Channel • Service Search • No-crystal scanner • AM Aircraft and Public Service bands. • Priority Channel • AC/DC Bands: 32-50, 118-136 AM, 144-174, 421-512 MHz. The Bearcat 300 is the most advanced automatic scanning radio that has ever been offered to the public. The Bearcat 300 uses a bright green fluorescent digital display, so it's ideal for mobile applications. The Bearcat 300 now has these added features: Service Search, Display Intensity Control, Hold Search and Resume Search keys, Separate Band keys to permit lock-in/lock-out of any band for more efficient service search.



NEW! Bearcat® 350

FREE Bearcat® Rebate Offer

Get a coupon good for a \$25 rebate when you purchase a Bearcat 300, 250, 220 or 210XL; \$20 rebate on model 160; \$10 rebate on model Four-Six Thin Scan and \$5 rebate on the Bearcat 5. To get your rebate, mail this coupon with your original dated sales receipt and the Bearcat model number from the carton to Electra. You'll receive your rebate in four to six weeks. Offer valid only on purchases made between April 1, 1981 and May 15, 1981. All requests must be postmarked by May 30, 1981. Limit of one rebate per household. Coupon must accompany all rebate requests and may not be reproduced. Offer good only in the U.S.A. Void where taxed or prohibited by law. Resellers, companies, clubs and organizations—both profit and non-profit—are not eligible for rebates. Employees of Electra Company, their advertising agencies, distributors and retailers of Bearcat Scanners are also not eligible for rebates. Please be sure to send in the correct amount for your scanner. Pay the listed CE price in this ad. Do not deduct the rebate amount since your rebate will be sent directly to you from Electra. Orders received with insufficient payments will not be processed and will be returned.

Bearcat® 250

List price \$429.95/CE price \$279.00/\$25.00 rebate
Your final cost is a low \$254.00

50 Channels • Crystalless • Searches Stores • Recalls • Digital clock • AC/DC Priority Channel • 3-Band • Count Feature. Frequency range 32-50, 146-174, 420-512 MHz. The Bearcat 250 performs any scanning function you could possibly want. With push button ease you can program up to 50 channels for automatic monitoring. Push another button and search for new frequencies. There are no crystals to limit what you want to hear. A special search feature of the Bearcat 250 actually stores 64 frequencies and recalls them, one at a time, at your convenience.

Bearcat® 220

List price \$449.95/CE price \$289.00/\$25.00 rebate
Your final cost is a low \$264.00

Aircraft and public service monitor. Frequency range 32-50, 118-136 AM, 144-174, 420-512 MHz. The Bearcat 220 is one scanner which can monitor all public service bands plus the exciting AM aircraft band channels. Up to twenty frequencies may be scanned at the same time.

Not only does this new scanner feature normal search operation, where frequency limits are set and the scanner searches between your programmed parameters, it also searches marine or aircraft frequencies by pressing a single button.

Bearcat® 210XL

List price \$349.95/CE price \$229.00/\$25.00 rebate
Your final cost a low \$204.00

18 Channels • 3 Bands • Crystalless • AC/DC Frequency range: 32-50, 144-174, 421-512 MHz. The Bearcat 210XL scanning radio is the second generation scanner that replaces the popular Bearcat 210 and 211. It has almost twice the scanning capacity of the Bearcat 210 with 18 channels plus dual scanning speeds and a bright green fluorescent display. Automatic search finds new frequencies. Features scan delay, single antenna, patented track tuning and more!

NEW! Bearcat® 160

List price \$299.95/CE price \$189.00/\$20.00 rebate
Your final cost is a low \$169.00

16 Channels • 3 Bands • AC only • Priority Dual Scan Speeds • Direct Channel Access Frequency range: 32-50, 144-174, 440-512 MHz. Would you believe...the Bearcat 160 is the least expensive Bearcat crystalless scanner.

This scanner presents a new dimension in scanning form and function. Look at the smooth keyboard. No buttons to punch. No knobs to turn. Instead, finger-tip pads provide control of all scanning operations, including On/Off, Volume and Squelch. Of course the Bearcat 160 incorporates other advanced Bearcat features such as Priority, Direct Channel Access, Dual Scan Speeds, Automatic Channel Lockout, Scan Delay and Auxiliary. All this performance in sleek, contemporary styling. And at a price so low, it astounds even us!

Bearcat® 5

List price \$134.95/CE price \$94.00/\$5.00 rebate
Your final cost is a low \$89.00

8 Crystal Channels • 3 Bands • AC only Frequency range: 33-50, 146-174, 450-508 MHz. The Bearcat 5 is a value-packed crystal scanner built for the scanning professional — at a price the first-time buyer can afford. Individual lockout switches.

Bearcat® Four-Six ThinScan™

List price \$189.95/CE price \$124.00/\$10.00 rebate
Your final cost is a low \$114.00

Frequency range: 33-47, 152-164, 450-508 MHz. The incredible, Bearcat Four-Six Thin Scan™ is like having an information center in your pocket. This three band, 6 channel crystal controlled scanner has patented Track Tuning on UHF. Scan Delay and Channel Lockout. Measures 2 3/4 x 6 1/4 x 1 1/2. Includes rubber ducky antenna. Order crystals for each channel. Made in Japan.

TEST ANY SCANNER

Test any scanner purchased from Communications Electronics™ for 31 days before you decide to keep it. If for any reason you are not completely satisfied, return it in original condition with all parts in 31 days, for a prompt refund (less shipping/handling charges and rebate credits).

Fanon Slimline 6-HLU

List price \$169.95/CE price \$109.00

Low cost 6-channel, 3-band scanner!

The Fanon Slimline 6-HLU gives you six channels of crystal controlled excitement. Unique Automatic Peak Tuning Circuit adjusts the receiver front end for maximum sensitivity across the entire UHF band. Individual channel lockout switches. Frequency range 30-50, 146-175 and 450-512 MHz. Size 2 3/4 x 6 1/4 x 1 1/2. Includes rubber ducky antenna. Order crystal certificates for each channel. Made in Japan.

Fanon Slimline 6-HL

List price \$149.95/CE price \$99.00

6-Channel performance at 4-channel cost!

Frequency range: 30-50, 146-175 MHz.

If you don't need the UHF band, get this model and save money. Same high performance and features as the model HLU without the UHF band. Order crystal certificates for each channel. Made in Japan.

FANON SCANNER ACCESSORIES

SCMA-6 Mobile Adapter/Battery Charger.....\$49.00
CHB-6 AC Adapter/Battery Charger.....\$15.00
CAT-6 Carrying case for Fanon w/Belt Clip.....\$15.00
AUC-3 Auto lighter adapter/Battery Charger.....\$15.00

OTHER SCANNERS & ACCESSORIES

Regency® M400 Scanner.....\$259.00
Regency® M100 Scanner.....\$199.00
Regency® R1040 Scanner.....\$169.00
SP50 AC Adapter.....\$9.00
SP51 Battery Charger.....\$9.00
SP58 Carrying Case for Bearcat 4-6 ThinScan™...\$12.00
FB-E Frequency Directory for Eastern U.S.A.....\$12.00
FB-W Frequency Directory for Western U.S.A.....\$12.00
FFD Federal Frequency Directory for U.S.A.....\$12.00
MK350 Mobile mounting kit for Bearcat 350.....\$12.00
B-4 1.2 V AAA Ni-Cad's for ThinScan™ and Fanon...\$9.00
A-135cc Crystal certificate.....\$3.00
Add \$3.00 shipping for all accessories ordered at the same time.

INCREASED PERFORMANCE ANTENNAS

If you want the utmost in performance from your scanner, it is essential that you use an external antenna. We have six base and mobile antennas specifically designed for receiving all bands. Order #A60 is a magnet mount mobile antenna. Order #A61 is a gutter clip mobile antenna. Order #A62 is a trunk-lip mobile antenna. Order #A63 is a 3/4 inch hole mount. Order #A64 is a 3/8 inch snap-in mount, and #A70 is an all band base station antenna. All antennas are \$35.00 and \$3.00 for UPS shipping in the continental United States.

BUY WITH CONFIDENCE

To get the fastest delivery from CE of any scanner, send or phone your order directly to our Scanner Distribution Center. Be sure to calculate your price using the CE prices in this ad. Michigan residents please add 4% sales tax. Written purchase orders are accepted from approved government agencies and most well rated firms at a 10% surcharge for net 10 billing. All sales are subject to availability. All sales on accessories are final. Prices, terms and specifications are subject to change without notice. Out of stock items will be placed on backorder automatically unless CE is instructed differently. Most products that we sell have a manufacturer's warranty. Free copies of warranties on these products are available prior to purchase by writing to CE. International orders are invited with a \$20.00 surcharge for special handling in addition to shipping charges. All shipments are F.O.B. Ann Arbor, Michigan. No COD's please. Non-certified and foreign checks require bank clearance.

Mail orders to: Communications Electronics™, Box 1002, Ann Arbor, Michigan 48106 U.S.A. Add \$7.00 per scanner or phone product for U.P.S. ground shipping and handling, or \$14.00 for faster U.P.S. air shipping to some locations. If you have a Master Charge or Visa card, you may call anytime and place a credit card order. Order toll free in the U.S.A. Dial 800-521-4414. If you are outside the U.S. or in Michigan, dial 313-994-4444. Dealer inquiries invited. All order lines at Communications Electronics™ are staffed 24 hours.

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APPLICATIONS:
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• After-market auto/
RV clocks
• Aircraft-marine clks.
• 12VDC oper. Instru.
• Portable/battery
powered instruments.

Features: Bright 0.3" green display. Internal crystal time-base. ±0.5 sec./day accur. Auto. display brightness control logic. Display color filterable to blue, blue-green, green & yellow. Complete—just add switches and lens.

- MA1003 Module \$16.95
- MA1023 .7" Low Cost Digital LED Clock Module 8.95
- MA1026 .7" Dig. LED Alarm Clock/Thermometer 18.95
- MA5036 .3" Low Cost Digital LED Clock/Timer 6.95
- MA1002 .5" LED Display Dig. Clock & Xformer 9.95



National Semiconductor RAM SALE

- MM5290N-4 (MK4116/UPD416) . . . \$4.95 each
16K DYNAMIC RAM (250NS)
(8 EACH \$39.95) (100 EACH \$450.00/lot)
- MM5290J-2 (MK4116/UPD416) . . . \$6.95 each
16K DYNAMIC RAM (150NS)
(8 EACH \$49.95) (100 EACH \$550.00/lot)
- MM5298J-3A \$3.25 each
8K DYNAMIC RAM (LOW HALF OF MM5290J) 200NS
(8 EACH \$23.95) (100 EACH \$250.00/lot)
- MM2114-3 \$5.95 each
4K STATIC RAM (300NS)
(8 EACH \$43.95) (100 EACH \$450.00/lot)
- MM2114L-3 \$6.25 each
4K STATIC RAM (LOW POWER 300NS)
(8 EACH \$44.95) (100 EACH \$475.00/lot)

EPROM Erasing Lamp



- Erases 2708, 2716, 1702A, 5203Q, 5204Q, etc.
- Erases up to 4 chips within 20 minutes.
- Maintains constant exposure distance of one inch.
- Special conductive foam liner eliminates static build-up.
- Built-in safety lock to prevent UV exposure.
- Compact—only 7-5/8" x 2-7/8" x 2"
- Complete with holding tray for 4 chips.

UVS-11E \$79.95

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: 6 1/2" x 3-1/8" x 1 1/4"

JE747 \$29.95

6-Digit Clock Kit

- 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: 6 1/2" x 3-1/8" x 1 1/4"

JE701 \$19.95

NEW! JE215 Adjustable Dual Power Supply

General Description: The JE215 is a Dual Power Supply with independent adjustable positive and negative output voltages. A separate adjustment for each of the supplies provides the user unlimited applications for IC current voltage requirements. The supply can also be used as a general all-purpose variable power supply.

- FEATURES:
- Adjustable regulated power supplies, pos. and neg. 1.2VDC to 15VDC
- Power Output (each supply): 5VDC @ 500mA, 10VDC @ 750mA, 12VDC @ 500mA, and 15VDC @ 175mA.
- Two, 3-terminal adj. IC regulators with thermal overload protection.
- Heat sink regulator cooling
- LED "on" indicator
- Printed Board Construction
- 120VAC input
- Size: 3-1/2" w x 5-1/16" L x 2"H

- JE215 Adj. Dual Power Supply Kit (as shown) . . . \$24.95
- (Picture not shown but similar in construction to above)
- JE200 Reg. Power Supply Kit (5VDC, 1 amp) . . . \$14.95
- JE205 Adapter Brd. (to JE200) ±5, ±9 & ±12V. \$12.95
- JE210 Var. Pwr. Sply. Kit, 5-15VDC, to 1.5amp. \$19.95

MICROPROCESSOR COMPONENTS

8080A/8080A SUPPORT DEVICES

17K5806A	CPU	6.50
DP8227	8-Bit Input/Output	3.25
DP8224	Priority Interrupt Control	3.50
DP8224	Bi-Directional Bus Driver	3.40
DP8229	Clock Generator/Driver	3.30
DP8230	Bus Driver	2.40
DP8238	System Controller/Bus Driver	4.95
DP8238	System Controller	3.95
17N5243	I/O Expander for 48 Series	4.95
17N5250	Asynchronous Comm. Element	16.95
DP8251	Prog. Comm. I/O (USART)	7.95
DP8252	Prog. Interval Timer	14.95
DP8253	Prog. Peripheral I/O (PPI)	14.95
DP8257	Prog. DMA Control	19.95
DP8259	Prog. Interrupt Control	14.95
DP8275	Prog. CRT Controller	48.95
DP8279	Prog. Keyboard/Display Interface	25.95
DP8280	Octal Bus Receiver	6.95
DP8282	System Timing Element	6.95
DP8284	8-Bit Bi-Directional Receiver	3.95
DP8287	8-Bit Bi-Directional Receiver	3.95
DP8288	8-Bit Bi-Directional Receiver	3.95

6800/6800 SUPPORT DEVICES

MC6800	MPU	14.95
MC6802CP	MPU with Clock and RAM	19.95
MC6801AP	12K Static RAM	4.95
MC6801	Peripheral Inter. Adapt (MC6800)	7.45
MC6802	Priority Interrupt Controller	10.95
MC6803L3	12Kx8-Bit ROM (MC6803-E)	14.95
MC6805	Asynchronous Comm. Adapter	6.95
MC6802	Synchronous Serial Data Adapter	6.95
MC6805	5600bps Digital MODEM	22.95
MC6802	2400bps Modulator	12.95
MC6808A	Quad 3-State Bus Trans. (MC6802E)	7.25

MICROPROCESSOR CHIPS

Z80 (780C)	CPU (MK3800N) QMHZ	13.95
Z80A (780-1)	CPU (MK3800N-1) (4MHZ)	13.95
CDP1802	CPU	19.95
2650	MPU	16.95
1DM2601ADC	CPU—4-Bit Slice (Com. Temp. Grade)	19.95
MC68002	MPU w/Clock (8K Bytes Memory)	11.95
17N5287N-4	MPU—8-Bit (8MHz)	16.95
17N5287N-4	CPU—Sgl. Chip 8-Bit (128 Bytes RAM)	13.95
17N5287N-4	CPU (256 Bytes RAM)	24.95
17N5287N-4	CPU—64 Bytes RAM	24.95
17N5287N	CPU w/Basic Micro Interpreter	25.95
FM80	CPU	19.95
17N5290U	CPU—16-Bit	29.95
TM59900JL	MPU—16-Bit	49.95
MM5100H	Dual 25-Bit Dynamic	.50
MM5101H	Dual 50-Bit Dynamic	.50
MM5106H	Dual 100-Bit Static	.50
MM5107H	Dual 64-Bit Accumulator	.50
MM5102	256-Bit Dynamic	3.95
MM5103	1024-Bit Dynamic/Accumulator	1.95
MM5202H	305/512-Bit Dynamic	.49
MM5203H	Octal 80-Bit	9.95
MM5205H	Octal 80-Bit	9.95
2524V (166A)	1024-Bit Dynamic	3.95
2528N	Hex 22-Bit Static	4.95
2527V	Dual 132-Bit Static	2.95
2524V	512-Bit Dynamic	.90
2525V	1024-Bit Dynamic	2.95
2527V	Dual 256-Bit Static	2.95
2528V	Dual 260-Bit Static	4.00
2529V	Dual 260-Bit Static	4.00
2528N	Quad 80-Bit Static	2.95
3M1PC	Fifo (Dual 80)	6.95

DATA ACQUISITION

AF300-1C7	Universal Active Filter 2.5%	5.95
AF300-1C7	Touch Tone Low Pass Filter	29.95
LM339AH	Super Gain Op Amp	1.95
LM334Z	Constant Current Source	1.30
LM335Z	Temperature Transducer	1.40
LF399N	JFET Input Op Amp	1.10
LF399N	Sample & Hold Amplifiers	3.95
LM399H	Temp. Comp. Prec. Ref. (.50pm/C)	4.95
ADC0801LCN	8-Bit A/D Converter (1 L58)	4.95
DAC0801LCN	8-Bit D/A Converter (.57% Lin.)	5.25

DATA ACQUISITION (CONTINUED)

ADC0801CCN	8-Bit A/D Converter (8-Ch. Multi.)	5.25
ADC0811CCN	8-Bit A/D Converter (8-Ch. Multi.)	18.95
DAC0801LCN	8-Bit D/A Conv. Micro. Comp. (.525%)	13.95
DAC0802LCN	8-Bit D/A Conv. Micro. Comp. (.525%)	8.95
DAC0803LCN	8-Bit D/A Converter (.525% Lin.)	5.25
DAC1201LCN	12-Bit D/A Converter (.525% Lin.)	5.25
DAC1202LCN	12-Bit D/A Converter (.525% Lin.)	5.25
CD4051V	8-Channel Multiplexer	1.75
AV-5-1011	39C BAUD UART	9.95
1101	256x1 Static	1.49
1103	1024x1 Dynamic	.99
2101 (8101)	256x4 Static	3.95
2102	1024x1 Static	1.75
211L02	1024x1 Static	1.95
2113 (8113)	256x4 Static	3.95
2112	256x4 Static MOS	4.95
2114	1024x1 Static 40ms	5.95
2114L	1024x1 Static 40ms Low Power	5.95
2114-3	1024x1 Static 30ms	7.49
2114L-3	1024x1 Static 30ms Low Power	7.99
2117	16,384x1 Dynamic 50ns (housemarked)	4.95
4115 (UPD416)	16K Dynamic 250ns	4.95
MM2147J	4096x1 Fast 70ns	19.95
5101	256x4 Static	7.95
MM5261	1024x1 Dynamic Fully Decoded	.99
MM5262	2Kx1 Dynamic	.25
MM5265/2107	16K Dynamic 150ns	4.95
MM5265/21415E	16K Dynamic 150ns (UPD416)	6.95
MM5265-1A	8K Dyn. 200ns (lower % of MM5265)	4.95
408	2Kx1 Static	1.75
UPD434/5M4807	4K Dynamic 16-pin	4.95
TM5494-45HL	4K Static	14.95
TM5495	1024x1 Static	14.95

PROMS/EPROMS

1702A	2K UV Erasable PROM	3.95
2708	8K EPROM	3.95
TM52716	16K EPROM (-5V, +5V, +12V)	19.95
2716Intel(2516)T1	16K EPROM (Single +5V)	17.95
2732Intel(2532)T1	32K EPROM	49.95
2758	8K EPROM (40ns) (Single +5V)	7.95
5203	2048 PROM	14.95
62521(74518E)	32x8 PROM (Open Collector)	4.95
62513	408 Bipolar PROM	29.95
62522(74528E)	32x8 Tri-State Bipolar PROM	4.95
62518	8K PROM	29.95

ROM'S

2513(2140)	Character Generator (Upper Case)	3.95
2513(2021)	Character Generator (Lower Case)	3.95
2516N	Character Generator	10.95
MM5230N	2048-Bit Read Only Memory	1.95

NMOS READ ONLY MEMORIES

MCM6610P	128x8x1 ASCII Shifted w/Greek	13.50
MCM6674P	128x8x7 Math Symbol & Pictures	13.50
MCM6676P	128x8x1 Alpha, Control Char. Gen.	13.50

MICROPROCESSOR MANUALS

M-230	User Manual	7.50
M-CDF180	User Manual	7.50
M-250	User Manual	5.00

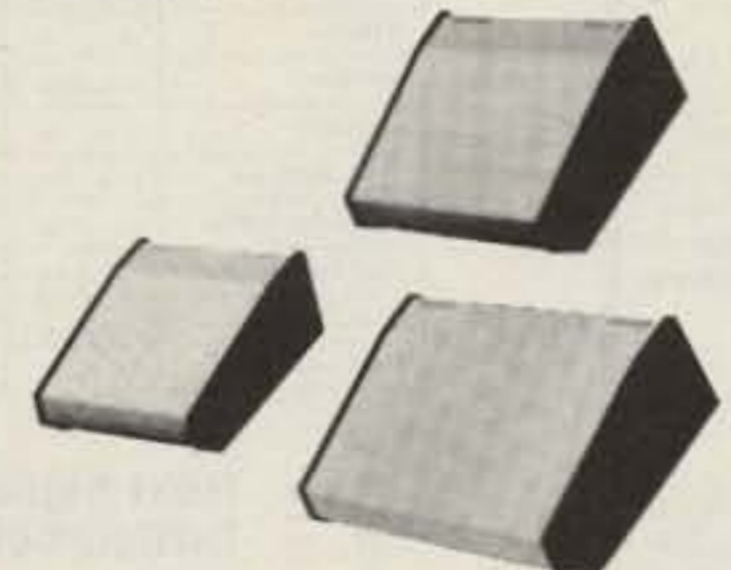
SPECIAL FUNCTION

OS005CN	Dual MOS Clock Driver (5M2)	1.50
OS005CN	Dual MOS Clock Driver (5M2)	1.95
17N5171N-1	Floppy Disc Controller	24.95
17N5261N	Communication Chip	19.95
MM58167N	Microprocessor Real Time Clock	8.95
MM5811N	Microprocessor Compatible Clock	11.95
COP402N	Microcontroller with 64-Digit RAM and Direct LED Drive	6.95
COP402MN	Microcontroller with 64-Digit RAM & Direct LED Drive w/N Bus Int.	7.49
COP402N	32-Seg. VAC Fluor. Driver (29-pin pkg.)	1.25

TELEPHONE/KEYBOARD CHIPS

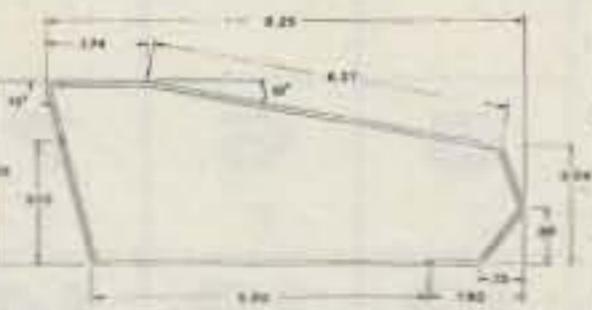
AY-5-5130	Push Button Telephone Dialer	24.95
AY-5-9008	Repertory Dialer	14.95
AY-5-9009	CMOS Clock Generator	4.95
AY-5-2376	Keyboard Encoder (88 keys)	11.95
HO0165-5	Keyboard Encoder (16 keys)	7.95
HC922	Keyboard Encoder (16 keys)	5.40
HC923	Keyboard Encoder (20 keys)	5.75
MM53190N	Push Button Pulse Dialer	7.95
MM5399N	96/144-Key Serial Keyboard Encoder	8.95

DESIGNERS' SERIES Blank Desk-Top Electronic Enclosures



- High strength epoxy molded end pieces in mocha brown finish.
- Sliding rear/bottom panel for service and component accessibility.
- Top / bottom panels .080 thk alum. Alodine type 1200 finish (gold tint color) for best paint adhesion after modification.
- Vented top and bottom panels for cooling efficiency.
- Rigid construction provides unlimited applications.

CONSTRUCTION: The "DTE" Blank Desk Top Electronic Enclosures are designed to blend and complement today's modern computer equipment and can be used in both industrial and home. The end pieces are precision molded with an internal slot (all around) to accept both top and bottom panels. The panels are then fastened to 1/4" thick tabs inside the end pieces to provide maximum rigidity to the enclosure. For ease of equipment servicing, the rear/bottom panel slides back on slotted tracks while the rest of the enclosure remains intact. Different panel widths may be used while maintaining a common profile outline. The molded end pieces can also be painted to match any panel color scheme.



Enclosure Model No.	Panel Width	PRICE
DTE-8	8.00"	\$29.95
DTE-11	10.65"	\$32.95
DTE-14	14.00"	\$34.95

\$10.00 Min. Order — U.S. Funds Only
Calif. Residents Add 6% Sales Tax
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Spec Sheets — 25¢
Send 41¢ Postage for your
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PRICES SUBJECT TO CHANGE

JOYSTICKS



- JS-5K 5K Linear Taper Pots \$5.25
- JS-100K 100K Linear Taper Pots \$4.95
- JVC-40 40K (2) Video Controller in case \$5.95

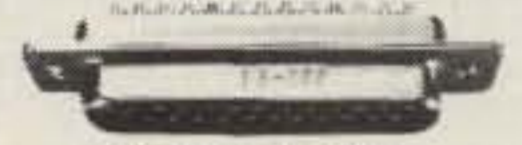
AC and DC Wall Transformers



Ideal for use with clocks, games, power supplies or any other type of AC or DC application.

Part No.	Input	Output	Price
AC 250	117V/60Hz	12 VAC 250mA	\$3.95
AC 500	117V/60Hz	12 VAC 500mA	\$4.95
AC1000	117V/60Hz	12 VAC 1 amp	\$5.95
AC1700	117V/60Hz	9 VAC 1.7 amp	\$6.95
DV 9200	117V/60Hz	9 VDC 200mA	\$3.25
DC 900	120V/60Hz	9 VDC 500mA	\$3.95

CONNECTORS



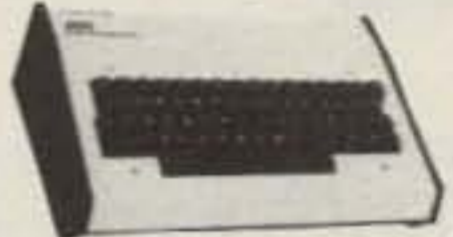
DB25P	D-Subminiature Plug	\$2.95
DB25S	D-Subminiature Socket	\$3.50
DB51226	Cover for DB25P/S	\$1.75
22/44SE	P.C. Edge (22/44 Pin)	\$2.95
UG88/U	BNC Plug	\$1.79
UG89/U	BNC Jack	\$3.79
UG175/U	UHF Adapter	\$.49
SO239	UHF Panel Recp.	\$1.29
PL258	UHF Adapter	\$1.60
PL259	UHF Plug	\$1.60
UG260/U	BNC Plug	\$1.79
UG1094/U	BNC Bulkhead Recp.	\$1.29

TRS-80 16K Conversion Kit

Expand your 4K TRS-80 System to 16K. Kit comes complete with:
* 8 ea. MM5290 (UPD416/4116) 16K Dyn. Rams (*NS)
* Documentation for Conversion

- TRS-16K2 *150NS \$49.95
- TRS-16K4 *250NS \$39.95

JE610 ASCII Encoded Keyboard Kit



The JE610 ASCII Keyboard Kit can be interfaced into most any computer system. The 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 @ 10 mA for operation. Features: 60 keys generate the 126 characters, upper and lower case ASCII set. Fully buffered. Two 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. Size: 3 1/4" H x 14 1/2" W x 8 3/4" D

- JE610/DTE-AK (as pictured above) . . . \$124.95
- JE610 Kit 62-Key Keyboard, PC Board, & Components (no case) . . . \$ 79.95
- K62 62-Key Keyboard (Keyboard only) . . . \$ 34.95
- DTE-AK (case only — 3 3/4" H x 14 1/2" W x 8 3/4" D) \$ 49.95

JE600 Hexadecimal Encoder Kit



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PROPAGATION

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EASTERN UNITED STATES TO:

	GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14A	14	7	7	7	7	7	7	14	14	14	21	
ARGENTINA	21	14A	14	14	7	7	14	21	21A	21A	21A	21	
AUSTRALIA	21A	14A	14	7	7B	7B	7B	14	14	14	21A	21A	
CANAL ZONE	21	14	14	7	7	7	7A	14A	21	21A	21A	21A	
ENGLAND	14	7	7	7	7	7A	14	21	21A	21	14	14	
HAWAII	21A	14	14	7	7	7	7	14	14	21	21A	21A	
INDIA	14	7A	7B	7B	7B	7B	14	14	14A	14A	14	14	
JAPAN	21	7A	7B	7B	7B	7	7	7	14	14B	14	21	
MEXICO	21	14	14	7	7	7	7	14	21	21A	21A	21	
PHILIPPINES	21	7	7	7B	7B	7B	7B	7B	14B	14	14	14A	
PUERTO RICO	21	14	7	7	7	7	14	14	21	21A	21A	21	
SOUTH AFRICA	14	7A	7	7	7B	14	14A	21	21A	21A	21A	21	
U. S. S. R.	7B	7	7	7	7	7B	14	14	21	21	14	7B	
WEST COAST	21	14	14	7	7	7	7	14	21	21	21A	21A	

CENTRAL UNITED STATES TO:

ALASKA	14A	14	14	7	7	7	7	7	14	14	14	21	
ARGENTINA	21	14	14	7A	7	7	14	21	21A	21A	21A	21	
AUSTRALIA	21A	21	14A	14	7B	7B	7B	14	14	14	21A	21A	
CANAL ZONE	21	14	14	7	7	7	7A	14A	21	21A	21A	21A	
ENGLAND	14	7	7	7	7	7	7A	14	14A	21A	14	14	
HAWAII	21A	21	14	7	7	7	7	14	14	21	21A	21A	
INDIA	14	14	7A	7B	7B	7B	7B	7B	14	14	14	14	
JAPAN	21	14	14	7B	7B	7	7	7	14	14	14	21	
MEXICO	21	14	7	7	7	7	7	14	14	21	21A	21A	
PHILIPPINES	21	14	14	7B	7B	7B	7B	7B	14B	14	14	14A	
PUERTO RICO	21	14A	14	7	7	7	14	14	21	21A	21A	21	
SOUTH AFRICA	14	14	7B	7	7B	7B	14	14A	21	21A	21A	21	
U. S. S. R.	7B	7	7	7	7	7B	7B	14	14	21	14	7B	

WESTERN UNITED STATES TO:

ALASKA	14A	14	14	7	7	7	7	7	14	14	14	21	
ARGENTINA	21A	21	14	14	7	7	14	21	21	21A	21A	21A	
AUSTRALIA	21A	21A	21	14	14	14	14	14	14	14	21A	21A	
CANAL ZONE	21	14A	14	7	7	7	7A	14	14	21	21A	21A	
ENGLAND	14	7B	7	7	7	7	7	14	14	21A	14	14	
HAWAII	21A	21A	14A	14	14	7	7	14	14A	21	21A	21A	
INDIA	14	14	14	7B	7B	7B	7B	7B	14	14	14	14	
JAPAN	21A	21	14	14	7B	7	7	7	14	14	14	21	
MEXICO	21A	14	14	7	7	7	7	14	14	21	21A	21A	
PHILIPPINES	21A	21	14A	14	7B	7B	7B	7B	14B	14	14	21	
PUERTO RICO	21	14	7A	7	7	7	7	14	21	21A	21A	21A	
SOUTH AFRICA	14	14	7	7	7B	7B	7B	14	14	21	21A	21	
U. S. S. R.	7B	7B	7	7	7	7	7B	7B	14	14	14	7B	
EAST COAST	21	14	14	7	7	7	7	14	21	21	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

april

sun	mon	tue	wed	thu	fri	sat
			1 G	2 F	3 G	4 G
5 G	6 G	7 F	8 G	9 G	10 F/SF	11 F
12 F	13 F	14 G	15 G	16 F	17 G	18 G
19 P/SF	20 F	21 G	22 G	23 G	24 G	25 G
26 G	27 F	28 F/SF	29 F	30 F		