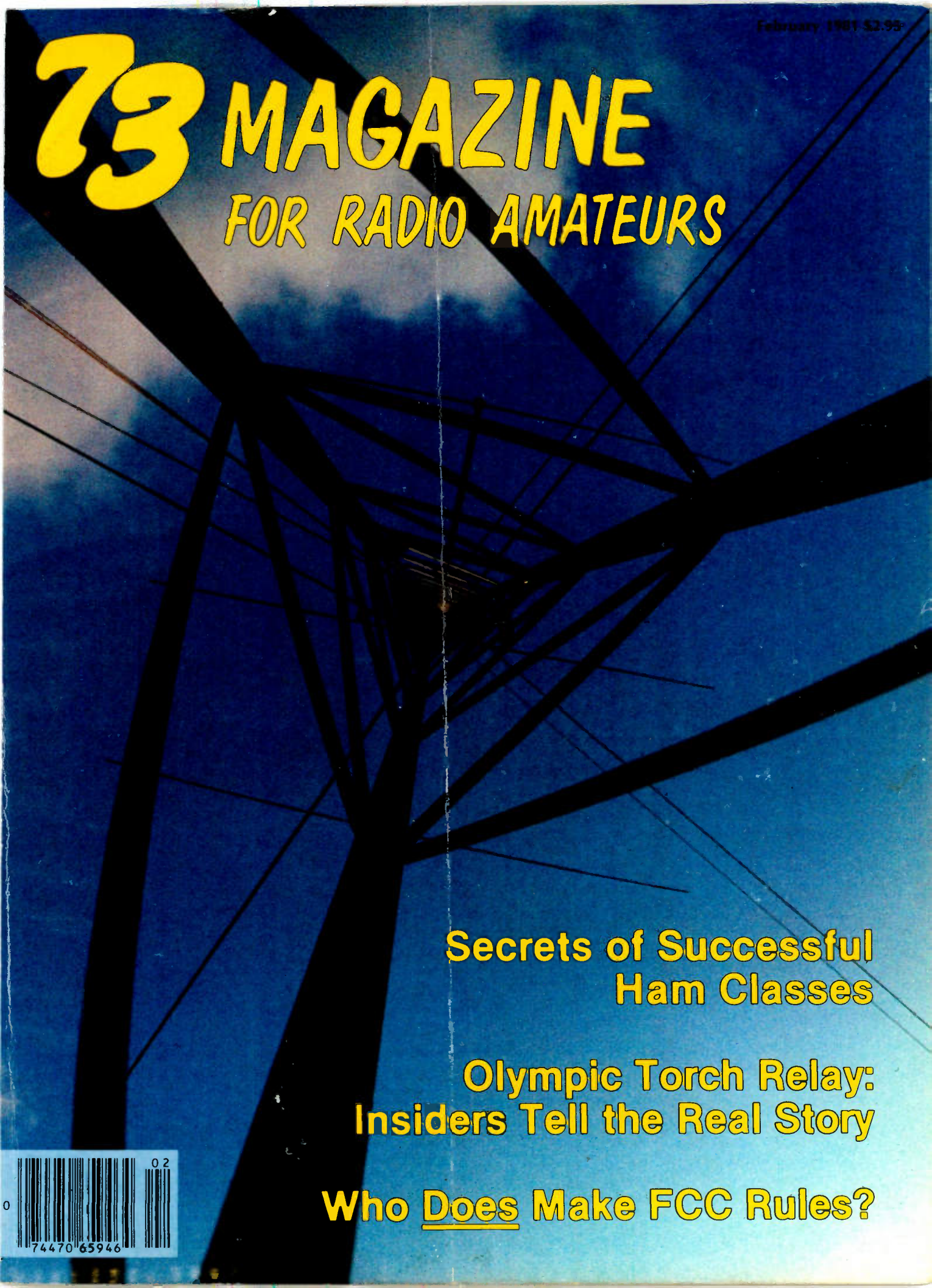
February 1981 $2.95

73 MAGAZINE
FOR RADIO AMATEURS



Secrets of Successful Ham Classes

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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 helds, 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

TEMPO VHF & UHF SOLID STATE POWER AMPLIFIERS

Boost your signal. . . give it the range and clarity of a high powered base station. VHF (135 to 175 MHz)

Drive Power	Output	Model No.	Price
2W	130W	130A02	$209
10W	130W	130A10	$189
30W	130W	130A30	$199
2W	80W	80A02	$169
10W	80W	80A10	$149
30W	80W	80A30	$159
2W	50W	50A02	$129
2W	30W	30A02	$ 89

UHF (400 to 512 MHz) models, lower power and FCC type accepted models also available.

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New! AZDEN PCS 3000

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SUPERIOR COMMERCIAL GRADE 2-METER FM TRANSCEIVER

INTRODUCTORY OFFER

$339.00

COMPARE THESE FEATURES WITH ANY UNIT AT ANY PRICE

- **8 MHZ FREQUENCY COVERAGE, INCLUDING CAP/MARS BUILT IN:** Receive and transmit 142.000 to 149.995 MHz in selectable steps of 5 or 10 kHz. COMPARE!
- **SIZE:** Unbelievable! Only 6¾" by 2⅜" by 9¾". COMPARE!
- **MICROCOMPUTER CONTROL:** All frequency control is carried out by a microcomputer.
- **MUSICAL TONE ACCOMPANIES KEYBOARD ENTRIES:** When a key is pressed, a brief musical tone indicates positive entry into the microcomputer. COMPARE!
- **PUSHBUTTON FREQUENCY CONTROL FROM MICROPHONE OR PANEL:** Frequency is selected by buttons on the front panel or microphone.
- **8 CHANNEL MEMORY:** Each memory channel is reprogrammable and stores the frequency and offset. Memory is backed up by a NICAD battery when power is removed.
- **INSTANT MEMORY 1 RECALL:** By pressing a button on the microphone or front panel, memory channel 1 may be accessed immediately.
- **MEMORY SCAN:** Memory channels may be continuously scanned for quick location of a busy or vacant frequency.
- **PROGRAMMABLE BAND SCAN:** Any section of the band may be scanned in steps of 5 or 10 kHz. Scan limits are easily reprogrammed.
- **DISCRIMINATOR SCAN CONTROL (AZDEN EXCLUSIVE PATENT):** The scanner stops by sensing the channel center, so the unit always lands on the correct frequency. COMPARE this with other units that claim to scan in 5-kHz steps!
- **THREE SCAN MODES WITH AUTO RESUME:** "Sampling" mode pauses at busy channels, then resumes. "Busy" mode stops at a busy channel, then resumes shortly after frequency clears. "Vacant" mode stops at a vacant channel and resumes when signal appears. If desired, auto resume may be prevented by pressing one button. COMPARE!
- **REMOTABLE 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/SQUELCH 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!
- **25 WATTS OUTPUT:** Also 5 watts low power to conserve batteries in portable use.
- **GREEN FREQUENCY DISPLAY:** Frequency numerals are green LEDs for superior visibility.
- **RECEIVER OFFSET:** A channel lock switch allows monitoring of the repeater input frequency. COMPARE!
- **SUPERIOR RECEIVER:** Sensitivity is better than 0.28 uV for 20-dB quieting and 0.19 uV for 12-dB SINAD. The squelch sensitivity is superb, requiring less than 0.1 uV to open. The receiver audio circuits are designed for maximum intelligibility and fidelity. COMPARE!
- **ILLUMINATED KEYBOARD:** Keyboard backlighting allows it to be seen at night.
- **TRUE FM, NOT PHASE MODULATION:** Transmitted audio quality is optimized by the same high standard of design and construction as is found in the receiver. The microphone amplifier and compression circuits offer intelligibility second to none.
- **OTHER FEATURES:** Dynamic microphone, built-in speaker, mobile mounting bracket, external remote speaker jack (head and radio) and much, much more. All cords, plugs, fuses, microphone hanger etc. included. Weight: 6 lbs.
- **ACCESSORIES:** CS-ECK 15-foot remote cable ... $35.00. CS-6R 6-amp ac power supply ... $49.95. CS-AS remote speaker ... $18.00. CS-TTK touch-tone® microphone kit ... $39.95.

✓5

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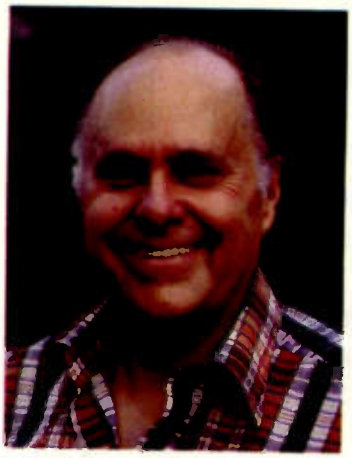

W2NSD/1
NEVER SAY DIE

editorial by Wayne Green

HARC BOMB

That's the Hudson Division ARRL Convention . . . an almost complete disaster according to the few survivors. Hardly any exhibitors and one of the most scant attendances of any HARC Convention. Lest I be given a hard time for just reporting the debacle without making some suggestions for the improvement of the show, I'd like to suggest that the event be put in the hands of someone competent . . . that a decent program be devised which features someone who will attract attendance . . . that manufacturers and dealers be provided with low-cost exhibit facilities . . . that the event be advertised in more than just one ham magazine . . . and be run near New York City.

A ham convention is a show which has costs running into the tens or even hundreds of thousands of dollars. In the hands of someone with no experience in promoting a show and with no ease in handling large sums of money, it is going to be screwed up. A show promoter has to know how to organize local clubs to get the work done . . . he has to be experienced in wheeling and dealing with hotels and exhibition centers . . . with caterers . . . with entertainment. He has to already know about advertising, PR, mailing lists, direct-mail work, mail order . . . etc. In other words, you do not turn a big business over to someone who has spent a lifetime working for the telephone company.

HARC has over 40,000 hams in the area, so they should be able to put on the biggest hamfest or convention in the country. They should be able to make even Dayton look sick. With that kind of an attendance prospect a convention that draws under 1,000 is ridiculous.

How about turning to a show promoter . . . a professional? Well, maybe, but I've seen these birds work and they can screw you all ways to Sunday. They know all about skimming the gate, running up fake expenses, double billing . . . etc. I've seen some shows where it was obvious that $50,000 or more was being skimmed off the top.

Hamfests and conventions can draw well if they are run right and well advertised. Our hobby is in desperate need of more successful hamfests, for these events help bring out prospective hams and build up their enthusiasm. They can also make a lot of money for those who do the work.

KENWOOD

Visitors to Japan often arrive with a distorted idea of how terribly expensive the visit is going to be. Hotels *are* on the high side, but certainly are no worse than in London and much of Europe. A visit to Tokyo *can* be an expensive experience if one is not wily unto the ways of the natives. I found it much like New York City, where meals come in all price ranges.

Not being able to completely overcome my frugal Yankee heritage, I tend to oscillate between a sort of fatalistic acceptance of the need to both give and enjoy lavish business entertainment and a lifetime of being thrifty. Thus, one evening I may be the guest (or even the host . . . aargh) of a fellow businessman and the next cadging free snacks in the food section of a Tokyo department store, armed with my best "I *may* buy some of this if I like it" smile.

The practice of almost all restaurants of having the food on display (plaster replicas, actually) in the front window, along with the price, makes it easy for the chintzy to shop for a cheap, but delicious meal. You can do nicely for $6 or $7, leaving the $200 dinners for more important evenings. If you get desperate, there are a number of American fast-food chains waiting for you. McDonalds is just about everywhere in Japan, ready when your Big Mac attack comes . . . and it eventually comes to everyone visiting a truly foreign country.

If a Big Mac doesn't get you, then you'll be able to get a reasonable and familiar meal at a Kentucky Fried Chicken, a Dairy Queen, or a Shakey's ("All the pizz and flies you can eat"). There's even a Wendy's . . . right there on the Ginza (Broadway) in Tokyo, complete with a standard Frosty. I'm a very big fan of the Wendy's salad bar, but that has not yet been exported . . . and I've checked 'em out in Brussels, too.

This trip to Tokyo had three major purposes. That was enough to keep me busy day and night, rushing to a computer show to see what the latest in Japanese microcomputers might be like . . . then talking with prospective trading partners about Instant Software . . . and meeting hams and ham equipment people. With quite a number of the Japanese firms promising to start exporting microcomputers to the US in 1981, I wanted to see what they had to offer and get an idea of what the

A busy production line at Kenwood in Tokyo.

KENWOOD
...paceseller in amateur radio

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Small wonder.

Processor, N/W switch, IF shift, DFC option

TS-130S/V

An incredibly compact, full-featured, all solid-state HF SSB/CW transceiver for both mobile and fixed operation. It covers 3.5 to 29.7 MHz (including the three new Amateur bands!) and is loaded with optimum operating features such as digital display, IF shift, speech processor, narrow/wide filter selection (on both SSB and CW), and optional DFC-230 digital frequency controller. The TS-130S runs high power and the TS-130V is a low-power version for QRP applications.

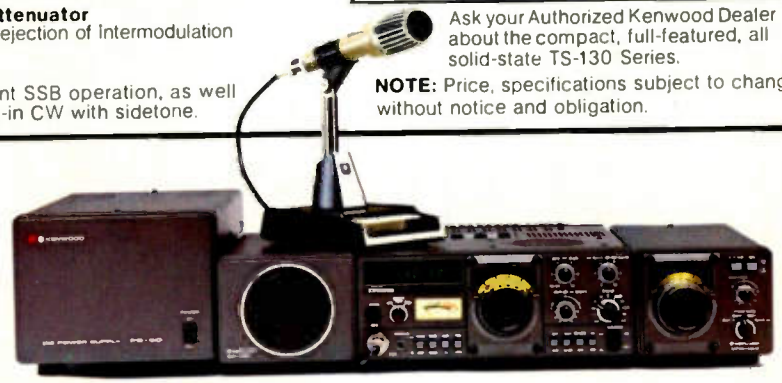
TS-130 SERIES FEATURES:

- **80-10 meters, including three new bands**
  Covers all Amateur bands from 3.5 to 29.7 MHz, including the new 10, 18, and 24-MHz bands. Receives WWV on 10 MHz. VFO covers more than 50 kHz above and below each 500-kHz band.
- **Two power versions . . . easy operation**
  TS-130S runs 200 W PEP/160 W DC input on 80-15 meters and 160 W PEP/140 W DC on 12 and 10 meters. TS-130V runs 25 W PEP/20 W DC input on all bands. Solid-state, wideband final amplifier eliminates transmitter tuning, and receiver wideband RF amplifiers eliminate preselector peaking.
- **Built-in speech processor**
  Increases audio punch and average SSB output power, while suppressing sideband splatter.
- **CW narrow/wide selection**
  "N-W" switch allows selection of wide and narrow bandwidths. Wide CW and SSB bandwidths are the same. Optional YK-88C (500 Hz) or YK-88CN (270 Hz) filter may be installed for narrow CW.
- **SSB narrow selection**
  "N-W" switch allows selection of narrow SSB bandwidth to eliminate QRM, when optional YK-88SN (1.8 kHz) filter is installed. (CW filter may still be selected in CW mode.)
- **Sideband mode selected automatically**
  LSB is selected on 40 meters and below, and USB on 30 meters and above. SSB REVERSE position is provided on the MODE switch.
- **Built-in digital display**
  Six-digit green fluorescent tube display indicates actual operating frequency to 100 Hz. Also indicates external VFO or fixed-channel frequency, RIT shift, and CW transmit/receive shifts. Also analog sub-dial for backup frequency indication.
- **IF shift**
  Allows IF passband to be moved away from interfering signals and sideband splatter.
- **Single-conversion PLL system**
  Improves stability as well as transmit and receive spurious characteristics.
- **Built-in RF attenuator**
  For optimum rejection of intermodulation distortion.
- **Built-in VOX**
  For convenient SSB operation, as well as semi break-in CW with sidetone.
- **Effective noise blanker**
  Eliminates pulse-type interference such as ignition noise.
- **Built-in 25-kHz marker**
  Accurate frequency reference for calibration.
- **Compact and lightweight**
  Measures only 3-3/4 inches high, 9-1/2 inches wide, and 11-9/16 inches deep, and weighs only 12.3 pounds. It is styled to enhance the appearance of any fixed or mobile station.

Optional DFC-230 Digital Frequency Controller
Allows frequency control in 20-Hz steps with UP/DOWN microphone (supplied with DFC-230). Includes four memories (handy for split-frequency operation) and digital display. Covers 100 kHz above and below each 500-kHz band. Very compact.

Ask your Authorized Kenwood Dealer about the compact, full-featured, all solid-state TS-130 Series.

NOTE: Price, specifications subject to change without notice and obligation.



MATCHING ACCESSORIES FOR FIXED-STATION OPERATION:

- PS-30 base-station power supply (remotely switchable on and off with TS-130S power switch).
- SP-120 external speaker
- VFO-120 remote VFO
- MC-50 50kΩ/500Ω desk microphone

Other accessories not shown:

- YK-88C (500 Hz) and YK-88CN (270 Hz) CW filters
- YK-88SN (1.8 kHz) narrow SSB filter
- AT-130 compact antenna tuner (80-10 m, including 3 new bands)
- MB-100 mobile mounting bracket
- MC-30S and MC-35S noise cancelling hand microphones
- PC-1 phone patch
- TL-922A linear amplifier
- HS-5 and HS-4 headphones
- HC-10 world digital clock
- PS-20 base-station power supply for TS-130V
- SP-40 compact mobile speaker
- VFO-230 digital VFO with five memories

American firms are really up against. I found out and the news is not good for the American firms.

Since the US is quite a bit ahead of Japan in the development of programs for microcomputers, I was interested in developing a market in Japan for the nearly 1,000 programs which my firm, Instant Software, has either released or has ready for release. I needed a good sized firm which could translate our programs and distribute them in Japan. Despite the shortness of my visit to Tokyo, both of these objectives seem to have been accomplished. Time will tell.

The way for a visit with the people at Kenwood was paved by Ken Bourne W6HX, their US marketing manager. Everything went off in style, from being picked up at the hotel and driven to the factory to my talks with their engineers and a look at their production and research departments.

In the last few months I've written a good deal about some ideas I have for advancing ham equipment. I was hoping Kenwood might be interested in some of these ideas and perhaps put them through their research lab and end up with some practical equipment for us. Some of these ideas were first discussed at the 1980 Ham Industry Conference in Aspen and others have evolved since then. I find that I brainstorm the best with a group of ham engineers so I was really looking forward to the session.

All of the top people at Trio-Kenwood whom I met were accomplished in English, so our talks were not slowed down by the need for translations. The meeting started off with a presentation to me by Mr. Toshio Okuhara, the managing director, of a complete TR-2400 system. This a wonderful Japanese custom and one which I'm going to try to import.

The Kenwood factory, while obviously efficient and well organized, was not remarkably different from some American firms I've visited. The quantities of units made is not large enough for the use of really automated systems such as I saw in Korea, where they were turning out color television sets with hardly any manual labor at all. No, the big difference between Kenwood and the American firms I've visited lies in their research laboratory. This was big, busy, and packed with avid hams.

The idea for a subaudible tone for automatic identification of ham rigs, which I have discussed in my editorials, certainly intrigued them. I think this one development alone could bring about major changes (for the better) in amateur radio. Obviously it would spark a whole new generation of transceivers . . . plus a lot of adapters for older rigs. This is just one more

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

"And under the terms of the will, your uncle is leaving you $750,000—of which $50,000 must be spent for ham gear."

Simply... the Best

ICOM IC-255A

Features that have made the field proven and tested IC-255A the most popular 2 meter FM rig on the air today.

- ★ 25 W / 1 W battery saving output
- ★ Scanning (memory and programmable limit band scan), now with automatic scan resume
- ★ Programmable splits - Felxibility for new repeater offsets
- ★ Dual speed tuning - 15 KHz Steps, 5 KHz Steps with TS Switch depressed
- ★ 5 memory channels - For easy access to your favorite repeaters
- ★ Dual VFO's built in, lockable mobile mount, dynamic mic standard, RIT fine tuning.
- ★ Simple, easy to use single knob tuning system for mobile operation.

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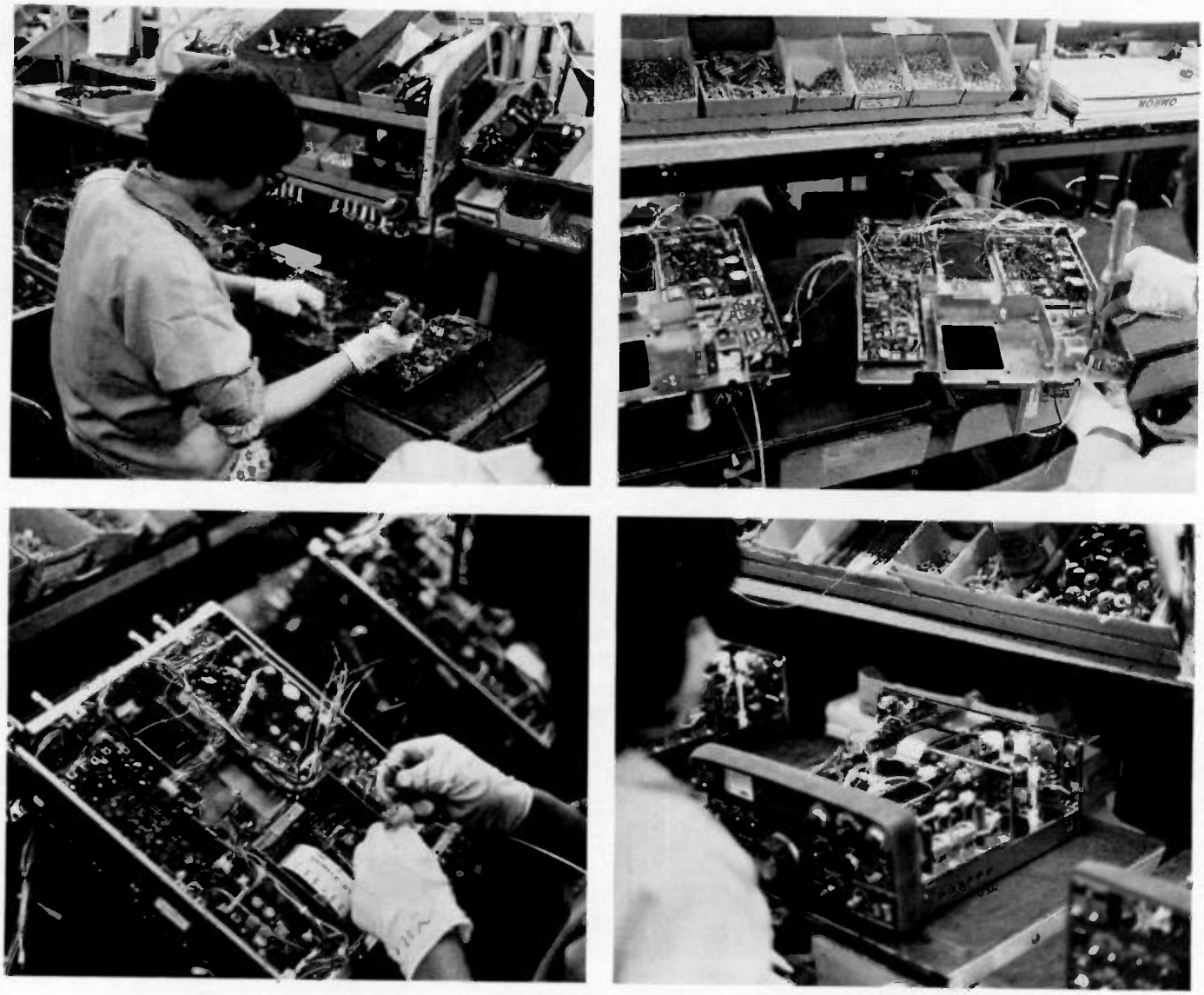


The empty chassis starts at one end and comes out with everything ready for testing.

A custom which is curious to Japan is one of presenting a gift to a visitor. While I'm usually good for a free lunch, here you can see Mr. Okuhara, the managing director of Kenwood, presenting me with a complete TR-2400 hand transceiver system . . . in return for a measly magazine.

marriage of digital electronics and amateur radio.

We also discussed some of the recent developments in narrowband single sideband which are promising us 5-kHz-wide repeaters for our VHF bands. Of course, if we are unable to get amateur radio back into a growth mode, we really won't need room for a whole lot more repeaters. I'm hoping that something can be done to get our growth back up over 10% so that eventually we'll be hurting for more repeater channels.

This meeting occurred before I'd bought one of the new Sony TC-300S stereo cassette recorders, so I hadn't yet come up with the idea for stereo double sideband. I did discuss DSB and its promise for providing up to 25 to 30 times more possible occupancy on our HF bands. I sure wish someone would start some work along that line. Will stereo be even better? We'll see.

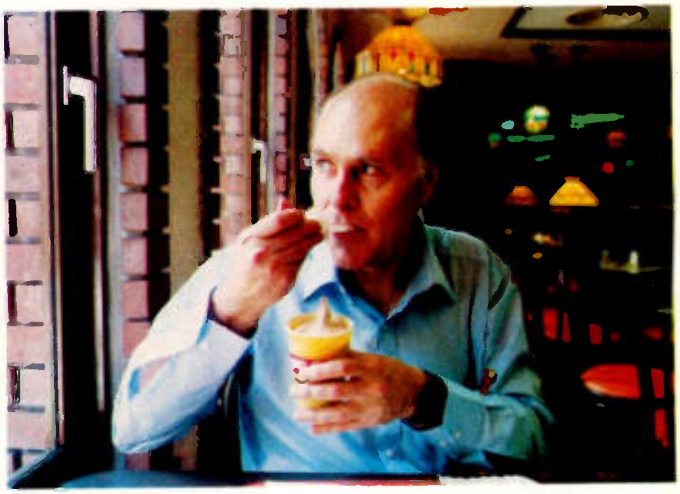
Our talking ran on into dinnertime, so they took Sherry and me to Tokyo's famous garden restaurant, Chinzan-So, a place for entertainIng honored guests (I got that from the brochure I picked up at the restaurant). The food, the service, and the location were spectacular.

Sometimes I get a bit depressed over not having the time and the facilities which I wish I had. I'd love to get into a lab for a few weeks and come up with a working piece of hardware for automatic identification. During these moments I suffer from flights of fancy about starting a lab and peopling it with ham experimenters. Then practicality sets in and I recognize that even if I was able to find people like that, there would be no way I could afford them. No, that sort of lab will have to be run by our manufacturers . . . for now.

You've heard about the high food prices in Tokyo? This is the menu at a food stand concession at the Consumer Electronic Show. Two hundred Yen is equal to $1 US, so you can see that the prices are not at all out of line with what you would pay at a concession stand in America. Soup needle, by the way, is noodle soup.

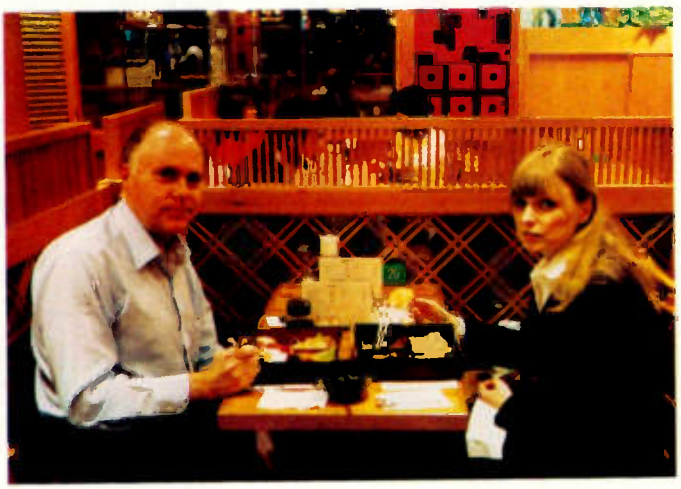
Here's Sherry working on the bowl of tempura soup needle ($1.75), which did a fair job of feeding both of us. In addition to the bowl of noodles and soup, there were a couple good-sized shrimp tempura.

Wendy's is not much different from anywhere else, with a double hamburger weighing in at around $3.15 with all the trimmings. One unusual item was a shrimp sandwich at $1.10.



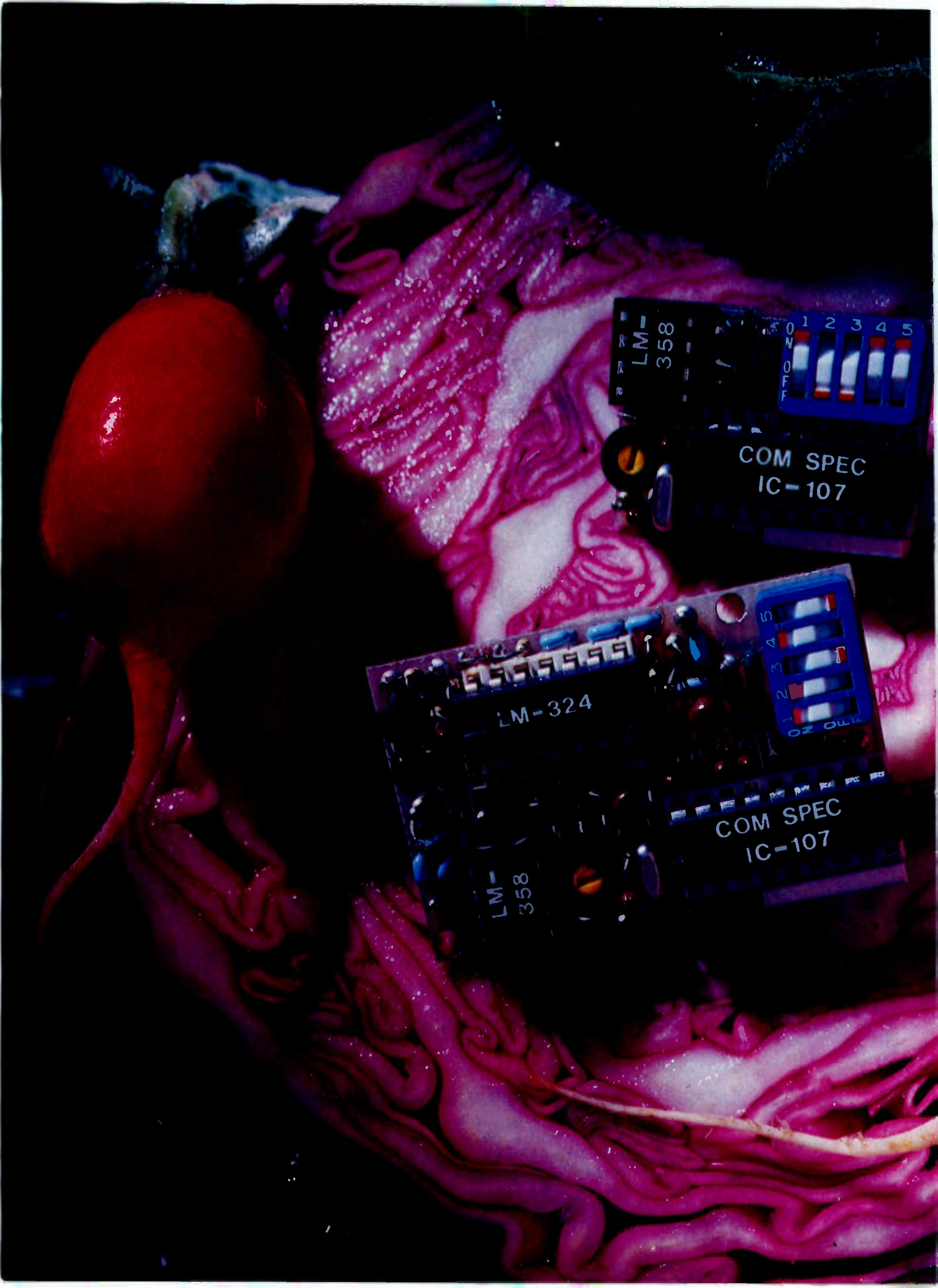
I'll let you in on a secret. . . Wayne really likes the Wendy's Frosty.

A recent television show discussed the Japanese approach to driving: They make a big deal out of driving school. Here is a practice driving course laid out on the top of a garage. It is busy all day long. Does this extra training pay off? You bet! Per capita, the Japanese have less than 3% as many accidents as we do. You rarely see a car with dents or signs of body work. It is almost enough to make a politician think. . . but not quite.



For about $6 you get a lacquer tray full of food. Delicious, and identical to the beautifully made plaster model in the restaurant window. All I had to do was take the waiter out and point and we got our meals.

Continued on page 110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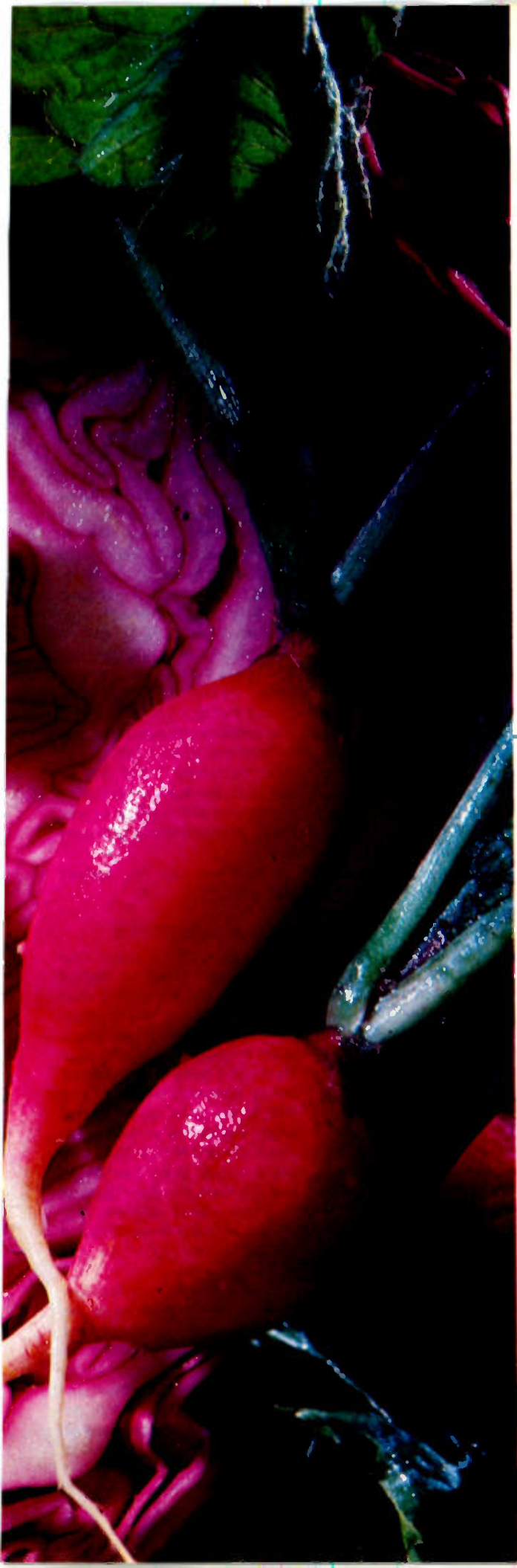

A fresh idea!

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 ± .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, ± .1 Hz maximum −40°C to +85°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°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**

VISA

COMMUNICATIONS SPECIALISTS

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15

LOOKING WEST

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

They're at it again. The spectrum thieves, I mean. Those who view the 220-to-225-MHz band with an acquisitive eye, envisioning huge corporate profits if they can find a way to steal the band from those of us who now occupy it. Maybe 220 CB is dead, and maybe "the ARRL slew it" as it is claimed. Anyway, the ARRL has not been all that successful in convincing other potential spectrum thieves that they mean business. Nor do I think they can. No, guys and gals, I don't think we can count on Newington to pull us out of this one. We are going to have to conquer this one on our own. It means pulling together and taking the offensive once and for all. You and I are going to have to fight hard to save 220. Don't look for help anywhere else.

It seems that the latest attack is coming from Inland Waterways again. That's the same group we thought we had trounced last year. I guess some people never learn, because they are again eyeing 220 to 225 MHz to relieve the purported congestion in the 160-MHz marine band. Last year they wanted to construct an "Inland Waterways Automated Data Relay" system along the Mississippi and connecting waterways. Now they want more room for boats to talk, and pass the time of day. What next?

Well, there is a "next." It seems that the manufacturers of cordless telephones are also eyeing 220. Cordless phones are becoming very popular these days, and the people who make them are running out of room on 72 MHz. So they are reported to be looking at new spectrum in both the 27-MHz CB band and the 220-MHz amateur band for their exclusive use. The December, 1980, issue of *Popular Electronics* carried a rather interesting article on the subject. If you are a 220-MHz user, I suggest you read it and respond to the editors. Maybe they can help get the word back to industry that there are several thousand of us who are not willing to just go away. You can kind of discount the 27-MHz idea as there is no way for the cordless phones to be compatible with current CB activity, either within 27 MHz or on either side. So in reality I think we can assume that it's 220 they will go after. We have a two-pronged attack on us it seems, and it might wind up to be one heck of a fight. Why? Because both of these entities seem to believe that 220 to 225 MHz is vacant spectrum, that it is not in use by anyone, and is, therefore, ripe for the taking.

There are many ways in which we can fight the problem. In the past we have always taken the nice-guy approach, and year after year we face the same threat. Maybe it's time to forget that we are usually ladies and gentlemen and take a hard line: that 220 to 225 MHz is amateur, and that it will always remain amateur. Sounds like a challenge to war, you say? I prefer to think of it as a response to a challenge. A response which will educate spectrum thieves with respect to the abundant amateur activity on 220 and the fact that this activity is there to stay. That we as amateurs learned our lesson well when the FCC took 11 meters and created the CB fiasco. That we will never permit this to happen again. That the band is ours, that all of our bands are ours, and that we are prepared to fight to retain every last kilohertz.

Frankly, most of the VHF/UHF experts I have spoken with agree that it would be impossible to share the 220 band with any other service, be it Inland Waterways, cordless telephones, or what have you. The way we have structured the band in its development over the past 5 or 6 years precludes this. It might be possible if we did not have repeaters sitting atop mountains with the ability to talk over several hundred miles. Even in areas where repeaters talk over only 50 or 60 miles, the mutual interference would be massive and intolerable. In the end you would have another 27-MHz fiasco and no way to solve the problem. One or the other would have to go, and I know that the amateur community would stand pat and not budge. This could and would lead to an ongoing confrontation between the business community and the amateur. It would be a war that neither side could win, so why have it in the first place?

There is no way that FCC regulation could help make this spectrum sharing work. Look at the record, look at the present mess, called 27-MHz, Class D CB. Here you are dealing with technologically-incompetent people, for the most part. Appliance operators who buy a legal radio, an illegal amplifier, and talk worldwide. Has the Commission been able to solve the regulatory enforcement problem? Has the linear amplifier ban worked? Has *any* regulation or attempted enforcement of the 27-MHz problem worked? The answer is a resounding no! The FCC says it lacks the funds to do an effective job of enforcement on 11 meters, but even if they had the monies, I doubt if they could catch any but the most hard-core offenders. And, of those already caught, how many turn out to be repeat violators who care little or nothing about the rules to begin with?

Until now, industry and others have viewed the radio amateur as the tinkerer who is given the cast-off frequencies until such time as they are needed by someone else. It is thought that once a need arises, we amateurs will simply vanish as mysteriously as we came. This is a stereotype upon which we are viewed and judged. In part, the stereotype is justified because we have projected this image for so many years that it has become the thinking of today's society. What many fail to recognize is that another type of amateur has emerged in recent times. He may or may not be a technical whiz kid, but no longer is he a back-room boy; he has social awareness. He is the kind of guy who will not be trampled on by others. In some cases, this may have manifested itself in contemptuous behavior—jamming, foul language, or what have you. But the majority are well-respected professionals. Doctors, lawyers, broadcasters. You name it. People with an ear to the ground and an eye on society. Activists with strong beliefs and ideals. Slowly but surely these people became dedicated to the preservation of the amateur service and to its continued vitality.

The spectrum thieves seem unaware that this has happened. They are used to dealing with the Newington types that they usually can walk all over. What they have yet to catch onto is that in the battle over 220 they will not be dealing with Newington but rather with the people now on the band. People who long ago turned a deaf ear to the ARRL and have fought and won wars for themselves. Most of the 220 people in my part of the nation turn to Newington the same deaf ear they turn to VHF. So, "Mr. Businessman," in this one you must face the angry mob alone. For the first time in its long history, the amateur service is ready to break out of its traditional good-guy role to do battle with what they consider to be the enemy. You, "Mr. Cordless Telephone" and you, "Mr. Inland Waterways," you're far from being our "good buddy." We know what you spectrum thieves want, and believe me when I tell you to look elsewhere...like 800 or 900 MHz. We don't want you on 220 or near 220. From us to you: Go play in the bathtub with a toy boat.

You can't say you weren't warned.

A BOOK REVIEW

Well, he's done it again. One never knows what to expect next out of Bob Heil K9EID. Just when the effects of his previous amateur-radio-related escapade seem to begin fading, Bob goes ahead and pulls another rabbit out of his bottomless hat and hits home once again. Bob's latest creation is a book titled *The 10-Meter FM Handbook*. I've got a better title: "Everything and Anything You Ever Wanted to Know About 10-Meter FM When You Didn't Know Whom to Ask the Questions Of." It's that inclusive.

For those of you who may not be familiar with Bob, he is the founder and president of Heil Sound Ltd., an electronics manufacturer of professional audio equipment for the entertainment industry. Since 1956, he has been one of the pioneers of VHF, SSB, and he spends a

Continued on page 106

DELTA RIG

THE TEN-TEC STATION FOR CHANGING TIMES

DELTA—symbol of change—and the first HF transceiver with all nine bands—offers more of the features you need for these changing times.

Tennessee Technology Leads The Way.

Today's operating demands the changes a DELTA station offers. All nine HF bands in all solid-state design with optimized receiver sensitivity and selectivity. 200 watt, 100% duty cycle no-tune transmitter. QSK, VOX, PTT, ALC, Notch, Offset, and more. All in a compact, ready-to-go-anywhere functional design that offers light weight, thorough shielding, and operating ease. And a price that permits affording the full complement of accessories. TEN-TEC put it all together—in DELTA—for you.

For The Change in Bands.

DELTA with all nine bands—another TEN-TEC "first." 160 through 10 meters, including the new 10, 18 and 24.5 MHz bands. (Crystals optional for 18 & 24.5 MHz). DELTA is ready.

For The Change in Band Conditions.

Optimized design for the ideal balance between sensitivity (0.3 μV for 10 dB S+N/N) and dynamic range (85 dB or better) plus switchable 20 dB attenuator that puts you in control of even extreme situations. No matter where you live or what power your neighbor is running, DELTA can handle it.

Super selectivity permits narrowing DELTA bandpass to suit the crowds. The four-position switch selects the standard 2.4 kHz SSB filter, adds a section of the 4-stage active audio filter, cascades an optional CW filter (for 14 poles of filtering), and cascades both filters with 4 stages of audio filters to give you the passband window you need with the virtually ultimate skirt selectivity required to knife through strong adjacent signals.

Built-ins to quiet the world. A *variable notch* filter is standard on DELTA. Vary from 200 to 3500 Hz to notch out interfering carriers or CW signals to a depth of 50 dB or more. *Offset tuning* for moving the receiver frequency ±1 kHz to reach that DX or to fine tune. *"Hang" AGC* to give you smoother receiver operation.

For The Change in Operating Styles.

Variety is the word for today, and DELTA offers it.

For a rag-chew with an old friend, 200 watts of SSB to the proven solid-state amplifier (designed by the leader, TEN-TEC) with built-in VOX and PTT.

For the fun of operating 200 watts CW with QSK—full, fast break-in that makes CW a conversation, saves time, and opens a window on DX.

Power up or down. Adjustable threshold ALC and drive let you choose power levels with full ALC control.

DELTA accepts what you have, what you want . . . from separate antennas to linears, transverters, remote VFO, 12 VDC, keyers and more—just plug in.

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DELTA moves with you. "At home" anywhere—on your operating desk, in the field, on a boat, plane, camper, wherever. Its neat small size (4¾"h x 11⅜"w x 15"d) and light weight (12½ lbs.) make it a good traveling companion. Yet compact as it is, DELTA panel size and knob spacing make it comfortable to use hour after hour in your home station.

For The Change In Economics.

These days, everyone wants more value for his money. And DELTA offers it. More features and performance per dollar. Quality that's American-made. Service you can count on. A solid warranty—one year on the transceiver plus an extra five year pro-rata warranty on the amplifier transistors. And low prices!

The DELTA Rig

Model 580 DELTA Transceiver	$849.00
Model 283 DELTA Remote VFO	179.00
Model 280 DELTA Power Supply	149.00
Model 282, 250 Hz CW Filter	50.00
Model 285, 500 Hz CW Filter	45.00
Model 234 RF Speech Processor	124.00
Model 214 Electret Microphone	39.00
Model 645 Dual Paddle Keyer	85.00

Other Optional Accessories

Model 670 Single Paddle Keyer	34.50
Model 227 Antenna Tuner	79.00

Isn't it time for you to change? Check the DELTA rig at your dealer or write for full details.

TEN-TEC, INC.
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RTTY LOOP

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

In all the years that I have been writing this column, I have always tried to keep the tone light and cheerful. It is with some regret, therefore, that I must alter the tone this month, as I begin with an obituary.

Although not involved with amateur radioteletype at its inception, being only twenty-eight years old, this youngster played an important role in the introduction of new features in RTTY operation, such as selective calling, that we still appreciate today. Most of us became acquainted with this relative newcomer after getting involved in RTTY, and many remain attached, even to this day.

Several siblings have been quite influential in the growing computer field and, in a wanton act of genocide, they also are being dispatched. Yes, we'll miss them. But have no fear, for in the surplus market they shall live on to be resurrected time and time again as this part and that is replaced, much as those long gone have done before.

What am I talking about? Why, the Model 28 Teletype®, of course! The Teletype Corporation will cease production of this venerable machine soon. Others in the line, most notably the ASCII Model 33, also will go out of production. While spare parts will be maintained, and most of us did not get ours new anyway, it feels like another era is passing by.

If one era passes, though, then another arrives—and that's just what I am going to write about this month. One of the most exciting new developments in ham RTTY is the introduction of the computerized RTTY terminal. It is hard to pick up a magazine and miss the ads for the many complicated boxes which seem to do everything but turn off the shack lights when you are done operating. And now, RTTY Loop will take a close look at one of them: the Microlog ATR-6800.

About three years ago, the Microlog Corporation, located here in Maryland, introduced a video RTTY system. Based on the Motorola 6800 microprocessor, the system featured separate transmit (AKB-1) and receive (AVR-1) units, a video monitor, and a raft of options. Buying one fully stocked would have cost you about twelve hundred 1978 dollars. As experience has been gained, new features have been devised and the company's latest offering, the ATR-6800, packs it all into one box only slightly larger than the keyboard of three years ago. For a shade under two thousand 1981 dollars, it runs rings around the old system. Unfortunately, some compromises had to be made to fit everything in there, and I will cover some of them after going over the highlights of the unit.

First off, what can it do? Well, the basics of the unit include a 6800 microprocessor supported by a monitor program in 2716 PROM, about 4K of RAM, and one and one-half PIAs. Into all of this is stuffed enough programming to satisfy almost any operator. Data exchange is by any of three modes: Morse code, Baudot code, or ASCII. Transmission rates are available for any common, and a few not so common, speeds. From the user's point of view, operation is remarkably constant no matter what the code, so let's look at that first.

The video display is a black and white 24-line-by-40-character display. At the top of the display, a dedicated line shows the current transmit/receive status, mode, speed, and time. The time is maintained in an internal twenty-four hour clock set from the keyboard. The display is selectable as white on black or black on white, and a zoom command produces a twelve-line-by-twenty-character display that can be read from across the room—even on the small Sanyo, nine-inch monitor. The display is normally maintained in a split-screen format with the transmit buffer on top and the received data below a dashed line. The transmit buffer display may be removed entirely or its size varied from one to twenty lines (seven lines maximum in the zoom format).

There are several outputs available from the ATR-6800 that allow interfacing to a wide variety of devices. Standard video goes to the monitor, of course. A high-speed mercury relay is available to insert in a loop supply to allow hard copy on a teleprinter. Computer-compatible RS-232 levels also are provided so that devices using this transmission standard may be connected. For turning the transmitter on and off, voltage keying is available for both positive and negative circuits. AFSK tones also are generated, and their frequency and shift may be specified from the keyboard. Options are available to either silence the output tones during receive or leave them on, thus allowing VOX keying, if desired.

Inputs include speaker audio as well as TTL or dry contacts for a hand key or whatever. Again, RS-232 interfacing is provided for users of this standard. Now, not only can you connect the receiver, transmitter, and old clunker printer, but interfacing is provided also for a standard cassette recorder. Why? To save pictures, messages, or whatever, and send these plus your own "brag tape." Keyboard controlled, of course. To aid in tuning, outputs are provided also for an oscilloscope which will display a "cross" type of tuning pattern on received signals.

The operating system provides several features which may be used no matter what the mode. An ID key may be programmed to send the station's identification whenever pressed, and an alternate (SHIFT-ID) can send another one, perhaps including an automatic CW ID for RTTY operation. Ten messages may be stored and recalled actively during a QSO. A test signal may be sent appropriate to the mode in use: RYRYRY in Baudot, U*U*U*U* in ASCII, or VVV in Morse. We've all heard of diddle, that familiar sending of LETTERS when not sending anything else. Well, when you select this mode in Morse, the time is filled with BT (-...-) so that the other guy does not think you died.

Let's see, what else can I tell you? You can tell the thing to send each letter as you type it, to delay sending a word until you type a space, or to send the whole line after a carriage return only. Makes editing nice and easy, especially on Morse. (I can type faster than I can send Morse—much faster!)

What's that you say, "the modes"? Ah, yes, the modes. Well, you see, you have your Morse, your Baudot, and your ASCII. Now, when you are in Morse, the transmit speed may be adjusted in one-word-per-minute increments from five to 199 words per minute. The receive speed is self-tracking to the speed of the sending station. All of the special Morse signs, such as SK, AR, BT, KN, and varied and sundry punctuation marks are supported. And, of course, all of the general features mentioned above work just fine. When you are in Morse, the front end of the ATR-6800 functions as a direct detector, looking for an 800-Hz tone. When it finds that frequency, it locks on and the fun begins.

Now, in Baudot you have a choice of 45.45 baud (also known as the 60-word-per-minute standard) as well as 50, 57, 74, and 100 baud, corresponding to 66, 75, 100, and 132 words per minute. All kinds of RTTY niceties can be called into play here, such as downshift (or non-downshift) on space, automatic carriage return, line feed after so many characters, or remoting to an external printer. In this mode, the input is routed through a computer-enhanced demodulator, which detects the usual 2125 Hz-2975 Hz pair, with other tones selectable from the keyboard.

By selecting one of the standard ASCII transmission rates, 110 or 300 baud, the encoding is switched to ASCII with the full character set supported. Much as with many other primarily uppercase machines, you must shift to get lowercase, but this is a minor inconvenience as text editing is not one of the primary applications of the machine. Although the full ASCII appears to be generated, the display ROM does not have all of the appropriate symbols in it. It uses, rather, several patterns of dots for several of the codes. This causes no real problem unless you are fond of braces instead of parentheses, or tildes, or several other of the less-used symbols.

Besides communicating on the air, the ASCII capability can be directed through a "computer" mode in which the ATR-6800 becomes essentially a stupid

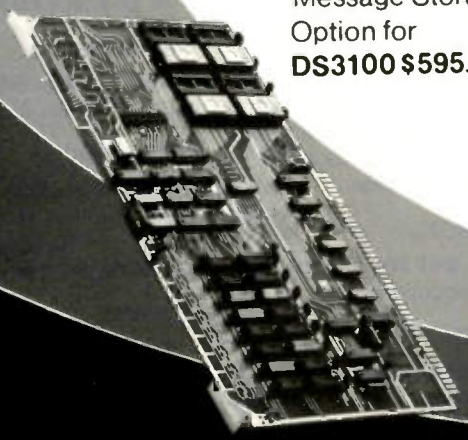
Continued on page 122

NEW FROM HAL

ELECTRONIC MAILBOX FOR RTTY

- DELETEF
- DIR
- ENDFILE
- EXIT
- FILEHELP
- HELP
- KY1ON
- KY1OFF
- KY2ON
- KY2OFF
- PRINTON
- PRINTOFF
- QBF
- READF
- RYS
- WRITEF

MSO-3100
Message Storage
Option for
DS3100 $595.00



DS3100ASR
$1995.00

The DS3100 Super Terminal is now even more versatile with the addition of the new MSO-3100.

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.

The MSO feature may be accessed from either the DS3100 keyboard or by other users through the WRU feature of the ASR terminal. Thus, messages can be written, played, and relayed with either remote or local control.

Automatic TX/RX relay control, CW ID, and user help messages make the "electronic mailbox" easy for all to use. This factory installed option may also be used for brag-tape and net bulletin preparation and storage.

Write or call us for more details.

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CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

CWSP INTERNATIONAL DX COMPETITION

0000 GMT February 7
2400 GMT February 8

Amateurs throughout the world are invited to participate in the annual CWSP contest using all bands on CW only. Entry classes include a) single operator, b) multi-operator (only club stations, single transmitter), and c) QRP limited to 10 Watts with a single operator.

EXCHANGE:

RST and QSO number starting with 001. CWSP members will add "/CWSP" after the report. QRP operators will add "/power." Example: 579015/5.

SCORING:

QSOs with same country = 1 point, other countries in same continent = 2 points, and other continents = 3 points each. Multipliers are ARRL DXCC countries and each Brazilian prefix (PY1, PT7, PS8, etc.). Multipliers are counted only once regardless of band. Final score is total QSO points times the total multiplier.

AWARDS:

Cup and award to 1st place worldwide. Medal and award to 1st place in each continent. Awards to 1st place in each country. Special awards to 1st and 2nd CWSP members. Other special awards for clubs and QRP 1st worldwide and 1st Brazil.

ENTRIES:

Logs must contain data and time in GMT, station worked, exchange, multipliers, and points per band. Please use separate logs for each band. Logs and summary sheet must be mailed not later than March 15, 1981, to: CWSP Contest Committee, PO Box 15098, 01000 Sao Paulo, SP —Brazil.

1980 RESULTS:

1st World = PY1ARS/4; 1st South America = PY8BI; 1st North America = WA4OML; 1st USA = W1OPJ.

NEW HAMPSHIRE QSO PARTY

2000 GMT February 7 to
0500 GMT February 8
1400 GMT February 8 to
0200 GMT February 9

Sponsored by the Concord Brasspounders, the contest is open to all radio amateurs. Each station may be contacted once per band, per mode.

EXCHANGE:

RS(T) and NH county/ARRL section or country.

FREQUENCIES:

CW — 1810, 3555, 3730, 7055, 7130, 14055, 21055, 21130, 28130.

Phone — 1820, 3935, 3975, 7235, 14280, 21380, 28575, 50.115, 145.015.

SCORING:

Score 5 points for each NH station contacted and multiply by the number of NH counties worked. NH stations score 1 point for each QSO and multiply by the total number of ARRL sections, countries, and NH counties.

ENTRIES:

Logs with summary sheet and dupe sheet should be mailed not later than March 16, 1981, to: O. W. H. Johnson, Box 63, Bristol NH 03222.

VERMONT QSO PARTY

2100 GMT February 7
0100 GMT February 9

Sponsored by the Central Vermont Amateur Radio Club, stations may be worked once per band and mode. VT mobile stations may be worked again considering each new county they enter as a new station.

EXCHANGE:

QSO number, RS(T), and VT county or ARRL section.

FREQUENCIES:

3685, 3909, 3932, 7060, 7265, 7290, 14060, 14290, 14345, 21060, 21375, 28100, 28600, 50.260, 50.360, 144-144.5, 145.8.

SCORING:

Score 3 points per contact and multiply by the number of VT counties worked on each band. VT stations score 1 point per QSO and multiply by the number of ARRL sections and countries worked.

AWARDS:

Certificates to highest scoring station in each ARRL sec-

CALENDAR

Feb 7-8	New Hampshire QSO Party
Feb 7-8	Two-Land QSO Party
Feb 7-8	RSGB 7-MHz Contest—Phone
Feb 7-8	CWSP International DX Competition
Feb 7-9	Vermont QSO Party
Feb 9-10	Land o' Lincoln QSO Party
Feb 14-15	QCWA QSO Party—CW
Feb 14-15	YL-OM Phone Contest
Feb 21-22	ARRL DX Contest—CW
Feb 27-Mar 1	CQ World Wide 160 Contest—Phone
Feb 28-Mar 1	G-QRP-Club CW Activity Weekend
Feb 28-Mar 1	French Phone Contest
Feb 28-Mar 1	RSGB 7-MHz Contest—CW
Feb 28-Mar 1	YL-OM CW Contest
Mar 7-8	1981 SSTV Contest
Mar 7-8	ARRL DX Contest—Phone
Mar 14	Boy Scout Exhibition Station
Mar 14-15	QCWA QSO Party—Phone
Mar 21-22	Bermuda Contest
Mar 21-22	CARF Phone Commonwealth Contest
Mar 21-23	BARTG Spring RTTY Contest
Mar 28-29	Spring VHF QSO Party
Mar 28-29	CQ World Wide WPX—SSB
Aug 8-9	European DX Contest—CW
Sep 12-13	European DX Contest—Phone
Sep 12-13	G-QRP-Club CW Activity Weekend
Sep 12-14	Washington State QSO Party
Nov 14-15	European DX Contest—RTTY
Dec 26-31	G-QRP-Club Winter Sports

RESULTS

Third DARC Corona 10-Meter RTTY Contest

Class A

N8ES	2340
DL5GAS	1739
WB2UEF	1548
OZ1CRL	1209
DF6ZV/A	1120
WA6WGL	962
AD0V	945
G3HJC	851
I5CBF	851
SL5AR	828
EA3BQQ	608
I0WBX	580
OK3KII	400
OK1WEQ	375
DL4GJ	364
G4HYD	325
EA3BLQ	322
DF8FD	231
W5TZB	084
DF6ZY	063
LA2IJ	050
LA7QM	025
Y32ZF	018
Y53UA	002

Class B

H. BALLENBERGER	972
WERNER LUDWID	580
OK1-20677	252
Y2-7111/A	144

tion and country. Trophy to highest scoring single-operator station in VT. Additionally, their names will be added to the Doris McGrath memorial plaque. Donated in memory of W1EOB, this award will be awarded in this manner for a 10-year period. The operator winning the QSO party the most times or the station with the highest score during the period will receive the plaque. Other certificates for 2nd, 3rd, and 4th highest scoring stations in VT. The W-VT (Worked Vermont) Award will be issued to stations working 13 out of Vermont's 14 counties, provided the station has not previously received this award. A special certificate will also be awarded VT multi-operator stations.

ENTRIES:

Send logs or facsimiles together with an SASE no later than March 31, 1981, to: Gerald W. Benedict, W1BD, 23 Foster Street, Montpelier VT 05602.

LAND O' LINCOLN QSO PARTY

0000 GMT February 9
2400 GMT February 10

The contest is sponsored by the Land o' Lincoln chapter of 10-X International in cooperation with the Central Illinois Radio Club. Operating throughout the 10-meter band on CW and phone, LOL and CIRC members will call "CQ LOL" in an effort to contact as many stations as possible.

EXCHANGE:

Name, QTH, RS(T), serial number, 10-X number if any, and LOL certificate number if any.

SCORING:

LOL certificate holders worldwide and CIRC members score 1 point per QSO, 2 points per QSO with 10-X number exchange, and 3 points per QSP with LOL number exchange. Multiply total QSO points (3 max per QSO) by number of different states, Canadian provinces, and DXCC countries worked.

All others, score 1 point per QSO with LOL certificate holders, 2 points per QSO with local LOL and CIRC members. Multiply total QSO points (2 max per QSO) by number of different states, Canadian provinces, and DXCC countries worked.

Achievement certificates will be awarded to the top scorers in each state, Canadian province, and DXCC country. A special Novice certificate will also be awarded. Make sure to denote Novice on your entry!

ENTRIES:

Logs, fully duped and summarized, to be submitted no later than March 15, 1981, to: AG9E, Dave Meiser, 1112 Andover, Bloomington IL 61701. Please include an SASE for special QSO and/or results.

QCWA QSO PARTY — CW

0001 GMT February 14
2400 GMT February 15

This is the 24th annual QCWA QSO party with separate weekends for CW and phone. Contacts with the same station on more than one band can be scored only once. Contacts made with "captive" stations, such as when operating in local nets, are not valid.

EXCHANGE:

QSO number, operator's name, and QCWA chapter identification (official number or name). Members not affiliated with a chapter should use "AL." If a member belongs to several chapters, then *one* must be chosen and used for the QSO Party. If desired, you may use one chapter for the CW Party and another one that you belong to for the Phone Party.

FREQUENCIES:

Any authorized amateur frequency is permissible. The following suggested frequencies have been selected to minimize interference to others:

Phone — 3900-3930, 7230-7260, 14280-14310, 21350-21380, 28600-28630.

CW — 3530-3560, 7030-7060, 14030-14060, 21040-21070, 28040-29070.

SCORING:

Each contact made with another QCWA member will count as a single point. Add up the contacts with QCWA members and then multiply this number by the number of Chapters represented.

AWARDS:

Plaques for the top phone and top CW scorers. Certificates will be given for the 2nd through 5th runners up in both the phone and CW Parties. Standings and scores will be published in the *QCWA NEWS* summer, 1981, issue.

ENTRIES:

Logs should include the following information: Time (GMT), call, QSO numbers, name, Chapter number or name, state or country. It is the responsibility of each contestant to provide a legible log (no carbon copies) and to list all claimed contacts. The total contacts for each page will be recorded at the bottom of each page. The total contacts for the Party should be recorded at the top-right of the first page of the log. Log sheets will not be returned. Make sure you have correct postage when you mail your logs. Send logs no later than March 31, 1981, to: Pelican Chapter QCWA, Arthur M. Monsees W4BK, 1407 48th Avenue NE, St. Petersburg FL 33703. Separate logs and scores must be submitted for both the CW and phone Parties. The decision of the Pelican Chapter of QCWA will be final with respect to scores and rules. In the event of errors or a disagreement, keep all details off the air and write either the Pelican Chapter or QCWA Headquarters.

Continued on page 108

RESULTS

RESULTS OF 1980 WASHINGTON STATE QSO PARTY

Alaska	
NL7D	330
Arizona	
W7ZMD	7,280
California	
N6PE	7,317
Colorado	
KA0CLS	1,411
Connecticut	
W1TEE	2,112
Florida	
N4IJ	1,118
Georgia	
N4NX	5,796
Idaho	
KB7N	33
Illinois	
W9QWM	3,486
Indiana	
WD8QBB/9	2,688
Iowa	
WB0UIT	374
Kansas	
K0TJB	506
Kentucky	
N4AOC	1,862
Louisiana	
W5WG	4,500
Maine	
WB1GLH	32
Maryland	
W3PYZ	966
Massachusetts	
W1AQE	1,395
Michigan	
W8WVU	1,092
Missouri	
K0RWL	2,520
New Jersey	
K9CW/2	1,040
New York	
W2RPZ	1,485
North Carolina	
K4YFH	1,190
Ohio	
W8EX	2,502
Oklahoma	
N5CII	351
Pennsylvania	
WA3JXW	351
South Carolina	
K4BZD	870
South Dakota	
WA0BZD	8
Tennessee	
WA4CMS	1,162
Texas	
W5VGX	3,759
Utah	
W7LN	1,078
Virginia	
W4KMS	1,001
West Virginia	
WA8CNN	561
Wisconsin	
K9GDF	1,386
Canada	
VE3KK	1,200
England	
G3MZV	432
Japan	
JA7KE	814
Peru	
OA8AX	24
Washington	
Clark	
W7FQE	1,488
Grant	
W7WMO	59,856
Jefferson	
W7IEU/7	3,888
King	
N7AYF	37,476
Kitsap	
W7DAZ	40,150
Kittitas	
KA7FWW	10,815
Mason	
WB7DZN	63,424
Pacific	
VE7ZZ/W7	174,141

Destined to become an old friend

This is one piece of equipment you'll keep for a *long* time. We've designed *out* the obsolescence with our new plug-in application modules. These fully shielded modules, about the size of a business card, will keep your ATR-6800 as new as tomorrow with updates, and future program expansion. You'll be proud of its top "on-the-air" RTTY/CW performance, and of its versatility as your HAM COMPUTER/STATION CONTROL. Make a permanent place in your station for the system that won't gather dust! ATR-6800 system with 10 practical programs in module number one, and nine inch video monitor . . . $2495. Companion printer, add $450. Module #1 separately, $189. Get to know the *active* hams at MICROLOG Corp., 4 Professional Drive, Gaithersburg, MD. 20760. Tel.: (301) 948-5307.

ATR-6800
COMMUNICATIONS SYSTEM

51 **MICROLOG**
INNOVATORS IN DIGITAL COMMUNICATIONS

ATR-6800 Standard Features

COMPATIBILITY with any radio transceiver. Simple speaker audio input, no extra equipment, terminal units, etc., required. Everything is built in. Narrow band single tone phase correlation detector for CW, dual tone computer enhanced demodulator for RTTY.

EXTENSIVE SHIELDING and a heliarc welded heavy aluminum enclosure for a degree of RFI immunity that plastic or loose sheet metal cased units cannot touch. Solid quality you can feel.

SPLIT SCREEN OPERATION allows you to type and edit your transmit text (up to 1800 characters) even while receiving. Location of split line (amount of viewable receive and transmit text) is keyboard programmable anywhere on the screen.

UP TO 10 INDEPENDENT MESSAGES of up to 80 characters each can be stored for instant recall.

WRU AND SEL-CAL MEMORIES for 'auto-response' capabilities.

BATTERY BACKUP MEMORY for all stored messages, ID and operating parameters means that when you lose power (or turn it off) the memory is retained. A full charge will hold memory for about two weeks. (Charging circuit built in.)

HARD COPY PRINTER INTERFACE actually converts any code input to your printer's code and speed. For example, MORSE code inputs to the ATR can be printed on any Baudot machine (Model 28, etc.). Baudot to ASCII or ASCII to Baudot conversion is easy and the line length is programmable.

AUTO-START inhibits display of non-RTTY signals.

AUTO CW ID IN RTTY shifts from RTTY to MORSE, sends your call and automatically shifts back to RTTY.

MICROLOG EXCLUSIVE NON STANDARD TTY SPEEDS plus all standard Baudot and ASCII speeds. (Ap. Mod. No. 1.)

MICROLOG EXCLUSIVE "SYNC-LOCK" ASCII @ 110 and 300 Baud is compatible with all other equipment. Sends standard ASCII codes with extended stop bit which prevents loss of sync on interference hits. This lowers the "info" rate while maintaining ASCII character rate.

ULTRA-CLEAN SYNTHESIZED SINE WAVE AUDIO outputs for AFSK, and SSTV are keyboard programmable for any tone pairs between 500 and 3000 Hz.

SOLID STATE SWITCHES as well as high speed mercury relay (n.o. and n.c.) keying outputs.

ZOOM DISPLAY MODE doubles the character size for even easier viewing. Video can be black letters on white background or reversed white on black.

TAPE RECORDER INTERFACE for pre-recording your message on standard cassette tape for later retransmission, or for direct recording of received signals or computer programs.

CONVENIENT SCOPE OUTPUT for RTTY tuning and a unique regenerated audio tuning aid for CW, as well as an LED for both modes.

KEYBOARD CONTROLLED TRANSMIT/RECEIVE RELAY for automatic transceive switching.

QUICK BROWN FOX, RYRY in Baudot. U*U* in ASCII and VVV in Morse stored in ROM.

RANDOM CODE GROUPS of 5 characters, MORSE or RTTY, for test transmissions.

INTERNAL 24 HOUR CLOCK displayed on screen may be inserted into transmit text at any time, or used in your computer program.

FULL 63 KEY COMPUTER GRADE KEYBOARD.

KEYBOARD CONTROLLED UNSHIFT on space in Baudot for auto reset to LTRS after reception of space.

VISUAL DISPLAY of all operating parameters shows system status and control commands.

REMOTE COMPUTER TERMINAL via built in RS-232 connector at rates of up to 9600 baud.

APPLICATION MODULE plugs directly into the rear panel connector.

MODULE NUMBER ONE INCLUDES:

AUTO SEND/RESPONSE — sends repetitive message, listens for reply, returns the call and alerts the operator.

SSTV — outputs standard SSTV tones for sending large screen characters and graphics.

MAIL BOX — unattended message store and retrieval.

RTTY SPEED SEEKER — determines the speed and code of an incoming signal.

LOG KEEPER — prints QSO, no., time, and log data.

NON STANDARD SPEEDS — ASCII operation at 10 to 100 baud.

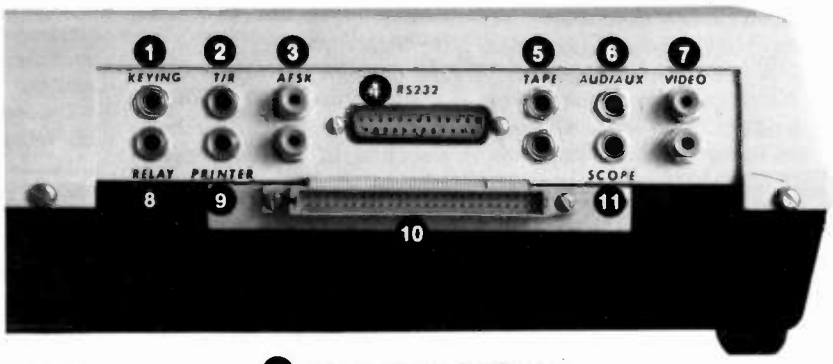
SELECTIVE PRINT — keywords enable/disable printer.

SPECIAL AUTO-START — inhibits display of "non-text" data.

DUMP TAPE — allows user to "dump" selected segments of memory to standard cassette tape.

SYSTEM DIAGNOSTICS — 3 self test modes.

REAR PANEL CONNECTIONS



1. SOLID STATE SWITCHES
2. TRANSMIT/RECEIVE RELAY
3. PROGRAMMABLE TONE OUTPUT
4. STANDARD RS-232 CONNECTOR
5. RECORDER INTERFACE
6. RECEIVE AUDIO IN
7. VIDEO OUTPUT
8. NO/NC RELAY KEYING
9. PRINTER OUTPUT
10. APPLICATIONS MODULE CONNECTOR
11. OSCILLOSCOPE OUTPUT

Reader Service—see page 146

AWARDS

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

ALGOA BRANCH MERIT AWARD

This past month some very encouraging letters of support have been received from all parts of the world. Of particular note was the letter I received from Fred Strutt ZS2JS, representing the Algoa Branch of the South African Radio League. In his letter, Fred tells of their new award recognizing operator efficiency in CW communications.

The Algoa Branch Merit Award will be issued to any radio amateur who has had a minimum of 250 CW QSOs with any other amateurs of the world.

To qualify, all contacts must have been made after January 1, 1979. While QSLs are not required, the applicant must have his list of contacts verified by at least two fellow amateurs or by a radio club secretary. Endorsements will be issued in increments of 250 CW QSOs.

To apply, forward your verified list of CW contacts and an award fee of five (5) IRCs to: Algoa Branch Merit Award, PO Box 10050, Linton Grange, Port Elizabeth 6015, South Africa.

It has been some time since we have listed an Asian continent award. Without further ado, allow me to share with you a letter I received from our dear friend, Mr. Green VS6EZ. In his letter, Anthony tells us of two awards being made available by amateur associates in his country, the Hong Kong Amateur Radio Transmitting Society (HARTS).

THE HONG KONG FIRECRACKER AWARD

Sponsored by HARTS, the Firecracker Award is issued to licensed amateurs and shortwave listeners worldwide. Contacts on or after January 1, 1964, are valid.

To qualify for their very spectacular diploma, applicants within zones 18, 19, 24, 25, 26, 27, and 28 require confirmation with at least 10 individual VS6 stations. All other zones of the world require only six (6) VS6 contacts to qualify for the award. Awards are issued for all CW, all phone, and mixed mode. Single-band accomplishments will be recognized if requested at the time of application.

Do not send QSL cards! Prepare a list of claimed contacts and have them verified by at least two amateurs or a radio club secretary. Forward this list and an award fee of 10 IRCs to: HARTS, Post Box 541, Hong Kong.

NINE DRAGONS AWARD

Probably one of the most elaborate of my Far Eastern awards is the achievement diploma known as the Nine Dragons Award. Sponsored by HARTS, this brilliant award with its red, black, and shiny gold accents an amateur's wall with the dignity that makes all award seekers proud.

To qualify, the applicant must make contact with a country in each of the following zones: 18, 19, 24, 25, 26, 27, 28, 29, and 30. The contact made in zone 24 must be with a VS6 station. Stations located within any of these nine zones will require two (2) contacts in each zone as above.

To be valid, all contacts must be made after January 1, 1979. There are no band or mode restrictions for this award; however, special recognition will be granted if requested at the time application is made.

To apply, prepare your list of claimed contacts and have it verified by at least two amateurs or a radio club secretary. Send this list and an award fee of $2.00 or 10 IRCs to: HARTS, Post Box 541, Hong Kong.

While in Asia, it would be proper to review one of the largest awards programs in that part of the world, the one sponsored by JARL, more commonly referred to as the Japan Amateur Radio League.

ADXA AWARD

Sponsored by JARL, the ADXA (Asian DX Award) is available to licensed amateurs and shortwave listening stations worldwide. To qualify, all claimed contacts must have been made on and after July 30, 1952.

The requirements for ADXA are fairly straightforward. Applicants must establish two-way contact with at least thirty (30) countries in the Asian continent. A list of eligible countries appears below.

Do not send QSL cards! Prepare a list of claimed contacts and have it verifed by at least two fellow amateurs or a local radio club official.

Forward your application and an award fee of 8 IRCs directly to: Awards Manager, JARL, Post Box 377, Tokyo Central, Tokyo, Japan.

ADXA Countries: A4, A51, A6, A7, A9, AP, BV, BF-BU, CR9, EP, EP, HM-HL, JA-JE-JJ, JR, JD1 (KG6I), JD1, JT, JY, OD5, S21, TA, UA9-UA0, UD6, UF6, UG6, UH8, UI8, UJ8, UL7, UM8, VS6, VU, VU2-VU7-VU9, VU5-VU7, XU, XV5 (3W8), XW8, XZ2, YA, YI, YK, 1S, 4S7, 4W, 4X4-4Z4, 5B4, 7O, 8Q6, 8Z4, 9K2, 9M2, 9N1, 9V1.

WORKED/HEARD ALL JAPAN PREFECTURES

Also sponsored by the Japan Amateur Radio League, the WAJA Award is available to licensed amateurs and SWL stations on a heard-only basis. All contacts, to be valid, must have been made on or after July 30, 1952. The only exception to that rule is for contacts with Okinawa (JR6), for which contacts on or after May 15, 1972, are considered valid for this award. In addition, all contacts must be made only with fixed base stations.

To qualify, the applicant must make contact with a Japanese amateur operator in each of the 47 Japanese prefectures as they appear below.

Do not send QSL cards! Have your list of claimed prefectures verified by at least two amateurs or a local radio club secretary. Send this list and an award fee of 8 IRCs to: JARL Awards Manager, Post Box 377, Tokyo Central, Tokyo, Japan.

Japanese prefectures: JA1—Tokyo, Kanagawa, Chiba, Saitama, Ibaraki, Tochigi, Gumma, Yamanashi; JA2—Shizuoka, Gifu, Aichi, Mie; JA3—Kyoto, Shiga, Nara, Osaka, Wakayama, Hyogo; JA4—Okayama, Shimane, Yamaguchi, Tottori, Hiroshima; JA5—Kagawa, Tokushima, Ehime, Kochi; JA6—Fukuoka, Saga, Nagasaki, Kumamoto, Oita, Miyazaki, Kagoshima, Okinawa (JR6); JA7—Aomori, Iwate, Akita, Yamagata, Miyagi, Fukushima; JA8—Hokkaido; JA9— Toyama, Fukui, Ishikawa, and JA0—Niigata, Nagano.

ALL JAPAN DISTRICTS AWARD

The Worked All Japan Districts Award is sponsored by the JARL and is available to licensed amateurs and SWL stations on a heard-only basis. This very basic award requires the applicant to make contact with one Japan station in each of the ten Japanese call districts.

This award is issued for single- and mixed-band accomplishments and also recognizes single- and mixed-mode achievements as well. To be valid, all contacts must have been made on or after July 30, 1952.

To apply, have your list of contacts verified by at least two amateurs or a local radio club official. Keep in mind that KA

stations (US military) will not be accepted for award credit.

Send your application with an award fee of eight (8) IRCs to the Awards Manager, JARL, Post Box 377, Tokyo Central, Tokyo, Japan.

JAPAN CENTURY CITIES AWARD

Similar to our own *73 Magazine* Century Cities Award, the Japanese version is sponsored by the JARL, requiring the applicant to make contact with a minimum of 100 individual cities within Japan. There are no further requirements and no stipulation as to band or mode. Endorsements are issued for each increment of 100 additional cities worked.

Applicants are asked not to send QSL cards! Prepare your list of cities in order of the city number. Though this may be confusing to some, it is best to write the JARL for a copy of this cities listing. This will enable you to make quick reference to the actual number assigned each city and will speed preparation of your application.

Once arranged in order, have your list of contacts verified by at least two fellow amateurs or a local radio club official. Send the application and an award fee of eight (8) IRCs to: JARL Awards Manager, Post Box 377, Tokyo Central, Tokyo, Japan.

As a final note, for those applicants who are fortunate enough to work all cities listed in Japan, a special Worked All Cities Award has been designed especially to recognize your feat!

Representing the Naniwa Club in Japan, Akio Sonoda JR3DDQ recently wrote me and asked that I share his club's new award with our many readers. With pleasure I present—

THE JAPAN OSAKA CENTURY CERTIFICATE

The JOCC Award is issued by the Naniwa Amateur Radio Club of Japan. It is made available to licensed amateurs throughout the world. To qualify for the award, applicants must submit proof of contact with stations within the Osaka prefecture. Three award categories are offered:

- Junior Class—applicant must work 10 JA stations which enable you to spell "NANIWA CLUB" with the last letter of each callsign contacted.
- Standard Class—applicant must work 10 different stations in the Osaka prefecture. Gold seal endorsements will be issued for each increment of 50.
- Special Class—applicants must work 100 different stations in the Osaka Prefecture, including 62 stations located in all 31 cities, 5 guns, and 26 wards of the prefecture. Note: A list of cities, guns, and wards is available from the Awards Manager for three (3) IRCs.

There are no band or mode requirements, but special recognition will be made if a request is made at the time of application.

Do not send QSL cards! Have your list of contacts verified by at least two amateurs or a radio club official. Send your application and eight (8) IRCs to the Awards Manger, Akio Sonoda JR3DDQ, 3-6-8 Daikoku-cho, Nanlwa-chu, Osaka, Japan 556. For Gold Seal endorsements,

Continued on page 114

OPERATION BALLARAT

There are at least two Ballarats. One is a thriving city in southern Australia, about 240 kilometers north of Melbourne. It boasts a population of approximately 75,000 and is the principal city in Australia's gold country. It is a modern city with an air of progress and prosperity.

In extreme contrast is the other Ballarat. It is an almost forgotten ghost town in the rugged desolate mountain range which rings California's Death Valley. The California Ballarat is tied to Australia's through a young prospector named George Riggins, who, in 1897, came from the famous Australian mining center of Ballarat.

The prospectors who gathered in the Panamint mountain range wanted a town named where they struck it rich. Riggins suggested the new town be given the name identified with gold the world over and it was named Ballarat. However, in the early decade of the new century, the mines were exhausted and the town of Ballarat, California, became deserted.

Now, almost 100 years later, amateur radio will briefly revive the town. For a short period during the winter weekend of January 30-31 and February 1, 1981, the old ghost town will become alive again. This time it will not be humming mining machinery or tall head frames towering above the hills hauling gold ore from the mine shafts. It will be humming from the sound of gasoline-driven emergency generators.

Towering beam antennas and dipoles will replace the head frames and ore crushers. The miners' trademark, the pick and the shovel, will be replaced with radio operators' microphones and headsets. The prize will not be the gold nuggets but a certificate, showing today's scene from both Ballarats, linked together, although 10,000 kilometers apart.

To participate in this first-of-a-kind event, you must contact both Ballarats on either 10, 15, 20, or 40 meters on SSB. Some of you may also be interested to know that the California Ballarat is located in sparsely populated Inyo County and is probably high on many county hunters' most wanted lists.

By this time, you may be curious enough to wonder how all this is going to happen. Early, Friday, January 30, an advance group will leave the Los Angeles area, drive about 400 kilometers through the Mojave Desert into the Panamints and what is left of Ballarat. A suitable site will be selected and a VHF station will be established to guide those that follow later that day.

When the four HF transceivers, three 500-Watt linear amplifiers, beam antennas, the 1-kW gasoline-electric generators, and the balance of the support equipment have arrived, we will start to set up. By then, the group of twenty will be in work teams with each receiving its task. The criterion to demonstrate the establishment of an emergency communications center in a desolate area within a two-hour period is just a side objective of this weekend activity.

At 0200Z on Saturday, January 31, we will be ready to go to work. We will operate 28.100-28.600, 21.135-21.370, and 14.275-14.350 MHz until 1400Z, February 2, when the last contact from the ghost town will be acknowledged.

We will first look for our namesake in Australia, as it would be nice to have the first contact with them. But here is what is important for you if want to participate and obtain a certificate. You must communicate with two out of twenty stations in Ballarat, Australia, and the one at the ghost town. Give your callsign and signal report. You will get an identifier, a sequential number, and the last two characters of the Ballarat station's callsign. It will always be 6C from the ghost-town station and two letters from Australia. Contact the other Ballarat and give your callsign and the identifier you received. It does not matter which Ballarat you contact first. That way we can verify that you qualify for the certificate.

Send your name, callsign, identifier, address, and one IRC (International Reply Coupon) to WA6NKL, 4817 Paseo de Las Tortugas, Torrance CA 90505, or VK3VEZ, 2 Cambridge Street, Wendouree, Victoria 3355, Australia. Your certificate will be on its way shortly. Good luck.

Paul M. Turkheimer WA6NKL

OSCAR ORBITS

Courtesy of AMSAT

The OSCAR satellites are subject to atmospheric drag, of course, and the present period of intense solar activity has accentuated the problem. During this period, our sun has been expelling huge numbers of charged particles, some of which find their way into the Earth's upper atmosphere, increasing the density (and thus the drag) there. It is through this region that the OSCARs must pass. OSCAR 8, in a lower orbit than OSCAR 7, is the more seriously affected of the two.

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 FEBRUARY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
28430	1	0050:07	88.5
28443	2	0144:22	102.1
28455	3	0043:40	87.0
28468	4	0137:55	100.5
28480	5	0037:14	85.4
28493	6	0131:28	99.0
28505	7	0030:47	83.8
28518	8	0125:02	97.4
28530	9	0024:20	82.3
28543	10	0118:35	95.8
28555	11	0017:53	80.7
28568	12	0112:08	94.3
28580	13	0011:27	79.1
28593	14	0105:41	92.7
28605	15	0005:00	77.6
28618	16	0059:15	91.1
28631	17	0153:30	104.7
28643	18	0052:48	89.6
28656	19	0147:03	103.2
28668	20	0046:21	88.0
28681	21	0140:36	101.6
28693	22	0039:54	86.4
28706	23	0134:09	100.0
28718	24	0033:28	84.9
28731	25	0127:42	98.5
28743	26	0027:01	83.3
28756	27	0121:16	96.9
28768	28	0020:34	81.7

OSCAR 7 ORBITAL INFORMATION FOR MARCH

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
28781	1	0114:49	95.3
28793	2	0014:07	80.2
28806	3	0108:22	93.8
28818	4	0007:40	78.6
28831	5	0101:55	92.2
28843	6	0001:13	77.0
28856	7	0055:28	90.6
28869	8	0149:43	104.2
28881	9	0049:02	89.1
28894	10	0143:16	102.6
28906	11	0042:35	87.5
28919	12	0136:50	101.1
28931	13	0036:08	85.9
28944	14	0130:23	99.5
28956	15	0029:41	84.4
28969	16	0123:56	97.9
28981	17	0023:14	82.8
28994	18	0117:29	96.4
29006	19	0016:47	81.2
29019	20	0111:02	94.8
29031	21	0010:20	79.7
29044	22	0104:35	93.2
29056	23	0003:54	78.1
29069	24	0058:08	91.7
29082	25	0152:23	105.3
29094	26	0051:41	90.1
29107	27	0145:56	103.7
29119	28	0045:15	88.5
29132	29	0139:29	102.1
29144	30	0038:48	87.0
29157	31	0133:02	100.6

OSCAR 8 ORBITAL INFORMATION FOR FEBRUARY

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
14834	1	0006:31	58.8
14848	2	0011:19	60.0
14862	3	0016:06	61.2
14876	4	0020:54	62.5
14890	5	0025:41	63.7
14904	6	0030:28	64.9
14918	7	0035:16	66.1
14932	8	0040:03	67.3
14946	9	0044:51	68.5
14960	10	0049:38	69.8
14974	11	0054:25	71.0
14988	12	0059:13	72.2
15002	13	0104:00	73.4
15016	14	0108:47	74.6
15030	15	0113:35	75.8
15044	16	0118:22	77.0
15058	17	0123:09	78.3
15072	18	0127:56	79.5
15086	19	0132:44	80.7
15100	20	0137:31	81.9
15114	21	0142:18	83.1
15127	22	0003:53	58.5
15141	23	0008:40	59.8
15155	24	0013:27	61.0
15169	25	0018:14	62.2
15183	26	0023:01	63.4
15197	27	0027:48	64.6
15211	28	0032:35	65.8

OSCAR 8 ORBITAL INFORMATION FOR MARCH

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
15225	1	0037:22	67.0
15239	2	0042:09	68.3
15253	3	0046:56	69.5
15267	4	0051:43	70.7
15281	5	0056:30	71.9
15295	6	0101:17	73.1
15309	7	0106:04	74.3
15323	8	0110:51	75.5
15337	9	0115:38	76.7
15351	10	0120:24	78.0
15365	11	0125:11	79.2
15379	12	0129:58	80.4
15393	13	0134:45	81.6
15407	14	0139:31	82.8
15420	15	0001:06	58.2
15434	16	0005:53	59.4
15448	17	0010:40	60.6
15462	18	0015:26	61.9
15476	19	0020:13	63.1
15490	20	0024:59	64.3
15504	21	0029:46	65.5
15518	22	0034:33	66.7
15532	23	0039:19	67.9
15546	24	0044:06	69.1
15560	25	0048:52	70.3
15574	26	0053:39	71.6
15588	27	0058:25	72.8
15602	28	0103:12	74.0
15616	29	0107:58	75.2
15630	30	0112:44	76.4
15644	31	0117:31	77.6

FUN!

John Edwards WB2IBE
78-56 86th Street
Glendale NY 11385

DXing! Some call it a passion, others call it an addiction; many call it nothing at all and blithely work W8s and KA6s. Whatever your personal opinion, it's evident that DXing is a primary motivating force behind all of amateur radio. After all, even if you don't work DX, chances are it still directly affects your day-to-day hamming. (Ever try to work a friend in another state on 14.210?)

When did DXing start? Probably the first time a ham attempted to work a station over a distance greater than to his neighbor. Legend has it that the first pile-up occurred the following day. Want to learn more? Read on.

ELEMENT 1—CROSSWORD PUZZLE
(Illustration 1)

Across

1 Famous DXpedition island
8 Lebanese prefix
9 Prefix of 1 across
10 Japanese rig: rice_____
12 Father Moran's country
14 Over
15 Greenland—MARS prefix
16 Region 1 continent (abbr.)
19 International radio regulators (abbr.)
20 Ten, at night, on cycle's bottom
21 Greek prefix
23 DXer's reaction to hearing a new country
26 Home QTH for many
28 OSCAR group (abbr.)
30 Morse question mark
31 Egyptian prefix
33 Italian prefix
34 Time when you want QSLs
37 Foreign QSL clearinghouse (2 words)
41 WARC site
43 Four-land state (abbr.)
44 Good night (abbr.)
47 DX operating technique (2 words)

Down

1 Competitive pastime
2 Mystery signal (abbr.)
3 DX operating trap
4 Rig's output (abbr.)
5 5V-land
6 Noise blanker (abbr.)
7 New country journey
11 Greenland prefix
13 Canadian Island (abbr.)
17 _____ the list
18 Rare DX makes this
22 Test item (abbr.)
24 Operating establishment (abbr.)
25 Turkish prefix
27 Top scorer in DX contest
29 Get on the _____
35 Austrian prefix
36 Eight-land state (abbr.)
38 Revilla Gigedo's prefix
39 Radar image
40 Soviet prefix
42 CW "once more"
45 No good (abbr.)
46 Irish prefix

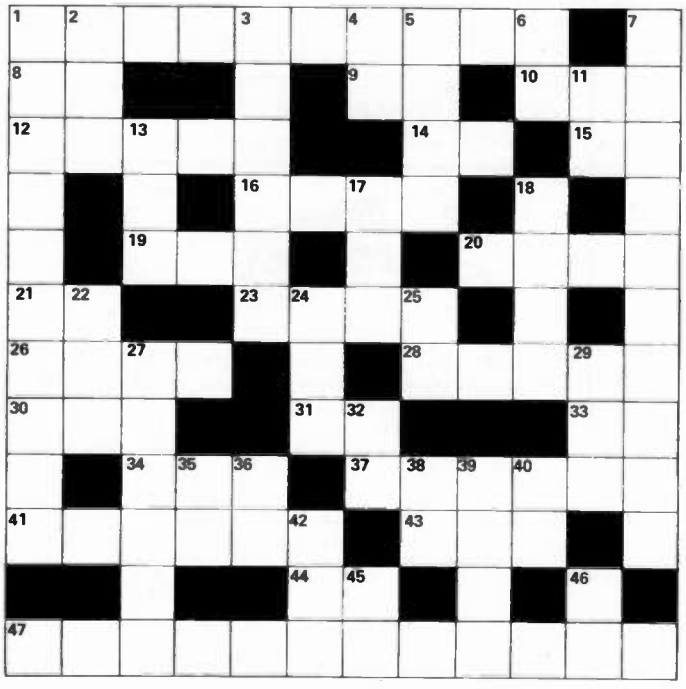


Illustration 1.

ELEMENT 2—MULTIPLE CHOICE

1) On what frequency will you find the Afrikaner Net?
1) 14.230 MHz
2) 14.250 MHz
3) 21.355 MHz
4) 28.510 MHz

2) WWV transmits solar activity bulletins:
1) 12 minutes before the hour
2) 18 minutes before the hour
3) 18 minutes after the hour
4) WWV does not transmit solar activity bulletins

3) We are currently experiencing solar cycle:
1) 21
2) 41
3) 610
4) 20

4) 160-meter DXers have to compete against LORAN generated QRM to find weak signals. Although this nuisance is now on the way out, it still pays to know your enemy. Therefore, what is LORAN an acronym for?
1) Liquid Oxygen Radio—And Nitrogen
2) Long Range Navigation
3) Low Ocean Radiation Aided Navigation
4) Long Radio Antenna

5) Which country listed below does not have a third-party agreement with the US government?
1) Cuba
2) Bolivia
3) Israel
4) Belize

6) Who was the first amateur to snag DXCC on 6-meters?
1) WB2LWJ
2) W2IDZ
3) W6AM
4) No amateur has ever worked 100 countries on 6

7) What phone frequencies are allocated to European (except Soviet) amateurs?
1) 3.6-3.8 MHz
2) 3.5-4.0 MHz
3) 3.5-3.8 MHz
4) 3.7-3.8 MHz

8) The term "master of ceremonies" (MC), when applied to DXing, refers to:
1) A DX operator
2) A QSL manager
3) A person in charge of organizing a DX list
4) A lid who disrupts a net

Continued on page 115

With the Yaesu FT-480R . . .

TWO METERS COMES ALIVE!

SSB activity is flourishing, repeater activity is at an all-time high, and OSCAR users are breaking records every day. Let the FT-480R step you up to space-age performance on SSB, CW, and FM.

Features

- Coverage of 143.5 - 148.5 MHz (good news for you MARS operators)
- USB, LSB, CW and FM operation are all built-in
- Four channels of memory, with priority channel
- Two VFOs for unusual repeater splits
- Convenient synthesizer steps: 10 Hz, 100 Hz, or 1 kHz per step on SSB/CW, 1 kHz, 20 kHz, or 100 kHz per step on FM
- Scanning control from microphone
- Highly effective noise blanker
- Receiver offset tuning for following Doppler-shifted signals
- SAT switch allows shifting of transmit frequency during OSCAR operation (many rigs cannot QSY on TX)
- 30 watts DC input on FM/CW, 30 watts PEP input on SSB, HI/LOW power selection on FM and CW
- Built-in tone burst generator
- Bright LED signal strength/relative power output level meter
- Easy-to-read fluorescent display of operating frequency and memory channel
- Front panel switch for zeroing synthesizer to convenient step when changing modes from SSB/CW to FM
- Requires 13.8 VDC, negative ground

Available Options:

FP-80 AC Power Supply
FTS-64E Synthesized CTCSS/Burst Encoder

Price and specifications subject to change without notice or obligation

Did You Know . . .
Yaesu now has a crystal-controlled 220 MHz FM rig — The FT-127

FLASH!
Also Now Available
NEW FT-680R USB/CW/AM/FM
6 Meter Transceiver

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The radio.

1080

YAESU ELECTRONICS CORP., 6851 Walthall Way, Paramount, CA 90723 ● (213) 633-4007
YAESU ELECTRONICS Eastern Service Ctr., 9812 Princeton-Glendale Rd., Cincinnati, OH 45246

LETTERS

BASH VS. FAA

The letters in reply to the September article on Dick Bash indicate there are many different views on the propriety of his publishing the questions and answers to the various amateur radio tests.

It is interesting to note that at least two readers had comparisons with the FAA written tests, and I agree in principle with Mr. Remont and his opinion, "You must literally learn the test" in order to pass them.

Mr. Hauser, however, has not done his homework regarding manuals on the FAA written tests. I've identified at least 16 written test guides published by the FAA itself. These test guides cover the pilot written tests from private pilot to airplane transport ratings, the instrument and instructor ratings, plus flight engineer and navigator ratings.

Most of the later FAA written test guides are formatted very similar to the actual written tests, with the subject areas corresponding to those on the test, including questions that may even be word for word with the actual test questions, even to the four multiple-choice answers.

On the last FAA written test that I took, the commercial pilot exam, I believe that 32 of the 60 questions on the test were identical to the ones in the study guide. But bear in mind that the FAA has a slightly different approach to their written tests. The actual test booklet has, in the case of commercial pilot, 600 questions, but the test itself has only 60 questions, and the test sheet given to the applicant indicates which of the questions the applicant must answer.

The FAA written test guides do not have the answers indicated, but at least two aviation ground school operations have published answers and explanations in booklets available to the public. In addition, any pilot wishing to take weekend "cram" courses for an exam can find them within easy driving distance almost any weekend.

Yes, I suppose a person could pass an FAA written exam by memorization. But if a person memorized the 600 questions, surely he would have some understanding of what the FAA requires an airman to know.

But there is one more thing to consider. An applicant for an FAA written test has to produce evidence, a certificate or statement from a flight or ground school instructor that the applicant has undergone a course of instruction preparing him for the exam to be taken. This precludes an airman from simply memorizing the test guide, and then taking the FAA written test.

I hold a commercial pilot's license with multi-engine, land, and instrument ratings.

Sheldon Daitch WA4MZZ
Greenville NC

HORDES OF LIDS

I would like to comment on certain readers' reactions to Dick Bash's interview in *73*: How soon we forget! Anyone who remembers the old (small-format, black-cover) *ARRL License Manual* will recognize Bash's book as approximately the same thing only with more accurate questions/answers. I don't remember anyone taking the League to task for publishing the old-format *Manual* (not to be confused with the new one which might teach theory but does nothing to help you pass the test). And, what of those "schools" that drill you on questions and answers so you can pick up a First Phone? I've met graduates of these "schools" that barely know the difference between ac and dc!

I, like most who took the Extra, noticed that technical competence alone would not get you a passing grade—you needed to know how to interpret the confusing semantics of the test questions.

As for the fears that the Bash approach of licensing will produce hordes of lids, I would like to have those of you who feel this way tune in to the average DX pile-up on the low end of 20m phone. And a lot of these guys are old-timers! You'll notice that the FCC exam says nothing about tact, diplomacy, etc., in operating!

Amateur radio is something that is learned by doing, not memorizing. If you have to memorize to pass the test, so what! Your real learning begins the moment you first press a transmit switch.

Fred Heisler K5FH
New Orleans LA

PASS THE WORD

We departed California on 1 October, 1980, and flew directly to Athens, Greece. The next 10 days were spent clearing customs and obtaining our licenses.

It was only through the efforts of SV1JG and SVØAA that we got our licenses that fast. Anyone going to Greece should apply at least 2 months before arrival.

We got on the air from Crete Island as W6KG/SV9 on 12 October and by 26 October we had 9500 QSOs, half phone and half CW. We worked stations in 142 countries and were on all bands permitted in Greece.

160 meters is not permitted yet for use by Greek amateurs. Operation on 40 meters is limited to 7000 kHz through 7100 kHz, and on 80 meters to 3,500 kHz through 3,600 kHz. We were on 48 hours in the *CQ* World-Wide phone contest and made the highest score for Crete.

The tourist business is a major industry in Greece, and, as a result, all of the islands have great numbers of hotels and everyone in the hotels and shops speaks English.

We try to use Lloyd's call in one country and Iris's call in the next. From here, we go to Rhodes Island in the Dodecanese and will use Iris's call there as W6QL/SV5.

We expect to be on the air almost continuously for 6 months—please pass the word to everyone.

Lloyd Colvin W6KG
Iris Colvin W6QL
Castro Valley CA

FINALLY PASSED

I'm sure that by this time everyone is tired of reading letters about FCC exams and Dick Bash, but if you will permit me, I should like to offer some of my observations and experiences.

After failing the General class exam three times, I was sorely tempted to buy a copy of *The Final Exam*. All that prevented me was the fact that the publication was unavailable. All stores and mail-order companies were sold out and had no idea when new copies would be available, since a revision was in the works due to new FCC exams.

Why was I so tempted? Here's why: The second time I failed the test, I went home and wrote down the gist of every question I could remember from the test. I came up with 47 out of 50. I still failed! My contention, and my biggest complaint, is I failed simply because I had no way of knowing which answers were wrong! Since the FCC examiner will not allow applicants to see their corrected tests, I think I kept missing the same 14 questions!

When I finally passed this week, I missed 9, but I sure couldn't tell you which 5 questions I finally answered correctly! I guess I was lucky to pass at all, but since I was given the exact same exam every time, maybe I just finally eliminated all the wrong answers on the "guess" questions. (Four possible answers, four attempts; the law of averages caught up with me.)

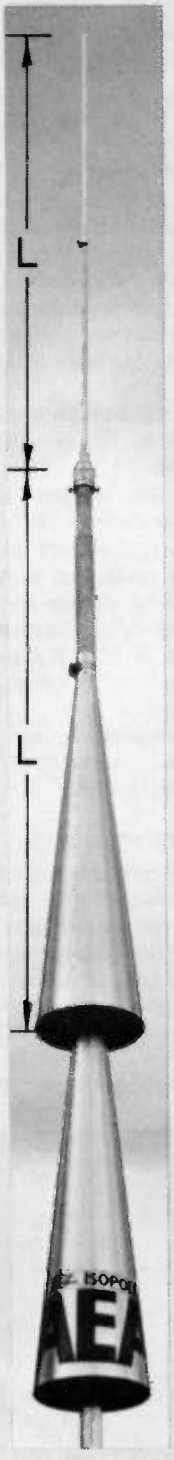
I'm sure that some will say that since I had managed to remember most of the questions, I should have been able to research the correct answers, but the FCC "trick," or what I considered to be vaguely worded questions, defied research. I asked my husband (a long-time electronics and radio hobbyist), Advanced class hams, and even my brother-in-law, who just spent four years working communications in the Navy, and could come up with no answers. I am not an electronic-minded whiz kid, and I guess I'm just lucky the General exam is mostly rules, regulations, and propagation. Otherwise I would be a Novice for life.

I know that there are amateurs who have no use for the "social" operators, but I am proud to be a radio amateur, and though I have great respect for anyone holding an amateur license (especially Advanced and Extras), I feel that I am, in my own "social" way, contributing to the "advancement of skills in

Continued on page 122

MORE PERFORMANCE FOR YOUR DOLLAR! COMPETITORS KNOW ABOUT THE ISOPOLE™

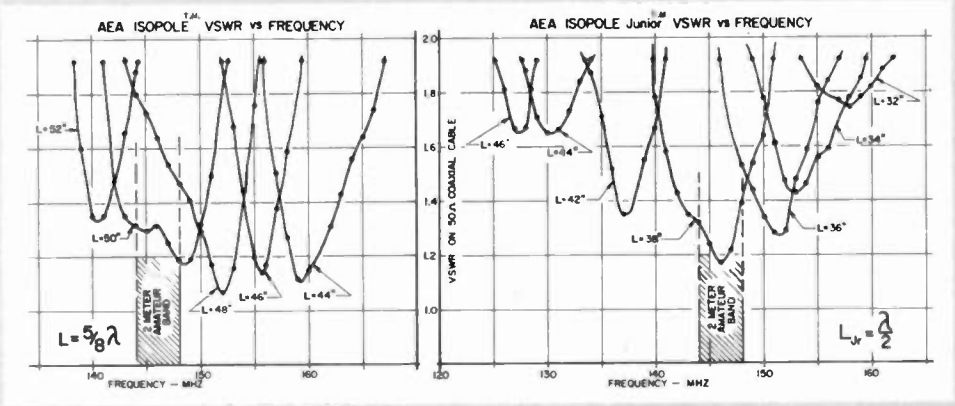
DO YOU? STUDY THE FACTS . . .



ISOPOLE 144
$49.95
ISOPOLE 220
$44.95
MAST NOT SUPPLIED

The IsoPole is building a strong reputation for quality in design and superior performance. The IsoPole's acceptance has already compelled another large antenna producer to make a major design modification to his most popular VHF Base Station antenna. Innovative IsoPole conical sleeve decouplers (pat. pend.) offer many **new** design advantages.

All IsoPole antennas yield the **maximum gain attainable** for their respective lengths and a zero degree angle of radiation. Exceptional decoupling results in simple tuning and a significant reduction in TVI potential. Cones offer greater efficiency over obsolete radials which radiate in the horizontal plane and present an unsightly bird's roost with an inevitable "fallout zone" below. The IsoPoles have the broadest frequency coverage of any comparable VHF base station antenna. This means no loss of power output from one end of the band to the other, when used with SWR protected solid state transceivers. **Typical SWR is 1.4 to 1 or better across the entire band!**



Outstanding mechanical design makes the IsoPole the only logical choice for a VHF base station antenna. A standard 50 Ohm SO-239 connector is recessed within the base sleeve (fully weather protected). With the IsoPole, you will not experience aggravating deviation in SWR with changes in weather. The impedance matching network is weather sealed and designed for maximum legal power. The insulating material offers superb strength and dielectric properties plus excellent long-term ultra-violet resistance. All mounting hardware is stainless steel. The decoupling cones and radiating elements are made of corrosion resistant aluminum alloys. The aerodynamic cones are the only appreciable wind load and are attached directly to the support (a standard TV mast which is **not supplied**)

Operating on MARS or CAP? The IsoPole and IsoPole Jr. antennas will typically operate at least ± 2 MHz outside the respective ham band without re-tuning. However, by simple length adjustment, the IsoPoles can be tuned over a wider range outside the ham bands.

Our competitors have reacted to the IsoPole, maybe you should too! Order your IsoPole or IsoPole Jr. today from your favorite Amateur Radio Distributor. For more information on other exciting AEA products, contact Advanced Electronic Applications, Inc., P.O. Box 2160, Lynnwood, WA 98036. Call 206/775-7373

ISOPOLE
144JR
ISOPOLE
220JR
$39.95
MAST NOT SUPPLIED

AEA Brings you the Breakthrough!

PRICES AND SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE OR OBLIGATION.

NEW PRODUCTS

NEW AUTOMATIC ANTENNA TUNER

A new automatic antenna tuner for use with amateur, commercial, and government communications systems has been introduced by the J. W. Miller Division of Bell Industries.

Auto-Track Model AT2500 antenna tuners can handle power in excess of 2500 Watts PEP over a frequency range continuous from 3 to 30 MHz. Average automatic tune-up time is 15 seconds.

Front panel switch positions permit the use of three coaxial antenna outputs, one long-wire antenna, and one coaxial tuner bypass. Impedance is 10-300 Ohms. A direct-reading swr meter on the front panel is calibrated from 1:1 to infinity.

The panel meter displays rms power with continuous carrier and automatically displays peak when in the SSB mode in ranges of 0-250 Watts and 0-2500 Watts.

Additional information may be obtained from Curt Henius, *J. W. Miller Division of Bell Industries, 19070 Reyes Avenue, Compton CA 90224.* Reader Service number 483.

FT-480R TWO-METER SSB/CW/FM TRANSCEIVER

Yaesu's FT-480R is a compact SSB/CW/FM transceiver for the two-meter operator. Rated at 30-Watts PEP input on SSB, 30-Watts dc input on CW and FM, the FT-480R covers 143.5-148.5 MHz, with two vfos providing coverage of repeaters not using the standard +600-kHz split which is built into the set. The microcomputer circuitry built into the FT-480R allows ease of operation. For example, when tuning on SSB/CW, the frequency synthesizer automatically tunes at 10 Hz, 100 Hz, or 1 kHz per step (three rates available), or 1 kHz, 20 kHz, and 100 kHz per step on FM. At the flick of a switch, you can zero the display to an even-channel step (when switching from SSB to FM), thus avoiding the nuisance of being a few hundred Hertz away from a "standard" channel when changing modes.

The rig has four memories with priority channel operation, scanning from the microphone, a noise blanker, high/low power selection on CW/FM, and provision for changing frequency during transmission. A matching external power supply, the FP-80, is available for ac operation.

For further information, write *Yaesu Electronics Corporation, 15954 Downey Ave., PO Box 498, Paramount CA 90723.* Reader Service number 482.

The FT-480R two-meter SSB/CW/FM transceiver.

THE 173D PRESENTATION MODEL CLOCK

Benjamin Michael Industries, Inc., has announced the addition of the 173D Presentation Model clock to its line of quartz digital timepieces. The 173D will be of particular interest to those involved in the aviation or communications industries where both local and Greenwich Mean Time (Zulu) is needed.

The 173D is a wall or desk piece which contains two independent digital electronic clock movements. Greenwich Mean Time is displayed in the proper 24-hour military time format while local time is simultaneously presented in a 12-hour format with am/pm indicators. Both large displays are of the LCD type for easy viewing and low power consumption. The 173D features quartz-crystal accuracy along with one year of operation on a single, standard penlight battery. The clock comes in a solid walnut case; the face plate is gold anodized, brushed aluminum.

For more information, contact *Benjamin Michael Industries, Inc., 65 East Palatine Road, Prospect Heights IL 60070.* Reader Service number 480.

NEW TEN-TEC DUMMY LOAD IS AIR COOLED

A new rf dummy load from Ten-Tec is air cooled for clean, easy use around the shack in testing and alignment. It is rated at 300 Watts for 30 seconds. A derating curve is included for using the dummy load over periods of time up to a 5-minute maximum.

Vswr is 1.1:1 maximum from 0-30 MHz and 1.5:1 maximum from 30-150 MHz.

The Model 209 weighs ½ pound and is housed in a 1¾"H × 2¼"W × 6¾"D aluminum enclosure that is perforated with wide slots for free air flow and dark-painted for more effective heat dissipation. An SO-239 coax connector is built in for convenient installation.

For more information, contact *Ten-Tec, Inc., Highway 411 East, Sevierville TN 37862.*

NEW HAMTRONICS KITS

Hamtronics® has announced a new single-channel UHF FM exciter called the model T451. Patterned after the T450 exciter, the new unit is rated at 2-Watts continuous output and is contained on a 3 × 5½ inch PC

Continued on page 120

A Bell Industries antenna tuner.

The Benjamin Michael 1730 Presentation Model clock.

REVIEW

CROWN MICROPRODUCTS ROM-116 RTTY INTERFACE AND OPERATING SYSTEM

There are many changes and technical improvements taking place in amateur radio these days, and some of the most profound changes are in the field of radioteletype (RTTY). One could say that the electronic revolution is taking place a little late in RTTY, but there can be no question about it; it is taking place. The noise and aggravation of mechanical RTTY gear has kept many hams from trying out this fascinating mode, but it is time to reexamine the situation. Electronic technology is arriving in force, and there are several manufacturers producing totally silent RTTY equipment that either incorporates a microcomputer on board or interfaces with one of the popular microcomputers such as the Apple, TRS-80, Pet, etc. There are many advantages other than silent operation, however, and the Crown Microproducts ROM-116 RTTY interface and operating system is a perfect example of what can be done with a microcomputer. With no further delay, let's examine this system and find out how easy and, indeed, how much fun RTTY operation can be.

The ROM-116 is an interface board and computer program that allows a TRS-80 microcomputer to operate as a computerized solid-state teletype machine. You connect a transceiver and demodulator to the ROM-116 and the ROM-116 to your TRS-80, and you will be very close to RTTY heaven. The capabilities of the system are almost unbelievable; it appears to incorporate every feature the avid RTTY operator could desire, yet it is not a complicated system to operate.

Like many RTTY systems with video displays, the ROM-116 operates with a split-screen system. Received text is displayed on the top half of the monitor, and a message can be pre-typed in the advanced typing mode on the bottom portion. On the right side of the screen is a continuous display of program status, letting you know whether you are in the receive or transmit mode, in the ASCII or Baudot mode, baud rate, line printer on/off, and a host of other informational items. A quick glance at the status display will reassure you that everything is doing what it's supposed to be doing (or it will warn you that it's not!). Also displayed on-screen is the date and time. This information is simply entered via the keyboard whenever you power-up the system. The date and the correct time will then appear on the screen, and each time the system automatically indentifies, the date and the correct time will be transmitted. A nice touch!

If you look at the picture for more than a second, you'll realize that the ROM-116 has only one switch: the power on/off switch. That's right, friends, the ROM-116 accomplishes everything under software control. Each of the many functions that this unit performs is selected by typing a code into the keyboard. All commands use a shift and a character, so it is unlikely you'll tell it to do something by accident. If you enter a shift T, for example, the computer will turn on the transmitter, send a CW ID, and then send anything you have typed into the text buffer. Shift K will accomplish the same thing, only a CW ID will not be sent unless it has been ten minutes since the last ID. This thing even keeps you legal!

The Crown Microproducts ROM-116 RTTY Interface and Operating System.

All the other functions of the ROM-116 are accessed in the same manner. Like many other products in our digital age, you'll have to commit the command codes to memory or else use a cheat sheet that tells you what to enter for a particular function. At first, you might wish that separate switches had been used for each function, but as you grow accustomed to the system, you'll be thankful the ROM-116 uses the direct keyboard entry system for all commands.

With this system, you'll have plenty of commands! The program allows for three memory buffers. If you have a 16K TRS-80, the main text buffer will hold about 7,000 characters. A general-purpose buffer for brag tapes, CQs, and anything else you send frequently holds approximately 2500 characters. Finally, there is a callsign buffer that will hold up to 140 characters. All these memories are held in the computer, not on tape, so you don't have to go through a complicated loading procedure every time you want to send the contents of a particular buffer. If you program all the pertinent details about your station into the brag-tape buffer, you can send that information at any point in the text by typing "shift C". Naturally, while that buffer is being sent, you can continue typing into the main text buffer. As soon as all the information in the brag-tape buffer is sent, the system will send whatever else you've typed in. The callsign buffer works the same way. Anyone who has used a cassette-tape lash-up to store messages will quickly appreciate this ease of operation!

You can, however, use the TRS-80 cassette tape recorder for simple and dependable storage of incoming data, and this brings us to one of the most fascinating features of the ROM-116.

When you initialize the system for the first time during an operating session, you are asked to enter a selcal code. This can be a word, a number, or any combination thereof. Now suppose you leave the shack someday, with your equipment turned on and tuned to 14.100 MHz. If anyone transmits QST, your call, or your selcal code on this frequency, the received text will be written to cassette, following the receipt of four Ns. The system will ignore any other activity that takes place on that frequency. But wait, it gets better! If someone sends your selcal code and the letters ZM, *your* system will switch over to transmit, CW ID if necessary, and send whatever you have typed into the general-purpose buffer. "ZQ" will send 10 lines of "quick brown fox," "ZW" will send "WRU", and "ZY" will send 10 lines of "RYRY". Pretty impressive! When you come home, play back the tape and see what your friends (or enemies) have sent you. It doesn't take too active an imagination to think of all the fun you can have with this.

At this point you probably are worried about hooking up all this glorious luxury. Surprisingly, it doesn't take long at all. I do encourage anyone hooking up this system for the first time to read the manual *very* carefully. The manual is very complete and well written; nothing is left to chance. Although my experience with microcomputers and RTTY gear was somewhat limited at the time, I had no difficulties hooking up the various control cables. Everything went smoothly and worked the first time. Once you have had the system for a while, you might want to examine the back section of the manual and try out some of the goodies that can be done with the ROM-116. Modem operation, TRS-80 as a host computer, and operation on time-sharing systems are just some of the things that are possible.

While the forte of the ROM-116 is RTTY, it comes with a pretty sophisticated CW program as well. Received copy was acceptable, but to quote

Continued on page 65

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.

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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.

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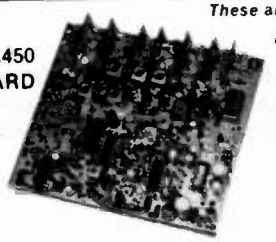


SCR100 VHF Receiver Board

- Wide dynamic range! Reduces overload, 'de-sense', and IM.
- Sens. 0.3 uV/12dB SINAD typ.
- Sel. 6dB @ ± 6.5 KHz, 110dB @ ± 30KHz. (8 Pole Crystal Fltr.)
- 'S Meter' Output.
- Exc. audio quality! Fast squelch! w/0.0005% Crystal.

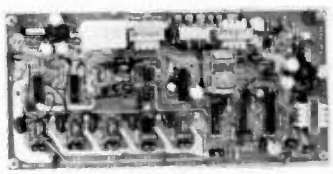
SCR100 Receiver Assembly

- 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 Fltr. & 8 Resonator Front End Fltr.!
- Discriminator & Deviation Mtr. Outputs
- ***Totally New Advanced Design!***

new



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- 0/1 Inhibit bd. also available.
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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 220 MHz).
- Provides tremendous rejection of "out-of-band" signals w/out the usual loss! Can often be used instead of large, expensive cavity filters.
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- Voltage Gain: apx. 10 dB.
- Selectivity: – 20 dB @ ± 2.0 MHz; – 60 dB @ ± 6 MHz (typ.).

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- For Repeaters, Base Xmtrs., etc.
- Fully Automatic ID timing & xmtr. keying.
- Convenient Front Panel Controls. Many Deluxe Features!
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- For SCR-1000 or SCR-4000
- Replaces Darlington Pass Tr.—*for improved reliability*
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- Adjustable ID tone, speed, level, timing cycle.
- 4 Input AF Mixer & Local Mic amp.
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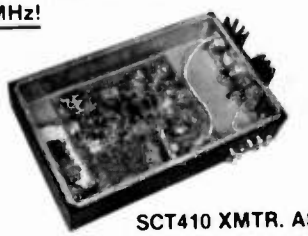
- CMOS logic; PROM memory—250 bits/channel.
- Up to 4 different ID channels!
- Many other features Factory Programmed



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SCT110 VHF Xmtr/Exciter Board

- 7 or 10 Wts. Output. 100% Duty Cycle!
- Infinite VSWR proof
- True FM for exc. audio quality
- New Design—specifically for continuous rptr service
- Very low in "white noise"
- 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.

SCT110 Transmitter Assembly

- SCT110 mounted in shielded housing
- Same as used on SCR1000
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- 7, 10 or 30 Wt. unit.

SCT410 UHF Transmitter Bd. or Assy.

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- Similar to SCT110. 8-10 Wts.
- Avail. w/ or w/o OS-18 Super High Stability Crystal Osc./Oven.
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TTC100 Touchtone 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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Winter Olympics Torch Run

— a one-year perspective

Editor's Note: In the May, 1980, *QST*, one participant's view was presented of amateur radio's part in the Winter Olympics Torch Relay Run. Due, in part, to more detailed explanations of the project's complexity and the many amateurs' responsibilities, we believe the story presented here lends a different perspective to and perhaps better captures the spirit of involvement of all those who had a hand in this historic event.

Amateur radio made important contributions last year to the Olympic effort at Lake Placid. A great deal of traffic handling and commemorative operating took place with the Winter Olympic Radio Amateur Network (WORAN) and its station, WØRAN. Amateurs also performed admirably during the Winter Olympic Torch Relay Run.

Photo A. The beginning amateur operating contingent in Yorktown poses for the obligatory group shot. Standing from left: W1RM, WA3PZO, KB3HF, KA2DBW, WB1ADL (on right); kneeling from left: WB3HWZ, K2AMU, KA2CNN, WB3EOU, WB3LGC, WA2DHF, WB2VUK, K2AV.

We were among the amateur operators who were chosen to accompany the Olympic Torch from Langley AFB to Lake Placid between January 31 and February 8. There were over 1,000 miles and nine days of extraordinary operating, mostly on VHF. It demanded all the skill and combined experience we had in contesting, traffic handling, and high-speed tactical communications. It was something none of us will ever forget, and something the entire amateur community can be proud of.

Early in 1979, the Lake Placid Olympic Organizing Committee (LPOOC) approached the ARRL. They needed experienced communicators to provide reliable communication for the vehicles involved in the Torch Relay Run. The Run had been organized, in an attempt to publicize the coming of the Olympics to the US and to Lake Placid,

as a combined public relations and educational effort. It would be the first time the genuine Olympic flame, kindled in the temple of Hera from the rays of the sun in Olympia, Greece, had been on American soil (the earlier Olympic flames displayed in this country were ceremonial duplicates). Ham radio was regarded as the most appropriate source for trained operators for a number of reasons, not the least of which was the fact that hams, like the athletes, are skilled amateurs who sacrificed a great deal of time and money for the thrill of public service contributions and competition.

It was a tall order to fill. Over 75 people in 11 vehicles, some of which would be as far as 100 miles apart, were needed to keep in touch constantly to coordinate their many and varied activities. Each little town on the Relay's route had planned its own ceremony to honor the passing of the torch, and these ceremonies needed to be coordinated with the scheduling, the program, and the safety requirements of the moving caravan within which the torchbearers were to run. This coordination would have been impossible through any medium other than ham radio. Lunches had to be found and picked up, and then the vehicle with the lunches had to find the moving caravan again. Ham radio had to deal with scouting for fuel, with command and policy communications, vehicular repairs, rest-room stop arrangements, and liaison with state and local law enforcement agencies. Literally hundreds of events each day had to be controlled in a coordinated fashion.

Safety communication was our highest priority. With eleven vehicles on two-lane roads in curving, hilly terrain, allowing vehicles to pass around the caravan became a problem. If the torchbearers stumbled, the entire caravan would have to come to an immediate halt to avoid running over them. Crisp, sharp—and secure—communications clearly were required. Bad weather had to be anticipated—but we were lucky in this potential problem area.

The operators who were chosen to accompany the torchbearers and staff were selected on the basis of their experience in contest operating (which bore many similarities to the type of operating we would be undertaking), traffic handling, and walkathon- and marathon-type operating. It included many with experience handling communications for the New York City Marathon, including the communications coordinator for that event, Steve Mendelsohn WA2DHF. The hundreds of amateurs who provided invaluable support communications along the route while the caravan was in their area are regrettably too numerous to be mentioned. The traveling operators were drawn mostly from the upstate New York, northern New Jersey, New York City, Baltimore, Philadelphia, Wilmington, and southern Connecticut areas.

Photo B. The early-morning arrival of the Olympic flame, during a snowstorm, in a State Department aircraft similar to Air Force One, on January 31, 1980, at Langley Air Force Base.

The runners numbered 52—one from each state plus one each from the District of Columbia and Lake Placid. Evenly divided between men and women, they were chosen from

Literally scores of amateurs and their families along our route helped in various support capacities, performing tasks ranging from repair of broken rigs to transportation of emissary runners from place to place, to donations of equipment for our temporary use, to relay from VHF to HF to maintain our contact with WORAN and Link Nixon in Lake Placid. Although it would be impossible to acknowledge all of those who played important roles in this effort, here are the calls of many without whom the traveling team would have been isolated and crippled.

Maryland, Delaware, District of Columbia

K3AHB	W3BCN	KA3BKW	WA3BPC	W3ENL	W3FA	K3HBP
WB3FOE	WB3GXD	WA3HQX	W3JAC	W3KDD	W3NFS	WB3ENF
K3RA	K3RKU	AE7T/3	W3TCI	W3XE	K3UAV	WR3ABA
WR3AFM/W3RUN			WR3ADH			

Virginia

WA4CCK	N4NK	K8LGA	WR4AAD	W3BBN/4	N4CCF	WD4FTK
KA4FVB	KA4GAV	WB4MAE	K4MU	W4NTG	WA4RBC	WB4SHK
WB4UHC	K4BKX	WR4AFT	WR4BBZ	WB4DNT/R	W4NTG/R	K4VYN/R
W4ZA/R						

Pennsylvania

WA3AOP	N3AYK	WB3ELA	W3NWA	WA3PZO	AG3R	
and literally hundreds of other hams...						

New Jersey

K2ASF	K2ASG	N2BBL	AA2C	KA2CHM	KA2DOH	WB2ZRU
KB2ET	N2GJ	N2GX	AA2H	KB2HM	WB2HON	K2ASF/R
WB2HZR	WB2JHN	K2JJM	AF2L	WB2LCC	WA2MVQ	AF2L/R
WB2SZI	WB2TZS	K2UL				

New York

N2DU	N2FU	K2GDX	W2GH	W2GN	W2CS	WA2AAU
W2HQW	WB2JDD	WA2JHJ	WA2KDE	WB2NEA	W2ODC	W1BQO
WB2PID	KA2Q	WB2QCJ	K2RJN	WA2RXQ	W2SZ	WB3BPU
KB2T	K2TR	W2TJ	WA1UGE/2	WB2VJC	W1VSA	WB2CFP
WA2WNI	N2YL	WA1ZYV/2	WR2ABB	WR2ACD	WR2ADZ	WB2CJS
K2AE/R	WR2AFS	WR2ALY	W2CXX/R	WA2CZT/R	WB2ERS/R	W2LWX/R
WB2FNV/R	W1KOO/R					

Photo C. One of the Chevy Trans-Sport custom vans used for Ceremonial, Command, and other positions. Having a fiberglass body, it required our own ground-plane metallic base with 19-inch radials attached to the body with duct tape.

among 6000 applicants on the basis of personal interviews, essays, and their running ability. They ranged in age from 15 to 54 years old. They were organized into four teams of 13 runners each, with two teams assigned running duty each day and the two off-duty teams given emissary functions. The emissaries traveled ahead of the caravan making public appearances at churches, schools, and service and social clubs, speaking about the Olympic spirit and the Relay Run itself. Officially, each runner ran between three and five miles each day, but many frequently ran alongside the torchbearer or ran after we stopped for the night.

Like the hams, the runners made the effort required for the run at their own expense, receiving only a uniform, meals, and lodging for the duration of the run and of the Olympics. Additionally, and perhaps most prized, were the Olympic participation medals we all received, along with certificates of appreciation. Runners and hams alike either took extended vacation or leaves of absence from their work to take part in this rare opportunity. Any distinction between the two groups soon faded in view of the shared excitement and sacrifice and was further eroded as the runners watched the amateurs in operation and the hams watched the runners in all weather, on all terrain, bearing the torch to Lake Placid. A great, solid bond of mutual respect developed after only a few hours.

Following personnel selection, there was a period of discussion and practice. The runners got together in Lake Placid in the summer of 1979 to practice the technique they would be using and to get to know one another better. The hams weren't so lucky where lead time was concerned. After an initial organizational meeting on the hard, cold floor at Rockefeller Center in Manhattan—to which many drove long distances—we practiced with a small group of the runners. This practice was a test of the last day of the Relay Run from Fort Ticonderoga to Lake Placid on the Albany East route, with a day-long recap and critique over the weekend of December 8-9. This full-scale test was invaluable for the technical and organizational lessons we learned there. Without it, we would have been ill-prepared for the coming trial.

We learned that because of the volume of traffic on the circuits, we would have to plan for two nets in simultaneous operation. We chose 2 meters due to the availability of equipment, although later we were to use 220-MHz simplex for part of the operation. One net would provide a low-power circuit for internal caravan safety and coordination on simplex. The other would provide a circuit for the external group of vehicles (described below), using higher-powered rigs and, where possible, using repeaters. Because of the proximity of the two nets in the same band, there were, inevitably, problems with desense and FM sideband noise.

Luckily, Dick Frey WA2AAU joined the practice group at the last minute. A competent home-brewer and technician, Dick constructed solutions to the desense and sideband problems in the short period between the practice and the real thing. He planned and built a narrow passband filter—a very sharp one—with a bandpass from 144.250 to 144.450 for use with the low-power internal frequency transceiver. Additionally, he procured and critically tuned a resonant cavity setup for use with the external net high-power transceiver, to notch out the 144.2-144.5 band. In use for almost three weeks under very harsh and demanding operating conditions, they performed flawlessly and were the ideal answer to our problems. Without Dick's effort, his advice, oodles of his own equipment (220- and 2-meter rigs and antennas), and his investment in time, gasoline, and money in this effort, it would not have worked out.

Dick's equipment was used with two UV3s loaned from Drake for the event, both of which performed perfectly in the demanding environment. Side by side, both on 2 meters, just 18 inches and 1½ MHz away from one another, with only 3 to 4 feet separating antennas on the roof of the vehicle, intermod and desense between the two rigs was so insignificant as to be almost unmeasurable. We were very pleased with both Dick's filter setup and with the performance of the Drakes. That company was also generous in the loaning of a TR7 with matching vfo and transmatch for use in our HF setup, described below.

Other companies also loaned various items of equipment for our use. Kenwood generously loaned four of their new TR-2400 synthesized handies with chargers, Tempo came through with four of their dependable S-1 handies with chargers, and Larsen loaned at least a dozen quarter-wave mag-mount antennas for 2 meters. Needless to say, synthesized equipment was the order of the day, and we all brought along what we owned if it could be put to work in the effort. Longer-range vehicles needed 5/8-wave antennas, and they were supplied by members of the team who owned them. Mobile rigs ranged from Heathkit 2036s to Icom, Yaesu, KDK, and Tempo equipment. One Yaesu FT-207R also made the trip in the hands of KA2DBW, and in the police liaison position it performed flawlessly on 75% charge, 200 mW, 15% duty cycle for 8-10 hours.

The eleven caravan vehicles—and their corresponding communications

Photo D. The arrangement of the caravan during a practice, showing the order of the vehicles, with the torchbearers visible in front of the second (Command) vehicle.

Photo E. From left, WA2DHF and KB3HF after about 30 hours as net controls.

positions—all had specific duties to perform. They were organized into an internal and external group. In order of their travel, the police vehicle came first. (We called it "PD" on the air; although we identified every ten minutes, the circuit was so busy that we referred to vehicle designations rather than callsigns.) Usually PD was a state police car in which one of our team members was placed to provide liaison between the caravan and the state police and, through their communications system, usually with local jurisdictions, also. This vehicle changed periodically, of course, not only at state or barracks boundaries, but also as different patrolmen were relieved, since our hours far outlasted their shifts. This fact, and their prohibition against the installation of any electronic gear not under their control, required the use of an op with an HT. In some states, getting the state police to agree to our placement of an op in their vehicles was like pulling teeth. But for both the liaison function—indispensable in itself—and for safety reasons, it was a requirement of the Director of the Run and, ultimately, every jurisdiction agreed.

Usually, the vehicle behind PD was the Pace vehicle. Its personnel were responsible for keeping the pace for the very tight schedule under which we were operating and for navigating the course from a detailed computer printout. Although the runner set the pace, the personnel in this vehicle could suggest, through their PA system, that the runner pick up the pace or slow it down. They communicated the position by checkpoint number to the Director at every checkpoint and gave speed instructions to the other vehicles. They also were responsible for the calculations of ETAs at upcoming events. All of this, of course, made for a rather high volume of traffic on the circuit both to and from this vehicle.

The torchbearer with his/her accompanying entourage, often including local guest runners and, sometimes, flagbearers (and even the occasional ham!), followed the Pace vehicle. Here a very delicate compromise had to be struck. Barred from Interstates because of our 8-minute-mile pace, we were traveling on two-lane roads. Oncoming traffic, only a few feet to the runners' left, sometimes passed slowly, rubbernecking, but more often apparently was oblivious to our slow-moving caravan despite the rotating police beacons. We were moving closely together, and off as far to the right as the shoulder would allow, but a great deal of traffic was backed up behind us most of the time. We frequently were pulled off the road by the police (when there was room to accommodate the entire caravan) to allow this traffic to pass, but we had the frequent problem of the maverick crazy driver who decided his need to get around us was greater than his own life's value.

Usually, it seemed, these maniacs pulled out on curves. Soon discovering that our long, tight caravan and oncoming traffic prohibited their passing, they would abort the pass halfway into it and try to squeeze into our group. We could usually accommodate these turkeys with minimum angst; more dangerous were the times when the driver would use what to him appeared to be the only available clear spot in the caravan—which, of course, was occupied by our torchbearer.

For this reason, we kept the Pace and Command vehicles, with the runner(s) in between, as close as possible. This brought up another safety problem: If one of the runners stumbled, the Command vehicle could (and on at least one occasion almost did) run over the people involved. A delicate balance existed. Our best drivers followed the runner, and transmissions on the internal net were kept as short as possible to allow immediate notice of either unauthorized passings or of stumbling runners.

The Command vehicle served many functions. With a customized fiberglass Trans-Sport body on a Chevy van chassis, primarily it was transportation for the Technical Director of the Relay (or, on the Albany West route, the Assistant TD) for whom we provided eyes, ears, and mouthpiece. The two nets were controlled from this vehicle, which contained the two UV3s, cavities, filters, amplifiers (to 100 W for the external transceiver), and HF gear, on a table in the center of the rear

Photo F. The first torch hand-off with full ceremony in a hangar at Langley AFB.

area of the van. The NCS operators sat in what we called the "Hot Seat" for the obvious reason that this was the most demanding of positions. They coordinated the movement of all caravan vehicles, relaying pertinent information to and from the TD, exchanging information and providing relays between the internal and external nets, and frequently (but inadvertently) by necessity acting as the TD in his absence, making snap decisions.

They were assisted by a rather complex home-brewed audio setup through which either op could switch in either or both of the nets using stereo cans. They also used a magnetic chalkboard with "shrimpboats" to keep track of vehicle placement. The hot seat was claimed by five operators for the entire run, who rotated into and out of the different nets. They were WA2DHF, W1RM, K2AV, KB3HF, and WA2SPK. By necessity, they frequently had to stay glued to their positions for twelve to sixteen hours without a break—sometimes longer—and had to be dragged out in burlap sacks and resuscitated with smelling salts.

Big Macs, Whoppers, and other assorted junk foods also served as first aid on the relay. Hams are, for the most part, notorious for their eating habits, and many diehards on the team refused to partake of the available fare. This consisted of oh-so-healthy vegetables, fruits, soups, lots of prunes, and, above all, "fiber." All of this was, of course, concocted with the needs of the runners in mind and included nary a shred of red meat for days on end. The chant which most frequently broke down net discipline on our circuits was "Junk food! Junk food!", along with the sound of growling abdomens in the background. Luckily, the frequency of the internal simplex net was a closely guarded secret, ostensibly for reasons of avoiding QRM, and this was not heard by the general public. We hope!

Command was, to say the least, crowded. With all the equipment, wiring, papers, and human beings (up to seven at a time), it became the hell-on-wheels of the caravan. There were heater problems in the vehicle, to add salt to the wounds, and the net controllers and staff in the vehicle remained bundled up throughout their shifts. Upon entry to this vehicle, one was immediately reminded of an igloo, smell and all.

Two Pace Arrow RVs served as transportation for the 26 athletes running each day. Although their designations changed during the Relay, they were known basically as the on-duty "Runner" and off-duty "Walker." Each carried 13 runners and took four shifts of on-duty and off-duty time each day. Walker was for the resting runner crew and occasionally would travel in the caravan (behind Command), but usually would go ahead to a designated checkpoint and wait for the caravan to catch up, at which time its designation might change and its crew would go on duty. The communicator in this position had an easier time than most, and it was frequently used as a resting slot for the radio ops. He or she was responsible for the relay of the next team exchange checkpoint, among other minor duties.

Runner was kept busy exchanging running teams with Pace and jumping ahead several miles to the next exchange point. The op in Runner was kept rather busy coordinating personnel exchanges, getting a fresh team ready and out, taking head counts of those coming aboard, keeping the athletes informed about ceremonies and schedules, and communicating with Command during the leapfrogging, for safety coordination.

Walker usually was followed by a tail PD, sans operator, and was sometimes followed by components of the external vehicle contingent temporarily traveling as part of the internal caravan. If there were local hams traveling with the caravan to help provide local liaison and relay on HF, their vehicles would follow the last of the official vehicles and precede the tail PD escort. This happened frequently, and the help from local hams was invaluable to the effort.

In the external contingent, the Convoy vehicle, another Chevy Trans-Sport van, provided transportation for the Convoy Director and the Food and Accommodations Coordinator. They were responsible for the procurement and conveyance of our meals and the advance work concerned with our accommodations. We were fed well (the above comments notwithstanding) with four square meals or more each day—about one meal every three to four hours—and usually there were lots of leftovers. The fare was difficult for some of us—especially those from NYC used to munching on famous Nathan's hot dogs—but it was thoughtfully prepared and it even, ah, well, it was *good*! Liking carrots can be learned. And rosy cheeks are cheery. Many of us now have healthier eating habits (and a few of us have even taken up running seriously). Often, the food was prepared by generous residents of the towns through which we passed, organized by church groups, Rotary, Elks, or Lions clubs, or, on some occasions, the military. Sometimes it was purchased by the Convoy Director out of her budget; on only one or two occasions did we have to pay for it ourselves.

Most of the meals were arranged for weeks or months in advance of our arrival. Sometimes we were on such a tight schedule that the lunches were passed in through windows by volunteers running alongside the caravan. The Convoy vehicle became, after a few days, a sea of sloshing soup and vegetables on the inside. Smelly and fun, but it threatened to short out the ham gear in-

stalled there! Hip boots and rubber gloves were in order, especially during the first two days which were nonstop for over 40 hours with no opportunity to clean up until after more than a dozen different meals. The convoy crew, during that first leg from Yorktown VA to Baltimore, affectionately called themselves the "Go-Fer Squad" and almost seriously considered never eating again.

A large European-style touring bus transported half of the running team—the 26 not running on any particular day—to the next day's overnight stop, ahead usually by 85-100 miles. Although for the first day an operator was placed in this position as a communicator, it was found not to be necessary. This vehicle also was responsible for transporting some of the emissary runners to their speaking engagements or ceremonies further up the route of the Run.

The event engendered a great deal of interest by the media, and we anticipated a certain amount of need to accommodate its representatives. What we were unprepared for was the amount of coverage we were to receive. It seemed to be due to the connection the public felt with the symbol of the international Olympic flame and patriotic sentiment, even nationalistic fervor, generated by the USSR's invasion and occupation of Afghanistan and the holding of American hostages in Iran. The media, apparently as taken by surprise as we were, quickly realized the sensational side of this story and it became the content of—and set the tone for—most of the articles written and programs aired. Of course, this was commonplace during the Olympics themselves, especially where it concerned the incredible victory of our hockey team over the top-rated USSR team, but our passage marked the first expression of this popular ground swell of opinion.

We tried to prepare for this onslaught with another Pace Arrow set aside especially for the purpose of public relations. From this vehicle, which was usually ahead of the caravan by as much as three or four hours, press kits were dispensed, questions were answered, and interviews were arranged between the runners and the media representatives. The communicator here acted as a relay for specific questions directed back to the caravan and the TD on the external net and for relay of ETAs and names of the runners involved at any particular time from the TD to the PR staff. Because of demands from the press passed along to the operator, this position frequently became rather high-pressure and busy, especially in the larger metropolitan areas.

Although many attempts were made to include word of the involvement of amateurs and amateur radio in the event, the PR staff was not sympathetic to our requests for publicity regarding our support. This attitude did not reflect the general sentiment of the runners or the rest of the Relay staff, fortunately, but it did mean that many opportunities for positive PR regarding our role were lost to personalities. There was little notice of our effort by the national or local media. WA2DHF appeared on the front page of the *New York Times* on February 5, but neither the caption nor the story included his function, his role, or his name, or identified that hand-held, funny-looking box with the rubber gizmo. Our uniforms, however, did include the ARRL logo and a large patch produced for the event with "Olympic Torch Relay Run" on the top and "Amateur Radio" on the bottom in large block letters. All of the vehicles bore "Amateur Radio" placards in every possible window.

Photo G. KA2DBW on the job in her hometown, New York City, on February 4.

Many of the questions the media asked involved the technical aspect of the torch itself. It was a specially-designed instrument constructed specifically for relay runners by an American of Greek ancestry, Jim Kalamaridis. Some 132 of the devices were custom-manufactured for the event. Charged with propane, they had a life expectancy of about 40 minutes per charge, and, theoretically, could withstand a wind of 80 mph. In practice, however, we had frequent flameouts, and the original flame was maintained in a series of miner's lamps, some with a hole drilled in one of the glass panels to accommodate a sparkler to transfer this original flame from lamp to torch. Each lamp had a life of about four to six hours per propane charge, and Jim and an assistant were kept busy almost full-time simply charging and maintaining the torches we used. The flame we saw in Lake Placid, which was trotted up to the huge gas flame bowl at the ceremonial stadium by Chuck Kerr, one of the torchbearers, was the very same flame lit in Olympia weeks before and carried by our combined team up the coast of the US. If the flame went out, it was relit from one of the backup miner's lamps; we didn't just flick our Bics.

Wondering how to get an Olympic torch across the Atlantic? The Air Force lent one of the aircraft used for Air Force One—a KC-135 (military designation for a Boeing 707)—for use in conveying this most honored of guests to our nation. Inside the plane, sitting in Jim Kalamaridis' lap and on the floor around him, were the six miner's lamps, all burning with the flame lit at the temple of Hera. The plane landed at Langley AFB on the morning of January 31 and taxied to a full multi-service Honor Guard in a huge hangar, in the midst of a snowstorm.

The Torch Arming Vehicle (aka "Torch" on our circuits) was used to transport the torch technicians and their gear for the long and grueling trip. After dark, this vehicle could be recognized by the light of the frequent spontaneous propane flares issuing from the open doors of this Santana van—reminiscent of the aurora borealis. The commu-

Photo H. In gratitude, the amateurs were permitted to carry the torch on the frosty last day, a few hours outside of Lake Placid. Here KA2CNN is carrying the flame.

Photo I. WB2VUK with Brooke Newell, one of the ceremonial coordinators, at a ceremony site in upstate NY, using one of the Kenwood TR-2400s to mike her as she describes the layout of the ceremony to the TD in the caravan a few miles away. Note the collapsible whip antenna which was used instead of the rubber ducky for added range.

nicator in this vehicle, besides being preoccupied with seeking air free of the stench of propane, was responsible for notifying the torch technician in case of a flameout or torch failure.

It seemed as though every town, no matter how big or small, had some sort of welcoming ceremony prepared for us. This usually involved a high school band attempting to play the rather difficult Olympic anthem and always botching it. We heard that piece in every possible key, in every possible arrangement—even with a disco flourish. This was followed by speeches—sometimes interminable—from local dignitaries or politicians, and then words from our ceremonial coordinators describing the caravan, the function of each of the passing vehicles (especially helpful for the often-confusing passage of the advance vehicles), and an attempt to educate the crowd about our safety requirements, because the crowds were frequently large and under-controlled and we were coming in in large vehicles.

This usually was followed by a short speech from the incoming or outgoing runner, and then the torchbearer would arrive, make a handoff, the caravan would continue, and, perhaps, the incoming runner would stay to speak a little more as the caravan moved out to the next stop. We had been informed of, and could plan for, about half of these events. The rest had either been organized by groups or communities at the last minute or were spontaneous gatherings of people. Frequently involving many hundreds of people, they were completely without any authoritative control and overran the roadway. The caravan drivers, the TD, the staff, and most of all, the runners, needed to know what they were getting into on these occasions. Somehow, these unplanned crowds had to be quieted, informed, organized, moved back, and opened up for the arrival of our caravan.

The runners had a special need to know what they were getting into because of a phenomenon we did not anticipate. They suffered from a certain amount of "tunnel vision" due to the exertion, the weather, the excitement, and the adrenaline. They frequently needed to be led in by another runner at the ceremonial site, or they would trip on a curb or bump into a member of the public in the crowds. Their torch also was a fire hazard, and holding it up high gave a runner an effective height in excess of 9 feet. The job of the ceremonial coordinator was to pre-brief the caravan from an advanced position relative to obstacles, pathway, crowd quantity and mood, clearance, fire hazard, etc. This information was passed along to each driver in the caravan and also given to the runner by PA from the Pace vehicle. Because of the involvement of the ceremonial coordinators with the local groups sponsoring the ceremonies, the job of sizing up the ceremony situation frequently fell to the communicators themselves. The communicator also was responsible for the relay of ETAs to the local groups so they could plan the timing on their stages.

After the caravan and torchbearer had passed through the location of the ceremony, after it was all over, the ceremonial vehicle driver waited to collect all of the personnel. Then it was off down the road to catch up to the caravan, and—often with a very high-speed police escort—to leapfrog the caravan and make the way ready for it at the next ceremony site. On our busiest day, there were 21 such ceremonies to coordinate. Although not the most difficult position, it was a high-pressure communicating position and perhaps the most exciting, since the op was able to view the ceremonies themselves and some of them were quite well put together.

One problem the personnel in the ceremonial vehicle did not have was that of the visual and psychic effects of day after day of travel at 7 or 8 mph. We all functioned under conditions of great pressure and constant demands. Breaks were few and far between, and we were almost constantly in a state of swollen derrieres and bladders. Hallucinations were one result of the slow movement

of the passing panorama (which also made for prolonged nulls on VHF); some of us imagined having seen trees grow. Radio traffic was constant and exhausting, of a nature only contest operators may be familiar with, or those with military backgrounds. Calls for the particular vehicle for which one was communicating always seemed to come during that once-in-an-hour period of dropped guard. The circuits were so busy that even a few seconds of dead air were cherished as the most precious of gifts.

Because of the unplanned ceremonies, constant changes in plan, variations from the published Technical Manual (TM), and inaccuracies in the TM itself, on the first day out W1RM nicknamed the entire operation "Rollerball." Those who've seen the motion picture will know what we're talking about: It describes a game in which the rules change every quarter, getting tougher and more violent. The entire script of the operation literally was changed from minute to minute. So pervasive was the use of this nickname that WR3AFM, the home repeater of one of our NCSs, KB3HF, changed its ID for us. When we arrived in their area, its CW ID was spelling "Welcome Olympic Torch de WR3AFM." When we were awakened the next morning and tuned in the repeater again, it was signing "de WR3AFM Rollerball." The NCSs referred to themselves after that first 40-hour stretch from Yorktown to Baltimore as "Rollerball Control."

In the December practice, the HF setup received a limited workout with K2GDX, the coordinator for WØRAN, in the Lake Placid area, and it was thought that we would be using HF links directly from the Command vehicle to WØRAN in Lake Placid during the relay. As it turned out, this equipment was hardly ever used because of the huge volume of tactical and safety-related traffic in the Comm van, the long operating hours, because of Rollerball, and because of the relatively low priority of traffic for HF. Instead, operators from the local area traveling with the caravan or in contact with the caravan on the external VHF net served as VHF-to-HF relays. Dozens of highly competent ops were involved in this particular effort. Without them, the caravan would have been virtually cut off from the LPOOC except for the overworked and extraordinarily unreliable mobile telephones installed in the Command and PR vehicles.

Working the HF link with WØRAN required the patience of old Job. We were bothered constantly by all the many and varied incarnations of the persistent QRMer, from hams who offered to help and ended up hindering (some have to learn to listen more and transmit less unless they're certain they can help), to ops seeking commemorative contacts during traffic operations, to real "sickies" with swishing vfos and persistent strong carriers. The patience, persistence, and experience of HF ops involved did prevail, however, and the traffic was passed.

Warren Gibson WA4CCK provided just one example—perhaps the most dedicated example—of the dedication and sacrifice so many of the local hams offered. Experienced as a traffic handler on many nets, he joined us in Yorktown as the amateur coordinator for Virginia, driving a station wagon full of a rather extensive HF and VHF setup. He accompanied the main caravan for its most

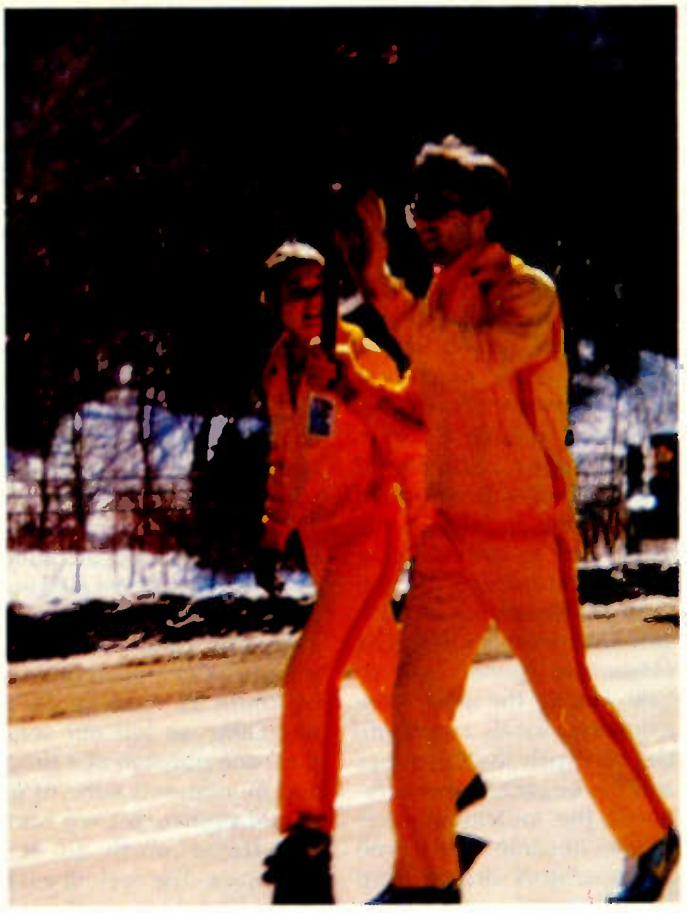

Photo J. Two of the torchbearers on the road, somewhere in upstate NY.

trying days, the first ones, from Langley AFB to Baltimore, nonstop for over forty hours of driving and operating relay, and also the third day, from Baltimore into a grand ceremony on the steps of the Capitol. He left us in DC amid cheers of gratitude from all members of the traveling communications team, having served as an invaluable shoehorn on countless occasions.

We even got some "maritime mobile" operating into this thing. Steve WA2DHF is a radio operator for the Naval Reserve and was chosen to accompany the torchbearer on a seagoing journey aboard a Navy landing craft from Langley AFB to the Yorktown pier—about 2½ hours in the water—using a Tempo S-1 all the way. For the startup of the Relay overland, he joined Pete Chamalian W1RM in the Command vehicle. Also present for the startup were ourselves; Bob Fern K2AMU; Jeff Young KB3HF; Jim Arnold WB3EOU; our coordinator, Bobbie Chamalian WB1ADL; Steve Shearer WB3LGC; Guy Olinger K2AV; Paul Vydareny WB2VUK; Bob Josuweit WA3PZO; Bob Strickland WB3HWZ; and, previously mentioned, Warren Gibson WA4CCK, in his own vehicle.

Joining in Princeton was Gary Kantor WA2BAU. In Albany, the route was split: Communities to the west of the officially planned route had raised funds on their own sufficient to allow the personnel and vehicles to split after the Albany ceremony, permitting 26 runners to go northwest through the Adirondacks while the "Albany East" team took the other half of runners on the original route. A tremendous ceremony involving thousands

of spectators, with disabled veterans holding the torch with the torchbearer for the last couple of hundred feet, greeted us all in Albany. Governor Carey, following a moving speech of welcome, oversaw the lighting of two torches from the original incoming torch, and two runners left the plaza, one bound northeast, the other northwest, both destined to meet a few days later in Lake Placid.

In Albany, additional vehicles and staff personnel were added to take up the slack and to provide coverage for the scores of ceremonies awaiting us on both east and west routes. The closer the runners got to Lake Placid, the more identification local communities felt with the Olympics and the larger and more frequent the individual ceremonies became. Five traveling operators drawn from the Albany/Troy/Schenectady areas were added to the communications team: Joe Krone WA2SPL; Dennis Connors WB2SPK; Armand Canestraro WA2EQW; Dan Marcella KA2DVK; and Guy Kitchen WA2SPE. Stationary support and east-with-west relay was provided by Dick Frey WA2AAU.

On the last day, during our approach to Lake Placid and facing the prospect of breaking up the group which by this time had built up an incredible bond of solidarity, the amateurs and support staff were afforded a rare privilege: We all were given the opportunity to carry the torch for a few minutes. On a clear stretch of Route 32 south of Saranac Lake, we left our vehicles, one position at a time, and in moments none of us would ever forget, we bore the flame north to the Olympics. The feeling each of us had, holding this sacred flame and running it north, was indescribable. Wonderful. As we ran, the runners cheered us on and our fellow ops took pictures by the dozens.

On the night of Friday, February 9, after rollerballing for nine days and nearly a thousand miles, we reached our goal. The east and west route torches had to meet in downtown Lake Placid at exactly the same instant. Timing was crucial and the circuits began to fill with almost nonstop checkpoint and ETA advisories between the two caravans. One caravan with torchbearer could not be kept waiting at the end for the arrival of the other. The crowd was huge, and the media were out in full force as we played our last hot and heavy round of rollerball. This was the biggest and last task for the communications team, and we knew we had to get it right; this was the event the participants would remember more than any other; it was our crucial test.

We did it. The timing was flawless, and not a dry eye remained in the entire team, runner, ham, or staff member. We had reached our destination. Looking back, despite some mistakes, some personality conflicts, and numerous technical difficulties, we had performed our job through the most incredible experience of teamwork any of us had ever had. When the two torchbearers met in Lake Placid that night, the elation and feeling of accomplishment that swept through the team made the stress, deprivation, and hardship of nine days on the road well worth the effort. We're looking forward to working together again in 1984 in Los Angeles. Perhaps we'll see you there! ■

✓ Reader Service—see page 146

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New Life for Old Klystrons

—tips for microwave experimenters

What? Use a vacuum tube in this modern era of solid-state electronics? Reading about Gunn diodes, Impatts, and other such exotic devices is fine, but with the exception of the Microwave Associates Gunnplexer, there are no complete solid-state oscillators available to the amateur.[1] This became very apparent while I was trying to put together a receiver for direct reception of television signals from geosynchronous satellites at 3.7 to 4.2 GHz.

A multi-stage oscillator-multiplier chain was ruled out because of insufficient time. If everything works, the final receiver might have a solid-state local oscillator, but then again, maybe not—why discard a working circuit? Reflex klystron oscillators of the 723 and 2K25 class (see Fig. 1) have been available on the surplus market for over thirty years. Output frequencies from below 3 GHz up through 9.6 GHz are currently available with output powers in the neighborhood of 10 to 150 milliwatts.[2] These klystrons have found applications in the past in polar-plexers and as pump oscillators for amateur and commercial parametric amplifiers.[3,4,5,6] The tubes listed in Table 1 are similar in construction and can be mounted in octal sockets that have had pin 4 removed and bored out with a number 24 drill. The output is via the small diameter, rigid coax line which terminates in a short probe. The probe was used to directly excite a waveguide or was capacitively coupled to a coax cable.

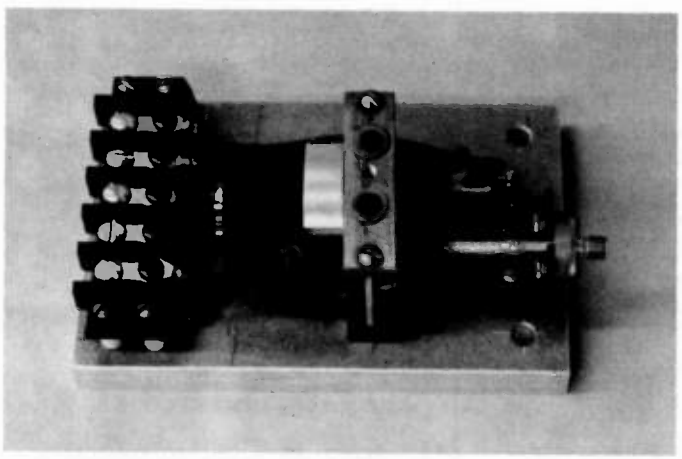

Photo A. 726A klystron with coax output and terminal strip.

Tube	Output frequency(GHz)	Output power(mW)
726C	2.7-2.96	100
726B	2.88-3.18	150
726A	3.18-3.41	100
2K22	4.3-4.9	115
6115	5.1-5.9	100
2K26	6.25-7.06	100
2K25*	8.5-9.66	30
723A/B	8.5-9.66	25

*Improved version of 723A/B, both of which can reach 10 GHz by stretching the cavity.[6]

Table 1. Reflex klystrons from 2.7 to 9.66 GHz.

In normal operation, the tube shell is operated at 250 to 300 volts above ground. This puts the output cable, which is connected directly to the shell, at a hazardous potential. However, by operating the cathode at a negative voltage, the shell and output cable can be maintained safely at ground potential.

The photograph shows a 726A klystron mounted on an aluminum plate for use as a local oscillator for the satellite receiver. The tube is clamped by a simple split block to allow conduction cooling and provide a mechanically stable support. This degree of mechanical rigidity is not required but was convenient in this case. Also, free-standing operation with convective cooling is alright. The oscillator covers a measured frequency range of from below 3.2 GHz to above 3.5 GHz.

The output frequency of this particular tube as a function of the rotation of the tuning screw is shown in Fig. 2. By changing the reflector voltage, the output frequency could be shifted electrically plus or minus fifteen megahertz from the mechanically set frequency. This FM characteristic can be used for fine tuning or for a form of afc with simple circuitry.[7]

The output probe is terminated with an SMA connector. A cross section of the connector assembly is shown in Fig. 3. A BNC connector could be used with equal success. The output probe center conductor is clipped close to the insulated sleeve, the ferrule is slid back onto the probe. Then the center conductor is soldered to the coax connector. Following this, the ferrule is slid forward, screwed to the connector with two 2-56 screws, and then sweat-soldered to the

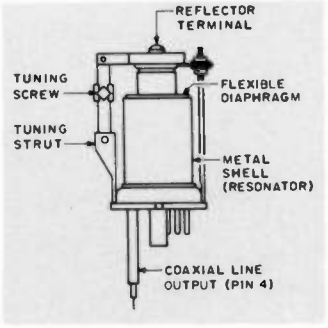

Fig. 1. 723-class reflex klystron.

probe.

Power leads run from a barrier strip to the tube. Connections to the tube are made with a modified octal tube socket—see Fig. 4. While normal operation requires −300 to −700 volts at zero current for the reflector, operation at reduced potentials and output powers is not only possible but desirable in that power dissipation and heat are reduced substantially. This adds to the tube life-expectancy.

Operation has been at cathode voltages as low as −150 volts at 10 mA and reflector voltages of −150 to −300 volts. With a −300-volt cathode supply, output powers in excess of 60 milliwatts were readily obtained. With a −150-volt cathode supply, the output dropped to about 4 mW, which is still sufficient for use as a local oscillator. Even at the high powers with only free convection cooling, life expectancy is high. Tubes pulled out of service after hundreds of hours of service and stored thirty years or more are still operating.

A word of caution: The reflector must *never* become positive with respect to the cathode. If it does, it will draw current, heat up, and outgas, ruining the tube. To prevent this from occurring, merely connect a rectifier diode between the cathode and reflector as shown in Fig. 4.

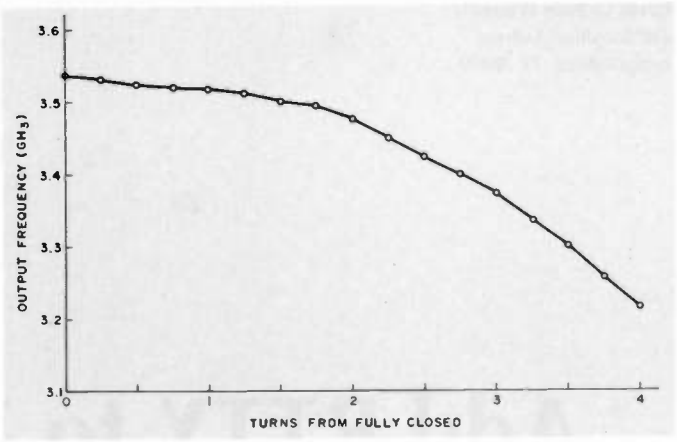

Fig. 2. Output frequency of 726A as a function of tuning-screw rotation.

The theory and operation of reflex klystrons is available elsewhere and therefore is not covered here.[8,9] What I hope I have accomplished here is to remind other amateurs of the availability of reflex klystrons as packaged sources of microwave power that are rugged, cover a wide spectrum, and are economical. ■

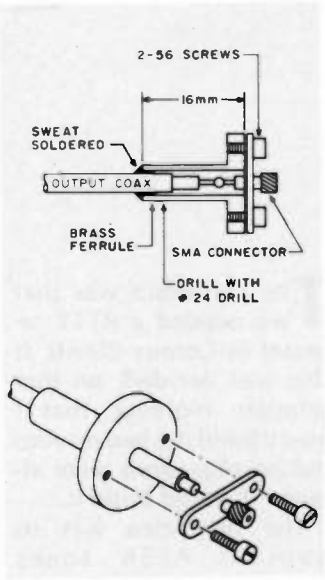

Fig. 3. Coax connector detail and assembly.

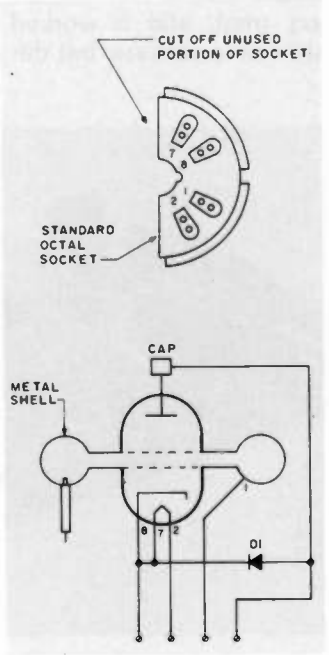

Fig. 4. Socket modifications and wiring diagram.

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Add RTTY to Your Repeater

— voice operation is preserved

The consensus was that we needed a RTTY repeater in Corpus Christi. It also was decided, on that Saturday morning, that I would build it. I had no vote and no objections were allowed. I would build it.

The first idea was to transmit AFSK tones through the local 147.06/.66 repeater. It used subaudible tone control, and few people used it. This method was tried, and it worked with some success, but different tone frequencies and levels caused problems in copying. What was needed were standard tones from the repeater.

Looking through the Flesher catalog, the answer stood out like a BY prefix on twenty. I could demodulate the incoming RTTY audio using the Flesher DM-170 and use the loop-keyer output transistor to key the FS-1 Audio Frequency Shift Keyer to feed audio to the mike input of the repeater transmitter. As an added bonus, I could use the autostart circuitry (on the DM-170) to operate the transmitter PTT control, clean and simple. Flesher even has a nice little power supply to operate both boards—Model TTP-12. All these goodies cost less than $100.00. The boards arrived in 4 days!

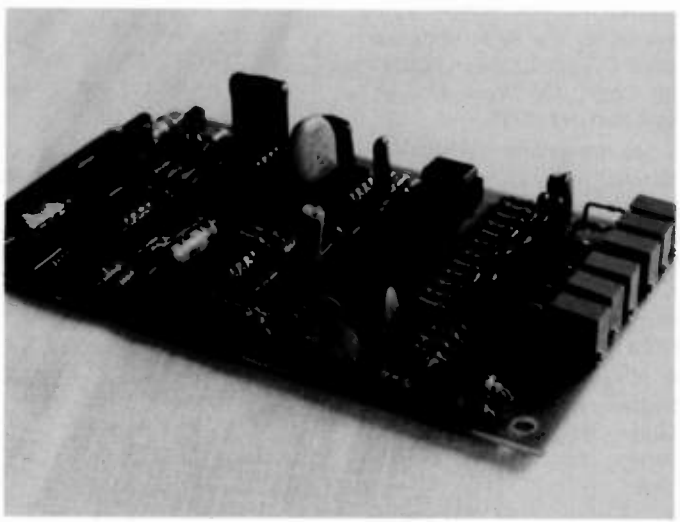


Photo A. Modified DM-170 showing use of 6 trimpots in place of 12 fixed resistors.

The FS-1 and power supply were constructed by K5OG, and I assembled the DM-170. Total construction time was about four hours and the boards worked the first time. The only problem was that hand-picking resistors to tune the DM-170 was slow and somewhat inaccurate. The DM-170 copied 20-meter RTTY perfectly, but I was bothered by the resistors. I assumed Flesher had used the resistors as a cost-cutting technique. However, my RTTY converter had to be perfect. I cut the 12 fixed resistors from the board (R14, 15, 18, 19, 22, 23, 26, 27, 30, 31, 34, 35) and superglued six Weston 850W 2k trimpots in place of them (see Photo A and Fig. 2).

Flesher's design used two resistors in parallel connected to the "—" terminals, pin 6 or 2 of the op amps serving as filters. The tune-up is similar to their method. When the pots are glued to the board, only one lead is connected to the ground for each pot and the wiper arm of the pot is soldered to the correct terminal as you tune that stage. (Read their instructions and use their method of tuning, and tuning the pots will be very straightforward.) I tuned the board with the pots in 15 minutes. It takes an hour with the hand-selected resistors.

I used an H-P audio oscillator driving a frequency counter as my frequency standard. It is important to keep the audio level to the DM-170 as low as possible to get accurate tuning. I faced the problem of having too much audio to the DM-170 when I had correct audio to the counter. I solved this by using a BNC T-connector on the oscillator, feeding directly to the counter and using a 10-to-1 scope probe as an attenuator to feed the DM-170. I now could lower the audio

oscillator to the correct level without losing the counter.

The DM-170 has an "improved mark hold" option which is the installation of an additional diode. I suggest this be installed to force the board to mark any time the audio is lost. This feature is very nice when the DM-170 is keying the FS-1. As soon as the repeater comes on the air, it transmits a steady mark. This mark is our local reference and is a convenient 2125 mark for tuning filters.

While building the board, install a wire from Q5 base to pin 2 of the edge connector to key RY1.

The Motorola repeater I was using has a 5-volt dc to ground to key the PTT. The autostart transistor (Q5) collector was used to take this voltage to ground. Without making any timing changes or adding the threshold control as suggested by Flesher, the repeater would key up after receiving six seconds of steady mark. The repeater would drop out 15 seconds after the input audio to the DM-170 was removed. These times proved popular with the local RTTY users so they were left unchanged. The threshold control was never added. The six-second delay prevents kerchunking the repeater, and the sharpness of the filter and time required prevents someone from whistling the machine up. The 15-second off delay gives a reasonable time to look at filter tuning or to zero your AFSK unit to the repeater mark. I found it possible to rough-tune a filter and AFSK unit enough to get on the air by zero beating the mark and space audio from another QSO.

The nice thing about using a demod and AFSK at the repeater is that everyone hears the same mark and space. Gone are the problems of who has the correct frequency. The only operating problem using this arrangement is the need to use a 170-cycle shift for the CW ID requirement. The mark/hold circuit will not repeat the narrower shifts used for some CW IDs. When the 170-Hz shift is used, the repeater will transmit the ID in CW as it is received. I don't consider the small bit of garbage from the CW on my screen a problem.

After operating the machine a few weeks, several operators wanted the audio for voice communication back on the machine so they could talk about RTTY problems without changing frequencies. A small 12-volt relay was installed to switch the input audio between the receiver audio and the FS-1 unit. A 2N2222 transistor controlled by the base voltage of Q5 through a 330-Ohm resistor was used to ground the coil of the relay. The relay closes in the RTTY mode.

When the repeater was in the standby mode, the subaudible tone would key it in the voice mode. Or, when 6 seconds of mark were received, the relay would close and the repeater would come up in the RTTY mode and transmit a steady mark until it received a RTTY signal, or it would stay up for 15 seconds and drop.

The repeater IDer is connected to ID when the transmitter is activated, regardless of mode. In the voice mode, operation is normal as required by FCC rules and can be heard in the background of voice communication. In the RTTY mode, the operation of the IDer is the same as voice, except the RTTY filters at the receiving RTTY station do not acknowledge the 700-Hz repeater ID frequency. So far, no one has complained of garbled copy due to the repeater ID unit. The repeater can properly ID itself and it will repeat the CW FSK IDs from the user RTTY station. Using this relay arrangement gives RTTY priority over voice and keeps voice communication in the input frequency from garbling RTTY copy.

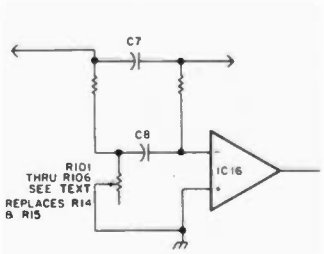


Fig. 2. Pot connection to DM-170.

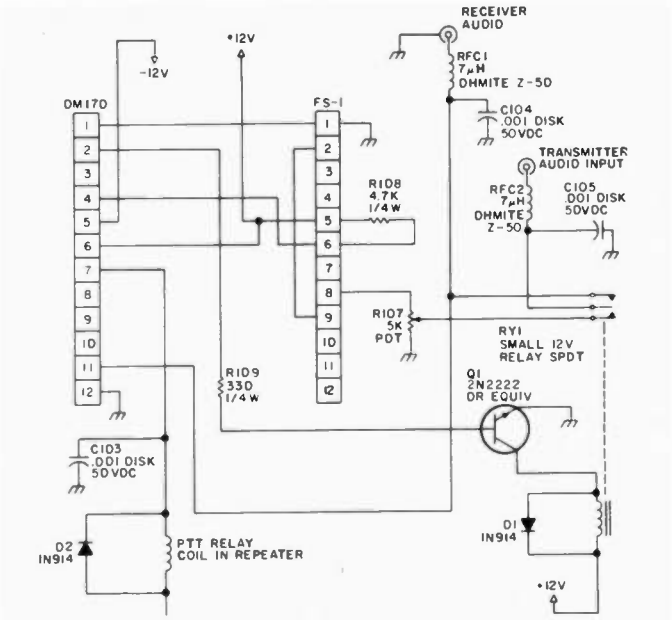


Fig. 1. Interface connections for RTTY repeater modifications.

All three boards were mounted in a 3-inch chassis which was mounted inside the repeater cabinet. With a cover in place and proper line filtering and audio filtering, there were no rf problems. It is important to use proper filtering as rf will keep the autostart in the on mode and keep the transmitter up. Connection of the FS-1 board is straightforward. Connect the proper output to match your repeater input level, adjusting R107 as needed to match the level of the RTTY tones to the level of the receiver voice audio, using a deviation meter monitoring the transmitter output.

Using the direct keyboard connection drawing shown in the FS-1 instructions, connect the junction of pin 6 and the 4.7k resistor to the collector of Q6 on the DM-170 (pin 4, loop keyer). The FS-1 will now track the DM-170 mark for mark and space for space, including CW IDs.

The TTP-12 power supply provides ±12 volts at 0.2 Amps and maintains regulation through a wide range of input voltages. The specifications for the DM-170 call for ±15 volts, but the board will operate fine with the 12 volts supplied from the TTP-12—just use the supply when you tune the filters. Install a power switch in the ac line, because the DM-170 will key the transmitter for 15 seconds at power on. When you bring your repeater up from a cold start, wait the required warm-up time if you are using a tube final and then turn on the RTTY boards.

It's not bad for a hundred bucks and a few hours of work. ■

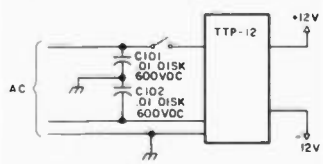


Fig. 3. Ac filter.

Carl C. Drumeller W5JJ
5824 NW 58 Street
Warr Acres OK 73122

A Patch for the TS-120S

—add phone patch compatibility

When I bought a Kenwood TS-120S and sold my Drake TR-4C, it cost my station phone-patch capability. There's just no graceful way of mating the existing patch with the Kenwood's input and output accesses. That brought on the challenge of second-guessing the Japanese engineers. Sometimes that's easy; often it's not. There seems to be an unwritten law (or is it written?) that all equipment must be designed to make customer modifications difficult.

A bit of study of the schematic wiring diagram for the TS-120S revealed an unused terminal (#7) on the remote connector. More study revealed that audio signal and send-receive functions were available at the remote connector. Ah, now if one had microphone input also available... Could it be just a matter of piping a wee bit of audio to the mic input jack from that unused (#7) terminal? It looked feasible on paper, but it pays never to leap too precipitately to conclusions. So the next step involved a bit of exploration of the innards.

If you've never uncovered your TS-120S, a word or two of advice might be of worth. Take the top cover off first, taking care not to disturb the four screws that hold the internal speaker in place. It's not necessary to remove the top totally; just loosen it and slightly move it from place. Now you can flip the set over on its top side without endangering the three top controls and without having to worry about the lead to the speaker.

With the top loose, the bottom comes off readily. Once it's off, take a look at the back side of the mic connector. One of the four terminals has a single white wire going to it. That's the one you're interested in! And it's the one most easily reached! No doubt the Japanese engineer responsible for this grievous faux pas has been compelled to commit hara-kiri.

But how about the other end? Not to worry! There's a plate mounting a number of jacks, the remote connector among them. This plate comes out with the removal of five screws. Once out, terminal #7 is most easily reached. Ah, breathe a prayer for the soul of the poor engineer!

Now, all that remains is to find a single-wire shielded conductor small enough to snake along the edge of the chassis. There are holes through the compartment shielding to accommodate a small and flexible cable. I suggest you ground the shield of this wire only at one end (I used the terminal #7 end) to avoid ground loops.

The remote connector now provides the following services: ground and #1—audio output, 8 Ohms; ground and #3—send-receive control; ground and #7—audio input, high impedance.

You might take a hint from the wiring diagram and put a 100-Ohm resistor in series with that audio output. This will both reduce the signal level (most likely too high for phone lines) and also protect the output transistors from any non-kosher load a phone patch may offer.

The introduction of the capacitance of the short cable across the mic circuit has made no detectable difference in the quality of the voice signal from my TS-120S. ■

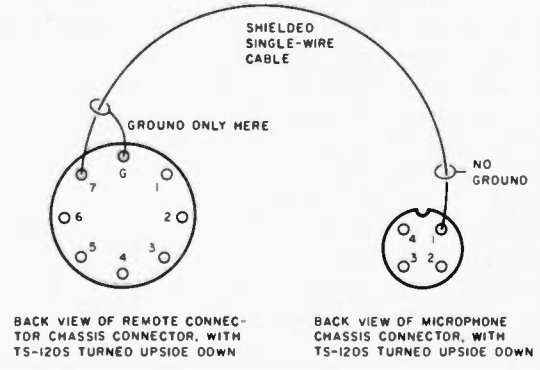


Fig. 1.

✓ Reader Service—see page 146

JB 1004 FC

Shows exact transmitter frequency every time you hit the mike button. Great for mobile professionals and hobbyists. Goes anywhere on 12 VDC, on the road or at home. AC/DC converter included for base operation. .5" red LED digits with lead digits blanking; range 1 to 50 MHz (typical); accuracy to 100 cycles; sensitivity 50 mV. Compact (1¾" x 4½" x 4") textured black plastic case sits anywhere with velcro-type "spots".

$99.95

$355.50

JB 6000 SW

Wattmeter is peak-reading and RMS switch selectable. Covering all frequencies 10 thru 80 meters with low insertion loss. Can be left in the antenna line for full time monitoring of transmitter power.

Five ranges switch selectable — 0-20, 0-200, 0-2000 watts. Multiplier range 2 x 2000 and 3 x 2000. The SWR bridge shows voltage standing wave ratios of 1.5, 2, and 3 for power inputs up to 200 watts. A must instrument for the professional or hobbyist operator.

$149.90

The most deluxe Black Cat® accessory. MONITOR SCOPE permits measuring RF output to antenna and viewing modulation patterns. In addition to standard wave envelope patterns, a new trapezoid pattern feature allows better visual inspection of the transmitted signal. It shows linearity of the RF amplifier, insufficient antenna loading, distortion of the modulating signal, regeneration, parasitics on modulation peaks, power supply hum, over and under

JB 1002 FC/M
COUNTER/WATT-METER/SWR BRIDGE

3-in-1 instrument for professionals and hobbyists. FREQUENCY COUNTER has six digit, 1 to 50 MHz range (typical), accuracy to 100 cycles, .5" LED readouts with seven-digit capability. Peak-reading WATT-METER has three switch-selected ranges — 0-20, 0-200, 0-2000 watts and covers all operating frequencies in the 10-80 meter bands. The SWR BRIDGE shows standing wave ratios of 1.5, 2, and 3. Designed to be left in transmission line of any base station; operates on 117 VAC. 4 11/16"H x 9⅜"W x 7"L. Every accessory an operator needs in one handsome cabinet.

$179.50

JB 4001

Monitor scope measures RF output to the antenna and shows modulation patterns. (See description of trapezoid pattern feature under JB 1001.)

Monitor with low impedance earphones your modulation characteristics for proper mike gain and talk power. Built in audio generator to help adjust transmitter for peak performance.

Covers all frequencies 10-160 meters, no loss in line; therefore can be installed as a constant monitor of your transmitter.

Size is 10½"W x 6¼"H x 11½"L.

Perfect for professional and hobbyist operators.

$204.50

JB 1001 SFC/M

SCOPE/COUNTER/ WATTMETER/SWR BRIDGE

modulation. Non-linear signals can be traced from transceiver to antenna. FREQUENCY COUNTER has six big LED digits, with seven-digit capability. 1 to 50 MHz range (typical), 100 cycle readability, 50mV sensitivity. Peak-reading WATTMETER has three scales — 0-20, 0-200, 0-2000 watts and covers all operating frequencies in the 10-80 meter bands. SWR BRIDGE reads standing wave ratios of 1.5, 2, and 3. 5½"H x 12⅛"W x 12"L. Perfect for professional and hobbyist radio base stations.

JB 2000 SW

WATTMETER/ SWR BRIDGE

WATTMETER is true peak reading type and has three ranges — 0-20, 0-200, 0-2000 watts and covers all operating frequencies in the 10-80 meter bands. The SWR BRIDGE shows voltage standing wave ratios of 1.5, 2, and 3. A must instrument for a professional or hobbyist operator

$82.50

JB 1000 S/M

SCOPE/WATTMETER/ SWR BRIDGE

The daddy of them all. the JB 1000 S/M. MONITOR SCOPE measures RF output to the antenna and shows modulation patterns. (See description of new trapezoid pattern feature under JB 1001.) Peak-reading WATTMETER has three ranges — 0-20, 0-200, 0-2000 watts and covers all operating frequencies in the 10-80 meter bands. The SWR BRIDGE shows standing wave ratios of 1.5, 2, and 3. 5½"H x 12½"W x 12"L. For professionals and hobbyists

$264.50

WAWASEE ELECTRONICS
"home of BLACK CAT® products"
MADE IN USA

✓ Reader Service—see page 146

JB 1007 SW

For the professional or hobbyist radio operator who is lucky enough to have more than one base station antenna, here's a handy way to select them or combine them . . . the Black Cat® 4-Position Coax Switch from Wawasee Electronics of Syracuse, Indiana.

The heavy duty coax switch is rated at 2000 watts PEP and is housed in a compact cabinet measuring just 3 7/16"H x 4 3/32"W x 4"L. The front panel carries nomenclature for the four switch positions: VERT., HORZ., AUX., and the combined position, VERT-HORZ. The switch is controlled by a large, easy-to-grip knob. The rear panel contains the coax connectors for Vertical, Horizontal, and Auxiliary antennas, plus the input connector.

$23.50

$8.95

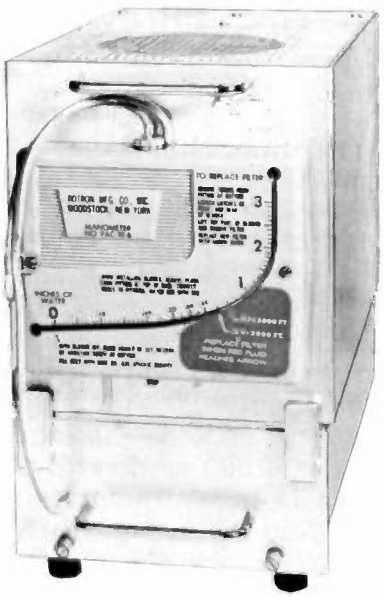
CO-PHASE HARNESS

Designed to match 50 ohm transmitter to a pair of 50 ohm antennas. Can also be used as a stacking harness for two beam antennas with 50 ohm impedances.

JB 4000 SW

The unit measures RF watts to 4 KW in frequency range of 10-80 meters. Both RMS and peak measures SWR and modulation percentage, all without changing cables. Net weight is approximately 3 lbs. Earphone jack for signal monitor. 4 position antenna coax switch included.

$169.50



$269.50

JB 4 K
AIR COOLED DUMMY LOAD

Load is 50 ohms resistive - 200 watts RMS (without blower operation). Frequency range is 1.6 KHz to 240 MHz, for a SWR of 1.2. With blower operating continuous rating is 4000 watts PEP, 2000 watts RMS.

JB 1000
KILOWATT DUMMY LOAD

Portable and capable of handling up to a kilowatt of power. The oil cooled temperature stable resistor provides a low VSWR up to 400 megahertz. 50 ohms impedance. Less oil.

$29.95

WAWASEE ELECTRONICS
"home of BLACK CAT® products" MADE IN USA
P.O. BOX 36, SYRACUSE, INDIANA 46567

Alan D. Kline WB1FOD
95 Banks Rd.
Swampscott MA 01907

Successful Ham Classes

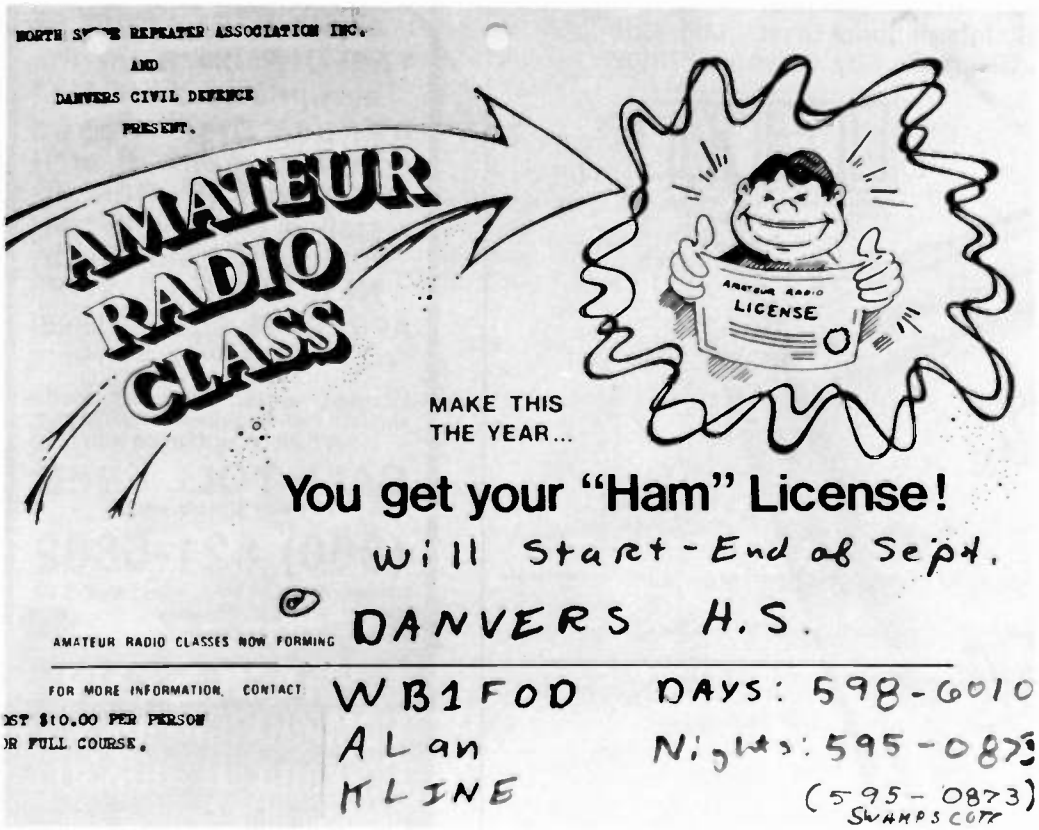
—a guide for club organizers

In 3 years, I organized 11 ham code and theory classes, with the following results:

- 70 Novices
- 40 Generals
- 5 Advanced
- 2 Extras

—with two more classes starting the first of the year in two different locations. If I can do it, so can you; here's how I did it, with help from my club members.

It all started when I joined the local repeater club and became friends with the club's secretary. Every morning for months we would meet at the local post office and he would fill me in on the club's history and current events. The ARRL had been pushing all clubs to sponsor classes to beef up the number of U.S. hams before the WARC conference. As the club had not fulfilled this request, he felt they should start some kind of educational program. I volunteered for the job.



This is the standard poster I use. It is from the League, but I like to add information to it.

Before I was going to organize *any* program, I had to know if there was a need. As there were classes in a town only 10 miles away, I wanted to be sure we would be successful in our attempts. It was discussed at length at my work QTH and decided that a marketing survey could be conducted to establish the community's ham radio educational needs. A test market of a 20-mile radius within our repeater's coverage would be a good parameter. I set out to do a direct-mail market survey.

As the survey needed to go to unlicensed but potential hams, I remembered having once been an associate member of the ARRL. Associate members are the unlicensed league members who get *QST* every month. For various reasons, this group joins the League, and the results from this mailing would show that this group had need for a class to help many of them get their tickets.

In requesting a list of the

League's associate members, the League told me any ARRL affiliated club could request a computer printout of the League's mailing list by zip code. The list is conveniently printed on pressure-sensitive labels.

Upon receiving the list, I immediately had it duplicated. Certain brands of commercial copying machines have this capability. I was glad I made three copies, because later I would find out that the League will only supply the list once a year. A quick scan of the labels produced the mailing list of associates I was to use. The rest of the list was used to solicit membership and to announce the General and Advanced classes.

Response

I printed an announcement of the possibility of having Novice and General classes and mailed one out to each of the fifty potential hams on the League's associate member list. There was instant response. All of the 25 calls I got were logged in a notebook with addresses and the callers' stories. By their stories, I mean that they all had various reasons for joining the League and for not being licensed.

The first caller claimed to be able to copy code at 20 wpm. He was in his early sixties and nearing retirement age, having learned his CW in the army in WWII, and he had never forgotten it. A Drake TR-4 was used to copy code for many years, but he never had the help he seemed to need to get a ticket. The second caller was a Vietnam veteran who also had learned the code in the service. Both of these calls were typical of the many I would receive.

Three of the responses came from adults with various handicaps. They had long-time interests in communications, but needed help to get on the air. To help them with their individual problems, I joined the Handi-Ham System at the Courage Center in Minnesota. Their program is a United Fund-sponsored agency that helps the handicapped not only get their tickets, but loans them equipment. Involvement in the Handi-Ham System has led me and my instructors into some very rewarding personal experiences.

A Committee Is Formed

Based on the calls I got, I knew there was need for a class of some kind. I announced that I was going to organize a class and asked the repeater club membership for help. We formed the club's first educational committee.

Those involved included a high-school guidance counselor with much teaching experience, a professional musician and teacher, a state safety inspector, and an electronics technician. (I am a ladder and scaffolding salesman.) After talking with them, I decided they all had the ability to explain ham radio and communications in layman's terms. In selecting teachers, you must let only the active hams do most of the teaching. It didn't take long to realize that my lack of CW experience and primary interest in VHF/UHF was of little help to aspiring Novices. I decided to stick to the organizational end of the program.

At this point, I contacted the Club and Training Department at the League and, for $1.50, they sent me their instructor's package. It included many items of interest. The first is a 10-12-week lesson plan for teaching a Novice class. It is written to go along with the ARRL's *Tune in the World* textbook and code tape. In later classes, we only used this as a guide for the teachers and let the students choose their own books.

Don Robson, 12 Boulder Way, Swampscott MA 09107. Don is blind and confined to a wheelchair. One of our first students, he worked hard for 18 months before getting his ticket. The repeater club gave him a standing ovation the night he came to announce his call.

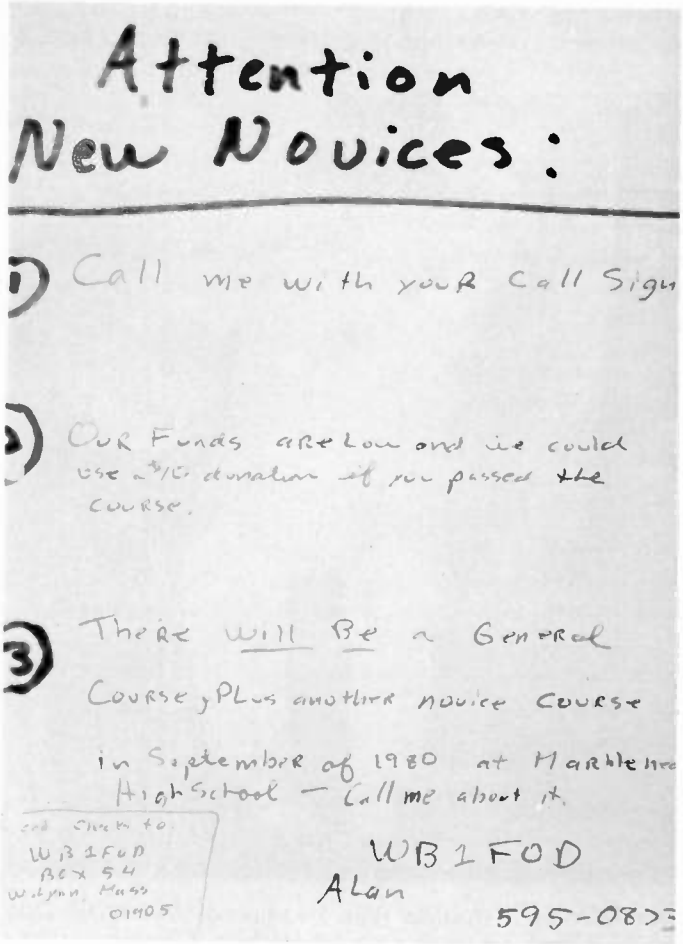
The second booklet was a workbook with problems and duplications of the League's 35mm Novice slide program. We invested in two sets of these slides so our instructors could reinforce hard-to-explain concepts. The third and most useful booklet is entitled *How to Start a Course in Amateur Radio*. After carefully reading all this material, I knew we were heading in the right direction.

For our first class, we decided to use the *Tune in the World* series plus the *73 Magazine* code tapes.

Rooms

In scouting out potential classroom sites, I had to remember the need for wheelchair access ramps. The room also would need to have a movie screen, blackboards, and ac outlets, and, most importantly, be in a good location for the students to drive to. In most communities there is usually a building that meets these requirements. Our first site was the local high school in my hometown. The school was open four nights a week for the town's adult education program and still had many large vacant rooms.

Since the students do not all pass the code at the same time, it is necessary to separate some students from the others. As the code exam is given, the students who pass it earlier than the rest will get their written exams back from Gettysburg before the slower students. If you have a second room, you can split the class into two groups each night. One group will



This is a follow-up mailer for a class we didn't have any money for. At least half the class responded by sending money.

always be in the second room taking one of the two exams. Because the FCC doesn't let instructors have bulk exams anymore, the Novice instructor is always burdened with the extra work of sending exams back to the FCC at staggered times.

I contacted the director of continuing education at the school I selected and arranged for three rooms. One was a large sewing room with big desks that served as Novice classroom number one. It was big enough to seat 25 students, three wheelchairs, and also large enough for our demonstrations. The second classroom was across the hall and was used as the extra exam room.

The third room was the high school's electronics lab. We chose to teach a small General class in there. Besides having VTVMs and scopes, there was a general coverage receiver. Lots of other electronic equipment there made it easier to teach prospective Generals. Most regional vocational technical high schools and junior colleges have similar labs and might be willing to let you use them.

Media	Calls	Percent of Total Calls
Newspaper ads	90	45
Heathkit posters	60	30
ARRL lists	20	10
Ham stores	20	10
Word of mouth	10	5
Totals	200	100

Table 1.

Taxpayers like to see and hear about the school being used as much as possible.

At this point, I made my first mistake: I offered to pay for the rooms. We had to charge $25 per student to cover our initial costs. For that, they received the *Tune in the World* package and a guarantee of a Novice license! When the time came to make the next year's arrangements for rooms, I had learned that most school departments are more than willing to let any civic group use their facilities.

For our second year's program, the town of Danvers, Massachusetts, civil defense radio unit was the repeater's cosponsor. The superintendent of schools and the school committee were glad to give us the needed four rooms at no charge. We met as part of the adult education program on Thursday nights. Both the school and the CD unit helped the club advertise the classes.

During the second half of the school year, we had planned only to teach the follow-up General class and a small Advanced class at the Danvers site. But there were so many calls for a Novice class, we quickly organized two new Novice classes in both Danvers and Swampscott.

Other Sites

Other room ideas I checked out and will probably use at later dates were the local hospital where our repeater is housed, the Boys Clubs and Girls Clubs, the Red Cross headquarters, a private nursing home, and both state colleges. Wherever you find a suitable room, try to contract for it for no fee. There will be plenty of ways to show the landlord your club's appreciation. Also, don't be surprised if the landlord, i.e., the school department, asks your club to sign a contract for the rooms. They must establish responsibility for not only the cleanup of the premises but also the liability in case of an accident.

Our current class is part of the very successful adult education program of the town of Marblehead, Massachusetts. It is a coordinated effort between the repeater club, the town, and the high school's industrial arts department. One class meets after school and the others on Thursday nights. Funds collected from the evening program will be used to donate station equipment to the school's new station.

Our other class is at the Lenox Hill Nursing Home in Lynn, Massachusetts. It is a private institution with many handicapped young people. The director was a radio operator during the Korean War who immediately saw the value of adding ham radio as a weekly activity. We will set up a station there (donated by Handi-Hams) and have a regular schedule of operators drop in during the week to use it. As interest in ham radio grows, we will show the recently produced Dave Bell film on ham radio to the patients. I'm sure we will have a small group of people interested enough to start teaching code and theory.

Our final teaching effort for this year will be a similar wintertime project at the Greater Lynn Boys Club. As an urban club, its membership swells in the winter months, and not all young people enjoy sports. These 5th, 6th, and 7th graders could turn out to be the future electronic technicians this country needs.

Finding Students

Armed with the results of the original test mailing, it was time to find more potential students. In advertising for our first class, an-

nouncements were sent out by mail to all the high schools, junior high schools, vocational schools, colleges, community centers, scout groups, and other ham clubs. A news release was also sent to all the newspapers, radio stations, and local magazines. And finally, posters were put up in the electronics stores, Heathkit® store, both ham stores, and local surplus emporiums. When having a class for the first time, you can never advertise too much. After logging the answers to the question of how the students heard about your class, you can decide which advertising media worked best.

Table 1 shows the results over a six-month period of sending out the announcements of the course and logging all the return calls. Using these statistics, much less advertising effort was required for our second and third classes. A small poster at the Heathkit store and Tufts Radio in Medford, Massachusetts, generated about 50% of the calls. The rest came from a small news item that reappeared weekly for four weeks in the local newspaper.

Careful selection of which newspaper to use was also a factor. In the towns we teach in, the residents all seem to read the smaller weekly papers that have a weekly events column. The one I chose was a weekly tabloid with more real estate ads and community news items than daily news.

Most students, when queried, said they saw or heard about the classes from more than one source. Many not only read about it in the newspapers, but heard about it from a repeater member or on the CB band. On a few occasions, I would answer questions about the class or ham radio in general on the CB band.

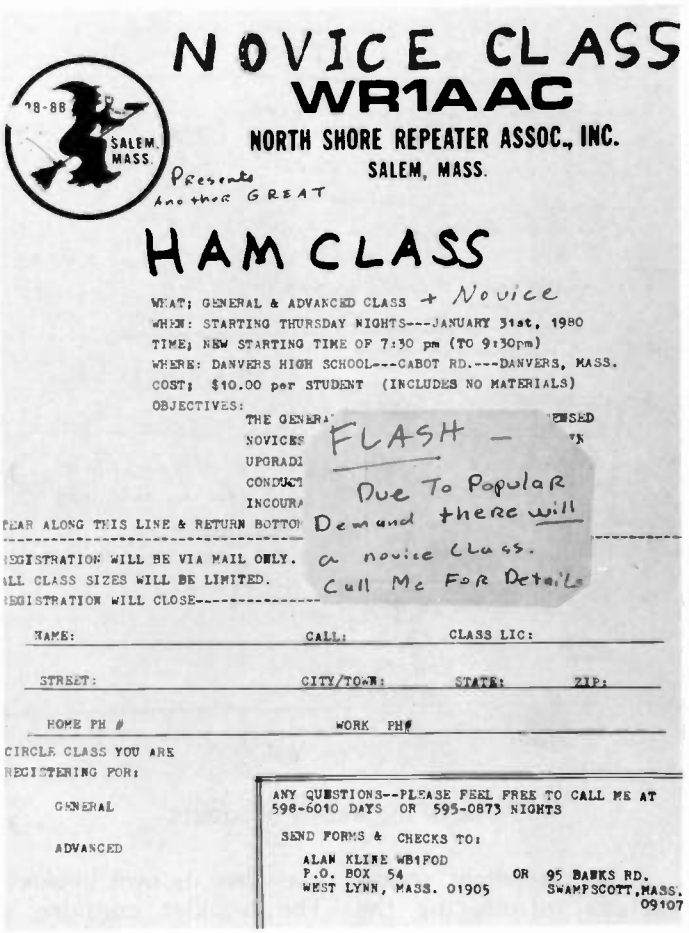
Once you've gone this far and generated all this interest, be prepared for the phone to start ringing. Find a retired or handicapped ham who is home a lot to take and log all the calls. He must be prepared to explain all facets of ham radio and mail out the ARRL's supplied material. Many people will call and not attend the next class, so it is important that they stay on your mailing list.

When writing announcements for the media, keep them as formal as possible. They should be typed on the club's letterheads and be neat. You want to convey that the organization running the classes is a professional one. When writing anything for the students, I wanted to project that ham radio is a relaxing, informal hobby. To help create this informal atmosphere, I always hand-wrote the announcements for the students. We always stress that anyone who puts in the effort and learns the required code will get the help they need to get their ticket—no matter how long it takes.

Many students who don't pass the course the first time will be hesitant to come again unless you have this relaxed atmosphere. Informality helps break down many barriers between the teachers and the students.

Teamwork

When it is possible, have three instructors for each Novice class. Two will alternate teaching the theory and the other will teach code and give exams. If any one of the three is absent, and that will happen, there will always be a back-up instructor who knows the students and the lesson plan. You can delegate one of them to handle all the paperwork. In our program, I do all the paperwork and advertising and leave the instructors to do what they do best.



NOVICE CLASS
WR1AAC
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SALEM, MASS.

78-88 SALEM, MASS.

Presents Another GREAT

HAM CLASS

WHAT; GENERAL & ADVANCED CLASS + Novice
WHEN: STARTING THURSDAY NIGHTS---JANUARY 31st, 1980
TIME; NEW STARTING TIME OF 7:30 pm (TO 9:30pm)
WHERE: DANVERS HIGH SCHOOL---CABOT RD.---DANVERS, MASS.
COST; $10.00 per STUDENT (INCLUDES NO MATERIALS)
OBJECTIVES:
THE GENERA[L] [PR]EPARED
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INCOURA

FLASH — Due To Popular Demand there will a novice Class. Call Me For Details

TEAR ALONG THIS LINE & RETURN BOTTO[M]
REGISTRATION WILL BE VIA MAIL ONLY.
ALL CLASS SIZES WILL BE LIMITED.
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ANY QUESTIONS--PLEASE FEEL FREE TO CALL ME AT 598-6010 DAYS OR 595-0873 NIGHTS
SEND FORMS & CHECKS TO:
ALAN KLINE WB1FOD
P.O. BOX 54 OR 95 BANKS RD.
WEST LYNN, MASS. 01905 SWAMPSCOTT, MASS. 09107

This is a typical announcement that was mailed to potential students. It was changed to offer a Novice class on short notice.

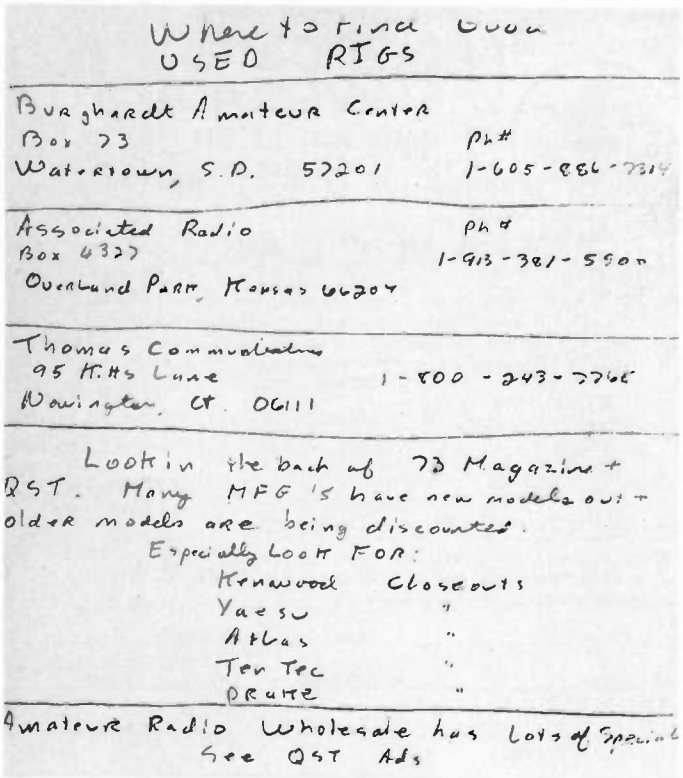
General and Advanced classes only require one teacher who is an active ham. By active, I mean one who has worked all modes and all bands. It is less important that you have a backup instructor for these classes, as the General students can always sit in on the Novice classes. The unlicensed Novices will have fun that night because they can spend the night asking the Generals questions about the hobby.

If you have only one Novice instructor, keep the class size as small as possible. One teacher can only handle about ten struggling Novices. We had no intentions of offering a Novice class during one session, but when 22 students showed up, a volunteer was called on the repeater and he gave it a good try. His passing rate was much lower than our other classes.

Opening Night

The most important meeting is always the first. For the first course we ran, on the first night, the four instructors all talked about some aspect of ham radio that they were into, public service, DX, RTTY, ATV, and CW, but this didn't work. Murphy's Law of boasting took over and each ham tried to out-talk the other. Too much material was covered. We didn't remember that the students were there because they already knew something about ham radio.

The correct first-night procedure should be to show one of the League's films. They cover all aspects of the hobby in 30 to 45 minutes. After showing the film, you can go right into the first night's lesson.



One of the weekly handouts.

Other first-night chores include introducing the teachers and having all the students introduce themselves. It is also helpful to have them tell why they came to the class and explain their communications experience.

Keeping the Interest

In most classes, the drop-out rate was as high as 50%, and they all dropped out within the first few weeks of code lessons. To keep student attention during this period, we tried to provide some sort of a handout at each class. They were either a small electronic part, catalog from an electronics company, or a printed sheet on antennas or circuits. We also brought in a different piece of ham gear each week to discuss. We were trying to string along the slow learners so they wouldn't get discouraged. Many of these methods worked.

Ham radio, like all hobbies, has its magazines, stores, and clubs. To help out aspiring Novices, each class has its own booklet. The booklet contains a short message from the sponsors, dates of meetings, teachers' names and calls, local repeaters to listen to on their scanners, W1AW code schedules, recommended magazines, parts stores, study guides, code tape sources, club meeting sites and times, and a ten-point check list on buying their first rig.

Since our repeater is located on the North Shore of Massachusetts, the booklet is entitled *An Introduction to Ham Radio on the North Shore*. With each new class, we add additional information we feel is needed, as most of us forget a lot of these facts ourselves. This booklet is also good as a ham radio public relations tool.

At each class after that you can pass out the other sheets and catalogs previously mentioned. Other good handouts we used were reprints of Novice articles, flea-market flyers, and old issues of ham radio magazines that came from the club members. The local Heathkit manager was not only a great help in supplying books, but also supplied catalogs, space for our posters, and a small kit for no charge. The printed circuit board, after having been assembled, was brought into a Heathkit store for checking. If it were properly built, it acted like an oscillator. It was a good gimmick for all involved.

Final Handout

The final handout should be an SASE or postcard for the students to mail back with their callsign. I usually put it this way: We need to know if our teaching efforts were successful—please let us know your callsign, and, if you didn't pass the exam, let us know if you want to try again. All students are so proud and so grateful for your help, that very few don't return the cards. Sometimes they are like QSL cards; a few will show up months later from other states because the students have moved.

Follow-Up

At this point, you might think that you've done your part. Not so! Most new hams will need some encouragement to get through that first CW contact. The club should start a slow-speed CW net that meets at least once a week. This is a good way to get other club members active in helping out the educational committee. Also, anyone who doesn't get a license should stay on your mailing list for future classes. We heard many personal reasons for dropping out of classes, but in a lot of cases they would sign up for another class at a more convenient time.

Registration Forms

In making up registration forms for both the repeater club and our classes, we ask for all the pertinent information such as name, nickname, address, town, summer address, zip codes, phone number, mailing address, if different, home and work phone numbers, bands active on, mobile or portable capabilities, and, finally, these important questions. First, how did you hear about the class? This will give you ideas on which advertising works best.

Second, what is your job or profession? This question is usually overlooked by clubs and here is why it's important. In the classroom, if the teacher knows everyone's backgound and jobs, he can draw on those talents in making analogies. This shows your interest in the students and if the club's board of directors has access to a list of what each member does for a living, they can draw from this group for meeting programs.

Clubs and classes are always in need of new speakers on both technical subjects and human interest stories. One good example of this was a husband who called to sign his wife up for a Novice class. In the conversation I found out that he was an Advanced class ham who was the new Belden cable salesman for the area. He was glad to talk to both the club and classes!

Deadlines

When printing up your class registration forms, always make the deadline for enrollment at least one week before your first night. This allows you to know exactly how much material you will need. It was a big surprise, at one first meeting, to have 20 more people show up for a Novice class than the 30 who had sent in checks. If you have a small class and decide to supply textbooks for them, it takes at least two weeks to procure them.

Our first attempt included the ARRL's *Tune in the World* which required careful guess work on the projected number of attendees. In later classes, we purchased ample supplies of the League's or Ameco's question-and-answer-style books.

Money

Having a total of 11 classes over three years with fees ranging to $25 per family member, we generated plenty of money to purchase all the supplies, code tapes, slide programs, books, and teachers' guides. Since I was the chairman of our educational committee, I usually decided what else the money was spent on.

As a club, we recently gave the town and high school libraries in three communities the ARRL's complete set of current publications. The League will sell any affiliated club this package for only $55. All six librarians were gracious enough to accept the donations at our annual meeting for the installation of new officers. A picture was taken and a small article appeared in the local paper about the books and our new officers. It was a good ham radio PR move.

Even if your club decides to underwrite the costs of the class, it's still important to charge for the class. I've argued this point many times over the air, but I am convinced the $10 or so you charge makes the student feel he has made a commitment. No student has ever questioned our fees, and many have made other donations. When asked what happened to the money, I always explained the Handi-Ham System, because all the extra funds were used to put the handicapped on the air.

Thank You

By donating books and new ham gear to the towns and school systems that provided rooms for our use, we had thanked them in our own way. In some other nearby communities, the ham radio instructors are paid as paid regular teachers in the evening school. None of my instructors gets any money out of our projects, but in my own way I showed them my appreciation.

After two years of teaching one night a week, my ten instructors had spent a lot of time teaching ham radio. I know that they would have been happy enough with the students' individual thank-yous, but that was not enough. My wife and I had the instructors over to our home, with their wives, for a dinner party. I wanted them and especially their wives to know how special this group was to me. I got a lot of thank-yous from the students and club members, but it was this group who actually got the teaching done.

After you organize your first class, no matter how large or small, and the first happy Novice calls up to say, "I just got my call-sign—KA1FCC," you'll know why we don't want to stop organizing them. If you think there aren't any people interested in ham radio classes for you to teach, then start by generating interest. I don't know how many classes we will help run over the next few years, but with the help of my fellow club members, the Courage Center, an understanding boss, and especially my wife, I look forward to many more happy Novices and Generals calling up to say "thank you."■

How FCC Rules Are Made

—a labyrinthine tale

Carey P. Busbin WD4DAZ
541 Broadway
Birmingham AL 35209

I think it appropriate to begin this discussion with a brief history of radio transmission and subsequent regulation. Federal regulation of interstate electrical communication can be traced to the *Post Roads Act of 1866*, which authorized the Postmaster General to fix rates annually for government tele-

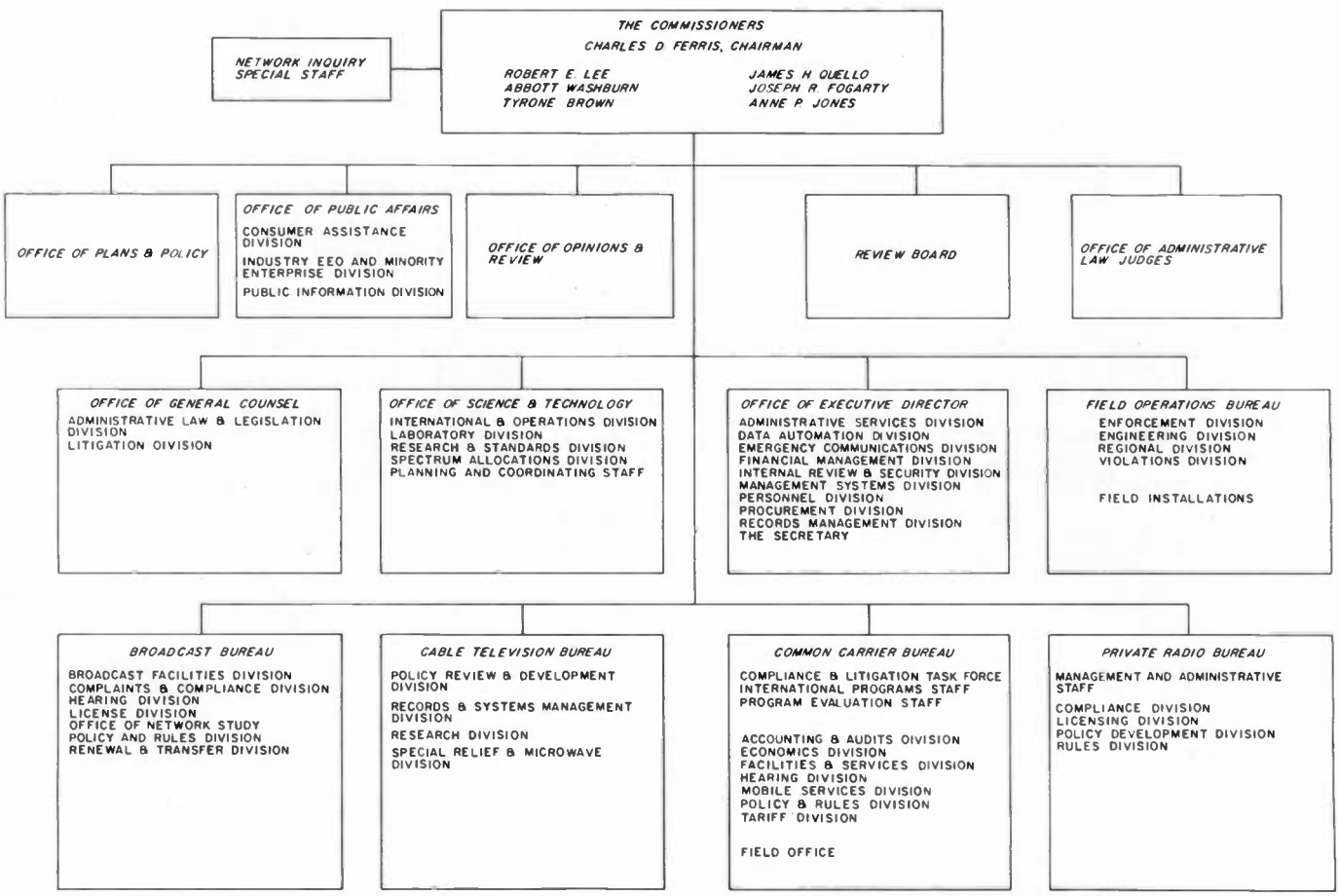


Fig. 1. FCC organization.

grams. This was followed by the *Interstate Commerce Act of 1887*, which granted the Interstate Commerce Commission (ICC) authority to require interconnection of telegraph systems to expand coverage across the country. Then, the *Vann-Elkins Act of 1910* directed the ICC to develop uniform accounting practices for these telegraph systems. This statute, in effect, extended provisions of existing law to cover certain wireless telegraphy. By 1910, wireless radio transmissions had proven worthwhile aboard ships, and the *Wireless Ship Act of 1910* required radio installation on large seagoing passenger vessels.

Two years later, the United States participated in the International Radio Telegraph Conference. Conference findings were the basis for the *Radio Act of 1912*. This Act regulated emissions, distress calls, set aside frequencies for government use, and mandated licensing. Licensing began later that year.

World War I ensued, and the Federal Government exercised control of radio, telephone, and telegraph as a precautionary measure. After the war, a tremendous growth in broadcast radio occurred. Broadcast radio had been unregulated by the legislation of 1912, which prompted President Coolidge to request of Congress the authority to control this growth. Congress responded with the *Dill-White Radio Act of 1927*. This Act established a five-member Federal Radio Commission under the Secretary of Commerce, with regulatory powers over radio.

Broadcast radio continued to prosper, and in 1934 Franklin D. Roosevelt asked Congress to approve the establishment of an independent commission to regulate radio transmissions. Congress responded by passing the *Communications Act of 1934*. This Act contained six major sections, or titles, and created the seven-member Federal Communications Commission (FCC) as we know it today.

There were extensive revisions to this Act, both in 1952 and during the period of 1960 to 1962. More recently, the *Communications Satellite Act of 1962* gave the FCC new responsibilities in the areas of space communications. Thus, over a period of time, Congress delegated authority to the FCC to govern radio; therefore, the Commission may develop regulations as they feel necessary to carry out these responsibilities.

Organization of the FCC

The seven commissioners are appointed for seven years by the President with the approval of the Senate. The Commission's chairman is selected by and serves at the pleasure of the President. The commissioners function as a unit, supervising all FCC activities. This is accomplished by delegating responsibilities to boards and staff units. Fig. 1 shows a current organizational chart for the FCC (amateur radio is within the Private Radio Bureau).

Rule Making

In order for the FCC to regulate radio transmissions as directed, the FCC must develop rules and regulations. Fig. 2 shows the pathway which a new Rule Making may follow. Using Fig. 2, let's begin at step 1 and follow a request for either a new rule or a rule change through the entire process.

Step 1. *Initiation of Action*. Any individual represented by one of the five groups may initiate a Rule Making.

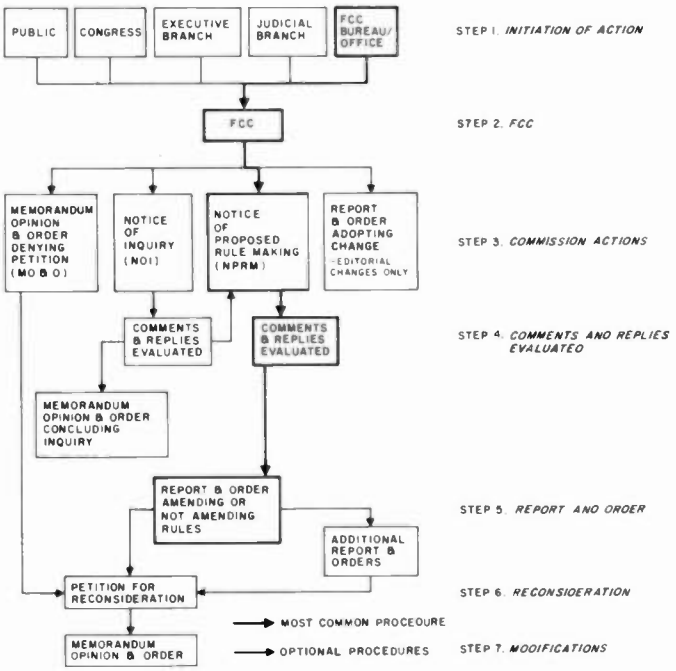


Fig. 2. FCC Rule Making diagram (from FCC Communicator, *September, 1975).*

Step 2. *FCC*. When a petition for Rule Making is received, it is sent to the appropriate Bureau for evaluation (the Private Radio Bureau for amateur regulations). If the Bureau decides a petition is meritorious, it will request that the Dockets Section assign a Rule Making (RM) number. The Bureau may then request one of four actions by the Commission as shown. A free weekly summary of Commission actions, *FCC Actions Alert*, is available from the FCC; the address for obtaining this publication will be found at the end of the "Publications" section.

Step 3. *Commission Actions*. If the Rule Making would require major changes in the rules, the Commission will issue either a Notice of Inquiry (NOI) or an Notice of Proposed Rule Making (NPRM). When either an NOI or an NPRM is requested, such a request will appear both in the *Federal Register* and the *FCC Actions Alert*. The NOI is basically to see if there is enough public interest to merit further consideration. The NPRM is an official announcement that a new rule is being considered. If the Commission feels that the proposal did not merit further consideration, they would issue a Memorandum Opinion and Order (MO), which would stop the action. The NOI usually leads to either an NPRM or an MO. An NPRM usually leads to a Report and Order (RO) or an MO. The RO either issues a new rule or amends and confirms an existing rule.

Step 4. *Comments and Replies Evaluated*. When an NOI or an NPRM is issued, the FCC solicits public comment. Replies to public comments are also solicited. Any comment or reply should reference the Docket Number.

Step 5. *Report and Order*. An RO is issued to institute a new rule, amend an existing rule, or confirm the current rule.

Step 6. *Reconsideration*. Petitions for reconsidera-

tion must be filed within 30 days.

Step 7. *Modifications*. A review of a petition for reconsideration may merit a change in the initial decision. The Commission may issue an MO to amend the initial decision.

Commenting

If you intend to file comments, the following subjects should be addressed. First, state your experience, expertise, and any insights which make your judgments accurate and worthwhile. Second, any facts, comments, or opinions should be clearly stated in easily understood fashion. Third, your comments should reach the Commission on or before the comment deadline. Moreover, if you intend to submit comments as a formal filing, you must submit an original and five copies. Comments should be submitted to: Secretary, Federal Communications Commission, 1919 M Street NW, Washington DC 20554. Be sure to note the Docket Number on the comments.

To help in filing comments, the next section will outline various materials available on the subject, and where they may be obtained. These publications will add clarity to FCC policies and procedures.

Publications

A) *Federal Register*, a daily publication from the U.S. Government which covers both proposed and official changes in regulations prepared by government agencies. The FCC is just one of hundreds of agencies and commissions which publish regulations in the *Federal Register*. A subscription may be obtained for $50 yearly from the Superintendent of Documents. The *Federal Register* is usually available at libraries in most areas.

B) *FCC Actions Alert*, a weekly bulletin published by the FCC containing Commission actions. The *FCC Actions Alert* is available without charge from the FCC.

C) *FCC Reports* contain complete texts of FCC reports and actions and is available for a fee from the Superintendent of Documents.

D) *FCC Rules and Regulations* is a looseleaf subscription service which continually updates the FCC regulations covered by that particular subscription. In order to cover all FCC Rules and Regulations, several separate subscriptions would be required. Information concerning which parts each subscription covers and how they may be ordered will be found in the U.S. Government Printing Office pamphlet *SB-281*, as described below.

E) *Federal Communications Commission Publication SB-281* is a subject bibliography available without charge from the Superintendent of Documents and lists all publications available from the U.S. Printing Office concerning the FCC.

F) *FCC Information Bulletins* are available without charge upon request from the FCC. Each bulletin covers a specific area of the FCC's responsibilities or a topic of interest to radio enthusiasts.

Federal Register, FCC Reports, FCC Rules and Regulations, and subject bibliography *SB-281* are available from: Superintendent of Documents, U.S. Government Printing Office, Washington DC 20402.

FCC Actions Alert and *FCC Information Bulletins* are available from: Federal Communications Commission, 1919 M Street NW, Washington DC 20554.

Summary

Amateur radio clubs should be apprised of proposed changes in FCC regulations which affect amateur radio. Too often over the last few years, we learned that we were the subject of substantial changes without sufficient prior notice. Because of printing and mailing lead times necessary with publishing magazines, it is very possible that the FCC comment period is long over by the time you receive the current issue containing the notice. This can be avoided by having the club or a responsible individual placed on the *FCC Actions Alert* mailing list (see "Publications"). If a Rule Making concerning amateur radio is received, then the membership can be notified. In addition, the FCC maintains two phone numbers, one for general information from the Public Information Officer, (202)-632-7260, and the second, a recorded message concerning weekly actions, at (202)-632-0002 (neither is toll-free).

As you know, the trend regarding frequencies has been "use them or lose them"; the same is true of Rule Makings. Failure by the FCC to receive a number of comments on proposals means to the regulator that there is little or no interest in the subject; therefore, they should proceed with their proposals. Many times this just isn't true. Therefore, I suggest that you as an individual or club member monitor FCC Rule Makings, perhaps even suggesting changes in amateur regulations which you feel merit consideration. Your very participation will help ensure the place of amateur radio in the future. ■

Acknowledgement

A portion of the information contained in this article was obtained from the Federal Communications Commission.

REVIEW

from page 32

the manual, "The quality of copy is directly proportional to the quality of the signal being received as well as the quality of the CW being received. If you are trying to copy a guy with a sloppy fist, then you'd better expect sloppy copy. If, on the other hand, the CW is being sent by a keyer or a keyboard, the copy will probably be perfect." Amen. If you intend to use the ROM-116 for serious CW reception, get a good CW filter and talk only to people who can send well! Whatever conclusions you draw about machine-read CW, the transmit portion of the ROM-116 is faultless. It is easy to use, sends perfectly, and even allows you to start typing a reply while receiving a message.

By necessity, this is only a brief overview of the capabilities of the ROM-116; it has many intriguing features that are not mentioned in this review. How did it perform in the real world? Superbly. It is at the top of its class. With equipment like this on the market, the old stalwarts are going to have to brace themselves for an influx of enthusiastic operators using computer-based RTTY gear. Few people who listen in on the RTTY segments of the band will be surprised if RTTY operation begins to spread out and take more spectrum. Things are already pretty crowded! A device like the ROM-116 will attract a lot of people to RTTY who would never have considered it before —people like me!

There is one big if that deserves mentioning. Microcomputers, to varying degrees, can emit a lot of hash into the rf spectrum. If your computer is unshielded (as is the TRS-80), you may or may not hear a great deal of noise in your receiver, all generated by the computer. In the *73* shack, using unshielded interconnecting cables and making absolutely no effort to reduce interference, the problem was there, but it wasn't severe. Weak signal work could suffer some interference, but the problem was not as bad as we expected. Best of all, the combined efforts of our Alpha 374 and Dentron MLA-2500 amplifiers did not cause any interference to the RTTY system, even while operating RTTY and SSB simultaneously.

This is the dilemma that hams face when they go shopping for a microcomputer-based RTTY system: Do they buy a completely RFI-proofed system that offers limited or non-existent use as a separate computer, or do they go for a microcomputer and interface system that can be extremely useful when the bands go dead, but may or may not need some work to clean up RFI? If getting dual usage out of your equipment appeals to you, the Crown Microproducts ROM-116 deserves your attention; it's a first class piece of gear that you'll never grow out of. For further information, contact *Crown Microproducts, PO Box 892, Marysville WA 98270.* Reader Service number 478.

Paul Grupp KA1LR
***73 Magazine* Staff**

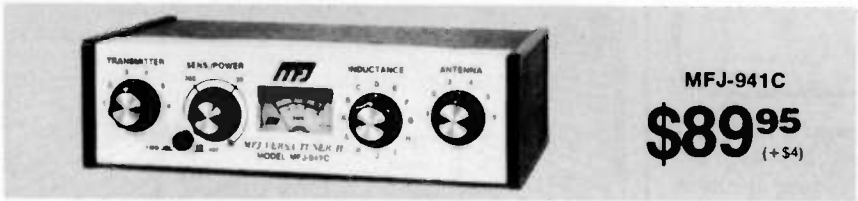
REALISTIC PRO-2008

Radio Shack's latest introduction to the scanner market, the PRO-2008, provides the Public Service Band enthusiast with an interesting blend of traditional and unique features. The new, stay-at-home relative of the popular PRO-2001 is designed to be a lower-priced alternative for those whose listening needs require a smaller number of channels without a searching capability. The 2008 is a 1980 addition to the Realistic family of scanning monitors and is midway in price and performance between the most expensive crystal-controlled scanners and the more sophisticated synthesized models.

The 2008 is a programmable FM scanning receiver with direct keyboard entry system, capable of scanning any eight frequencies in the ranges 30-50, 144-174, and 410-512 MHz. The entire unit is controlled by an onboard microprocessor designed especially for use in this scanning monitor. The microprocessor is accessed via the 18-key

Continued on page 117

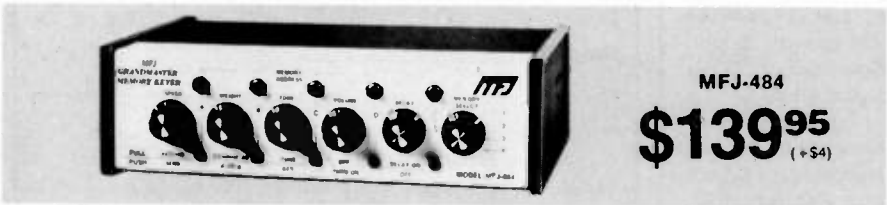
MFJ 941C Versa Tuner II



MFJ-941C
$89.95 (+$4)

Fastest selling MFJ tuner . . . because it has the most wanted features at the best price.
SWR + dual range wattmeter (300 & 30 watts full scale, forward and reflected power). *Sensitive meter* measures SWR down to 5 watts output.
More flexible antenna switch selects 2 coax lines, direct or through tuner, random wire/balanced line, or tuner bypass for dummy load.
12 position efficient airwound inductor for lower losses, more watts out.
Built-in 4:1 balun for balanced lines. 1000v capacitor spacing.
Matches everything from 160-10 meters: dipoles, inverted vees, random wires, verticals, mobile whips, beams, balanced and coax lines.
Easy to use, anywhere. Measures 8x2x6", has SO-239 connectors, 5-way binding posts, finished in eggshell white with walnut-grained sides.
MFJ-945, $79.95, like model 941C but less ant. switch. Optional mobile bracket for either model is $3.

MFJ 484 "Grandmaster" Memory Keyer



MFJ-484
$139.95 (+$4)

Up to twelve 25 character messages plus 100, 75, 50 or 25 ch. messages (4096 bits).
Repeat any message continuously or with pauses of up to 2 min. LEDs show use.
Record, playback, or change messages instantly at touch of a button. Memories are resettable with button or touch of the paddle.
Built-in memory saver — 9 V battery takes over when power is lost.
Iambic operation with squeeze key. Dot-dash insertion. Optional BENCHER paddle $42.95 +$4.
Dot-Dash memories, self-completing, jam-proof spacing, instant start.
Panel controls: Speed (8-50wpm)/Record; Weight/Memories Combined; Tone/Tune; Delay (0-2 min.)/Repeat; rotary Vol/On-Off; Memory Select; Message Buttons select desired 25 ch. messages; Memory Reset button.
Ultra reliable solid state keying: grid block, cathode, solid state transmitters (−300 V, 10 mA max; +300 V, 100 mA max). Operates 12-15 VDC or 110 VAC with optional adapter, $7.95 +$2. Size 8x2x6". **MFJ-482, $99.95,** four 25 or 50+two 25 ch. messages; **MFJ-481, $89.95,** two 50 ch. messages. **Get the best seller keyers**-MFJ "Grandmasters."

MFJ 410 "Professor Morse" Code Generator/Keyer

NEW LOW PRICE
Save $20
MFJ-410 Now Only **$129.95** (+$4)

Use it to learn, use it to operate. It sends *unlimited random code* in random groups for practice; *never repeats* sequences. And when you're on the air, it's a *full feature keyer*.
Vary speed from 5-50 wpm; meter readout.
Vary spacing; give fast sound to low speed.
Alpha or alphanumeric with punctuation.
Built-in speaker and phone jack; tone and vol. Ideal for classroom or private use.
Full feature keyer includes vol., speed, tone and weight controls, tune switch, dot-dash memories, keys grid block, cathode, solid-state rigs. Optional BENCHER paddle $42.95 + $4. Operates on 9-18 VDC, two 9 V batteries or 110 VAC with optional adapter $7.95 +$2. Size 7x2x6". **Get "Professor Morse"** — you'll never outgrow it.

MFJ Dual Tunable SSB/CW Filter "Signal Enhancer"

MFJ-752B **$89.95** (+$4)

Dual filters give unmatched performance.
The primary filter lets you *peak, notch, low pass or high pass* with extra steep skirts.
Auxiliary filter; *70 dB notch, 40 Hz peak.*
Both filters tune from 300 to 3000 Hz with variable *bandwidth from 40 Hz to nearly flat.*
Constant output as bandwidth is varied; linear frequency control.
Switchable noise limiter for impulse noise.
Simulated stereo sound for CW lets ears and mind reject QRM.
Inputs for 2 rigs, switch selectable. Plugs into phone jack. Two watts for speaker. OFF bypasses filter. 9-18 VDC, 300 mA or 110 VAC with optional adapter $7.95 +$2. 10x2 x6". **MFJ 751, $69.95,** similar, primary filter only, less high pass & noise limiter.

MFJ BEST SELLERS

favorite products from the world's leading manufacturer of amateur radio accessories

GMT Clock/ID Timer

MFJ-102
$32.95 (+$4)

NEW 12/24 Hour Digital Clock/ID Timer Switch from 12 hr. to GMT, to "seconds" readout, ID timer or elapsed timer. WWV sync, solid-state, blue 0.6" digits, reg. alarm +indicators. 110 VAC, 60 Hz, 6x2x3".

KW Dummy Load With Oil

MFJ-250
$29.95 (+$4)

Rated at 1 kW CW or 2 kW PEP for 10 min., half that for 20 min., cont. at 200 W CW, 400 W PEP, non-inductive 50 ohm resistor, quality transformer oil (no PCB), VSWR under 1.2:1 to 30 MHz, 1.5:1, 30-300 MHz, 2:1, 300-400 MHz. Coax conn., vent cap., 7½"h x 6⅝" diam.

300 Watt Antenna Tuner

MFJ-949B
$139.95 (+$4)

Does it all! Built-in dummy load, SWR, forward and reflected power meter, antenna switch, balun, matches everything from 1.8-30 MHz (coax, random wires, balanced lines), coax conn., binding post, 10x3x7".

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47

MFJ Super Keyboard

For $279.95 you get: CW, Baudot, ASCII, buffer, programmable and automatic messages. Morse code practice, full featured keyer, human engineering.

Sending CW has always been a task, especially when you get a little tired. Electronic keyers help, but it's still too much work.

Now MFJ has a Super Keyboard that makes sending perfect CW effortless. It also sends Baudot RTTY and ASCII.

"Big deal" you say. "What's so special about that. There are lots of keyboards." Yes, but this one is different.

HUMAN ENGINEERED

A lot of thought has gone into human engineering the MFJ-494 Super Keyboard.

For example, you press only a one or two key sequence to execute any command.

All controls and keys are positioned logically and labeled clearly for instant recognition.

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.

MORSE CODE PRACTICE

There are two Morse code practice modes. Mode 1: random length groups of random characters. Mode 2: pseudo random 5 character groups in 8 separate repeatable list. With answer list.

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✓ Reader Service—see page 146

Paul Danzer N1II
2 Dawn Road
Norwalk CT 06851

A $10 Phone Patch

—CQ Ma Bell

You don't *have* to spend $40 to $90 for a phone patch to match your new solid-state rig. This simple circuit will give perfectly adequate performance with parts purchased at your local Radio Shack. For a cost of under $10 and one evening's work, you can have a patch that will work with a new solid-state rig or an older tube-type transceiver. This circuit (or variations of it) has been in use by several hams in this area for a number of years (see Fig. 1). With the bypass capacitors shown, no effect from rf feedback has been experienced, even when used with a kilowatt.

S1 is a four-pole, two-position switch (Radio Shack 275-1384 or equivalent) used to switch the patch on and off. The fourth section of this switch (S1d) is used to switch the patch into the circuit in place of the usual station microphone. If your rig has a phone patch input, you can leave the mike connected to its usual jack and use the alternate connection shown by the dotted line.

S2 is a DPDT toggle or lever switch. It allows you to select XMIT (transmit) or RCV (receive) from the front panel of the patch, rather than fumbling with the microphone PTT switch, telephone handset, and receiver audio gain control all at once.

S2 is wired in such a way as to permit operation with many types of solid-state rigs. These rigs often have the novel little problem that the receiver audio is not cut completely off while in the transmit mode. During normal operation this is not a problem. However, with many of the usual phone patches, an audio oscillation will result, with the phone patch acting as the oscillator coupling element. Switch S2 disconnects the receiver audio from the patch when in the transmit mode, thus eliminating the problem.

The second section of this switch (S2b) grounds the PTT line when you wish to transmit. On a few of the new rigs, this line is called MOX rather than PTT. MOX stands for Manually Operated Xmit, similar to VOX for Voice Operated Xmit.

Impedance matching is provided by T1 and T2, which are identical 8-Ohm-to-1000-Ohm (center-tapped) audio transformers. Radio Shack lists this item as 275-1384. They are not critical, and any 8-Ohm-to-1000-Ohm or 8-Ohm-to-500-Ohm audio transformer will do. Good performance has been obtained even with a pair of 12-volt filament transformers. The 12-volt secondary is connected in place of the 8-Ohm winding and the 115-volt primary in

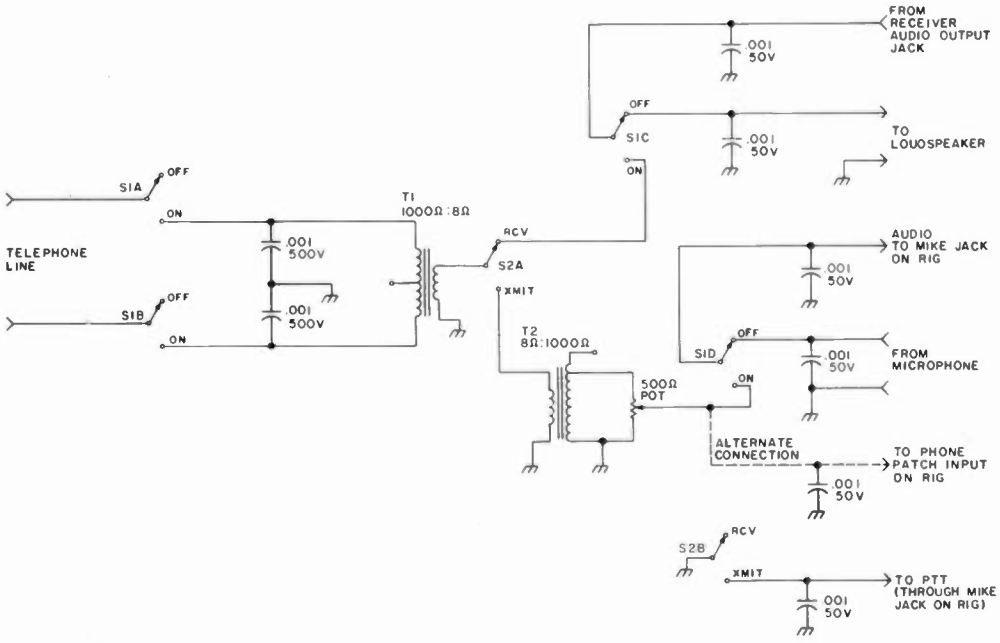


Fig. 1. Inexpensive phone patch uses readily available components.

place of the 500- or 1000-Ohm winding.

The transmit level is set by the 500-Ohm pot connected to T2. Bypass capacitors are shown on all input and output leads to prevent rf feedback. A metal enclosure for the patch is recommended.

To use the patch, set S1 to ON and S2 to RCV and listen on the telephone handset. You can get a clear line (no dial tone) by dialing the first digit of a local exchange. Tune in a station on your receiver and set the audio gain control on the receiver for a comfortable level in the telephone handset. Telephones are quite tolerant and level setting is not critical. If the audio sounds comfortable in your ear on receive while listening through the telephone handset, it probably is acceptable.

Next, put S2 in the XMIT position and talk normally into the telephone handset. Set the 500-Ohm pot so that the meter on the final in your rig swings into its normal area as though you were using the station microphone.

There is no provision for VOX operation. Most hams prefer manual RX/TX since it both prevents an operator's accidental sneeze or cough from turning on the transmitter and allows you to cut off the speaker if he or she attempts to say something inappropriate for transmission over your station.

One tip on phone patch use—for some reason, when you tell someone on the telephone to talk louder, they will do so for a few minutes and then lapse back to their orginal volume. However, if you turn the audio gain control down so that they hear the other station more softly, they will automatically speak up as though to compensate. ■

Two Stations on One Antenna

— Impossible? Guess again!

Charles Trice WA4RRB
50 N.W. 189 Terrace
Miami FL 33169

Phillip Vitrano WB4INC
40 N.W. 189 Terrace
Miami FL 33169

Can two amateurs live next door to each other and operate in harmony with *one* antenna system for *two* shacks? Sure! Here's how we did it.

At the time I (Charlie WA4RRB) moved in next door to Phil WB4INC, we had a few things going for us: (1) We had been friends for many years. (2) Our shacks were to be very close. (3) We had a lot of parts in the junk box. (4) And, most importantly, we agreed that it would be ridiculous to have two complete antenna systems side-by-side. We couldn't both operate on the same band at the same time, anyway.

We ended up with a very versatile and simple switching system that features: (1)

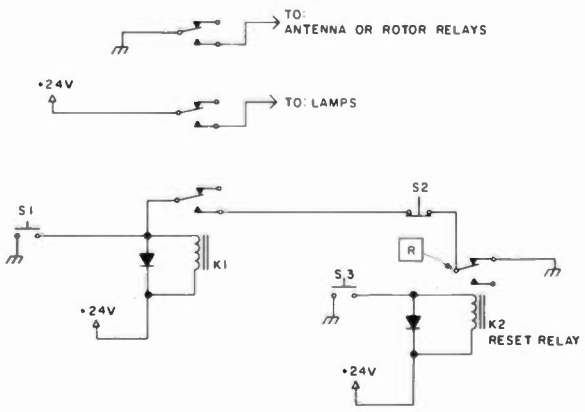


Fig. 1. Basic control relay hookup.

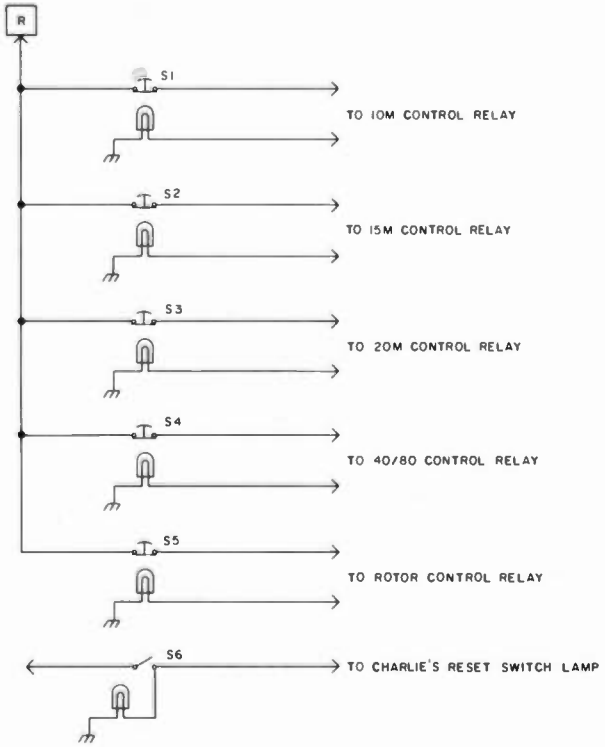


Fig. 2. Phil's control panel.

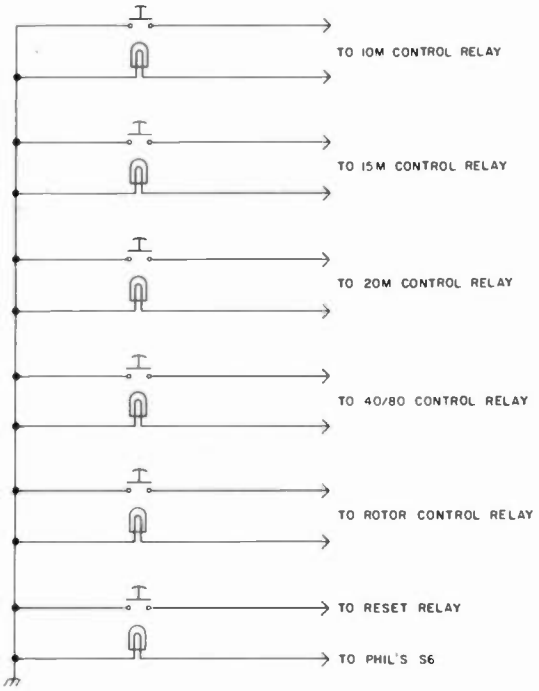


Fig. 3. My control panel.

two-way intercom between shacks; (2) remote control of all the separate feedlines for a three-band, two-element quad for 10, 15 and 20 meters; (3) remote control of a two-band trap dipole for 40 and 80 meters, and (5) lighted indicators.

Since all of the antennas already existed at Phil's, we left them there and I undertook the construction of the switching system. The design considerations were: (1) as little disruption to Phil's shack as possible; (2) a low control voltage between shacks; (3) fail-safe normals so that power supply failure would not inconvenience Phil (after all, I was saving lots of bucks by not having to buy and erect an antenna system); (4) a simple single-voltage power supply; (5) grounding of all antennas when not in use, and (6) ability to override the other shack—if one operator forgot to clear his control panel, the other still could gain access to any antenna.

There are four sections to the system: the control relays, Phil's control panel, my control panel, and the antenna relays. The basic control relay hookup is shown in Fig. 1.

If I press S1 (a momentary NO SPST push-button switch), K1 pulls in. The lower set of contacts applies a latching ground to the relay coil through two dependent normals: S2 (an NC momentary push-button switch) and an NC set of contacts on K2. S2 is on Phil's control panel and when it is pressed, it resets the condition that S1 set. K2 and S3 allow a momentary break in the ground used to latch K1. I use S3 to reset anything I've remoted. Phil uses S2 to reset the relay if I walk off and leave something remoted.

Point R is connected to all of Phil's switches, allowing reset of any remote condition to my shack.

S1 and S2 have internal lamps that are lighted when K1 pulls in. The lights indicate a remote condition. All bulbs are 28 V dc running on 24 V dc to lengthen life. All control relays are 4PDT 24 V dc.

This circuit is duplicated five times: four for the antenna relay control and the other for rotor control.

S6 is a push-on, push-off SPST switch with an internal lamp. Phil presses S6 when at the rig, illuminating my reset switch lamp (in S3) and warning me of Phil's operation. I check with Phil over the intercom to see what antennas are available.

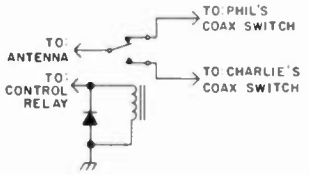


Fig. 4. Antenna relays.

All control switches are momentary SPST push-buttons with internal lamps.

We home-brewed the antenna relays, not only because of the availability of parts in the junk box, but also because of the cost of commercial units. The relays were enclosed in small aluminum miniboxes, with all coax connections made through SO-239s. We feared an impedance lump, but were pleased to find no change in the operation of any of the antennas. The relays used were 24 V dc with large contacts, capable of handling a kilowatt. We also were pleased that no rf got back into the power supply.

The outputs of the antenna relays feed ground-shorting rotary coax switches in both shacks.

All interconnecting cables run between the two shacks through four-inch PVC pipe that is buried about six inches down. The elbow connections into the shacks are hidden from the street with bushes and ferns.

We are able to operate simultaneously, even when both stations are using the quad. The only conflict that arises is in the direction the quad is pointed. Remember—we're friends . . .

The system has been in continuous operation for over two years, with not one failure. ■

Jim Lunacek KØYMJ
5145 Xerxes Avenue North
Minneapolis MN 55430

Build a 60-Hz Frequency Monitor

—keep the power company on its toes

How many times have you needed a simple, cheap, 60-Hz frequency indicator? Sure, a commercial reed-type meter is nice, but it never seems to be available when you need it. The other alternative, the station frequency counter, is bulky and expensive.

Here is another device—a circuit—which can resolve cycles per minute and costs only a few dollars to build. The circuit is basically a frequency comparator, and the idea can be extended to almost any frequency you wish.* Fig. 1 shows the schematic. The reference frequency (60 Hz) is derived by using a color-TV crystal and an MM5369 programmed divider (integrated circuit). Both crystal and IC are very reasonably priced and useful for many digital clock/timer projects as well. The input frequency is taken from the low-voltage secondary of the power transformer. The power supply is straightforward, using a bridge rectifier and a 5-volt IC regulator, U6.

The reference and the input frequencies are processed by the Schmitt trigger, U2, and fed to the comparator circuit, U3, U4, and U5. U3 provides identical pulse shapes to U4. U4 is a 4-bit counter which counts up with one input and down with the other. The counter contents are decoded by U5 and used to light D5 to D8, in sequence. The direction of the sequence will indicate whether the input frequency is fast or slow. For the display, I used a 7-segment readout with a defective segment, but four standard LEDs work as well.

The PC artwork I used is shown in Fig. 2, and parts placement in Fig. 3. Any method of construction you find convenient to use with ICs is okay. Nothing is particularly critical, but you may need 0.01-uF bypass capacitors for the 7400-series ICs. U6 should have a small heat sink.

It's simple to use. Plug it in and watch the rotation of the LEDs. For the most part, the oscillator trimmer doesn't really have to be adjustable. If you're a purist, the oscillator can be set to 3.579545 MHz with a frequency counter on U1 pin 7, a buffered output.

Plug it into your local power company, and you will see a very slow rotation, once every five minutes or so, corresponding to a frequency difference of perhaps four cycles in five minutes. Most power companies rarely hit 60 Hz on a

*"Circuits²," *73 Magazine*, July, 1977, p. 35.

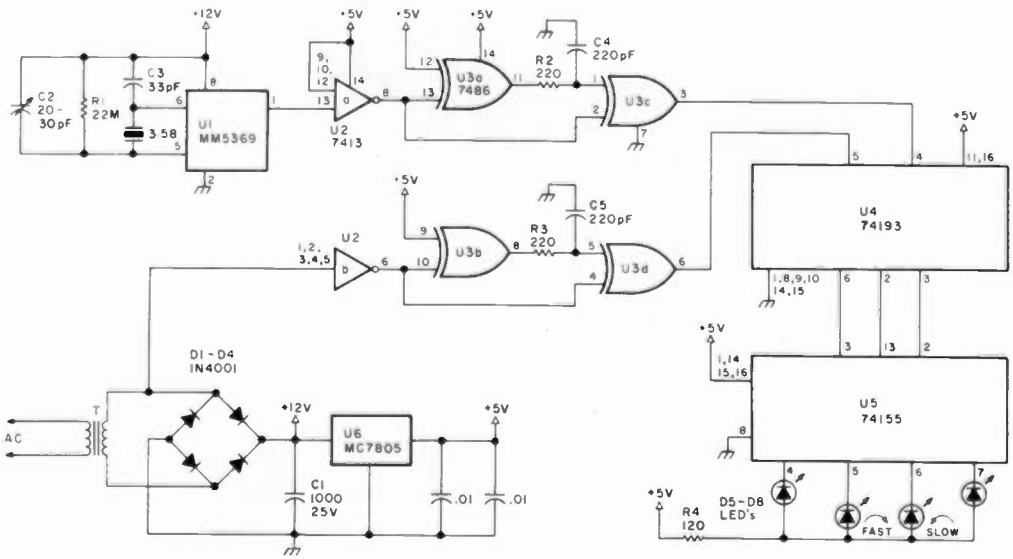


Fig. 1. 60-Hz comparator schematic.

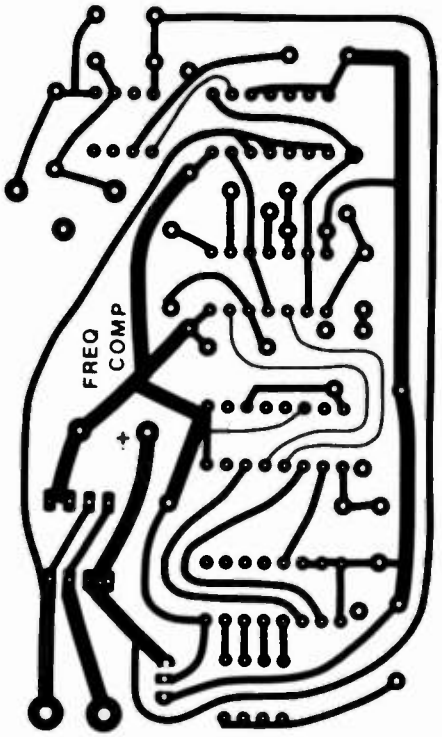


Fig. 2. PC board layout.

short-term basis because of adjustments needed for demand, etc., but over the long term, all the clocks stay on time. This is why the rotation will be fast (clockwise) at some times while slow (counterclockwise) at others. On an emergency or standby power system, you will see quite wide changes of frequency with load variations.

That's all there is to it. One of these devices is in use at a local radio station. (Opening the throttle on a 30-kW diesel generator until the fluorescent lights fire is not the best way to set engine speed!) Try one for Field Day.

I want to thank Carol Stoops and Keith Anderson for the photography, and Lindsay Mickler for her assistance in preparing this manuscript. ■

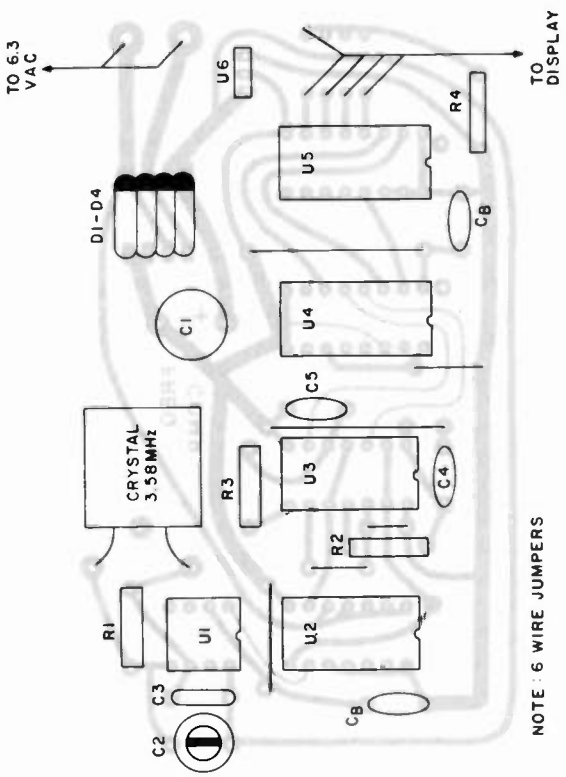
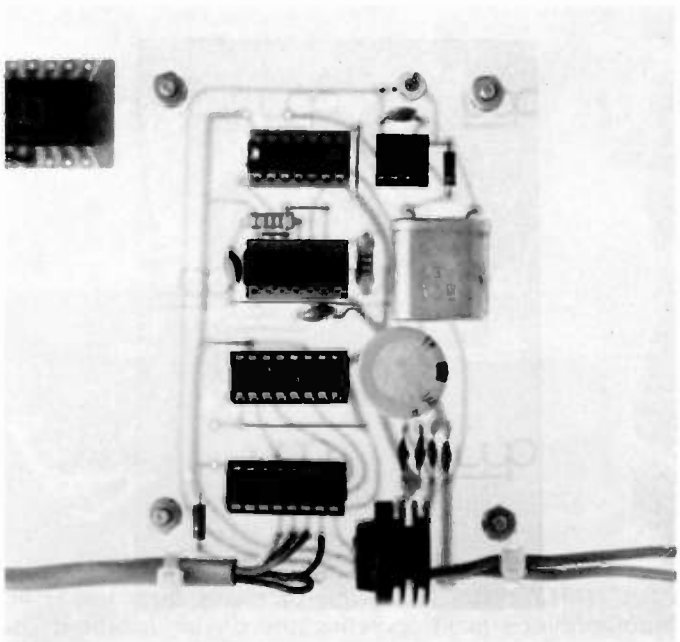


Fig. 3. Component placement.



60-Hz comparator.

Fred Bonavita W5QJM
PO Box 12072
Capitol Station
Austin TX 78711

Feelin' No Pain

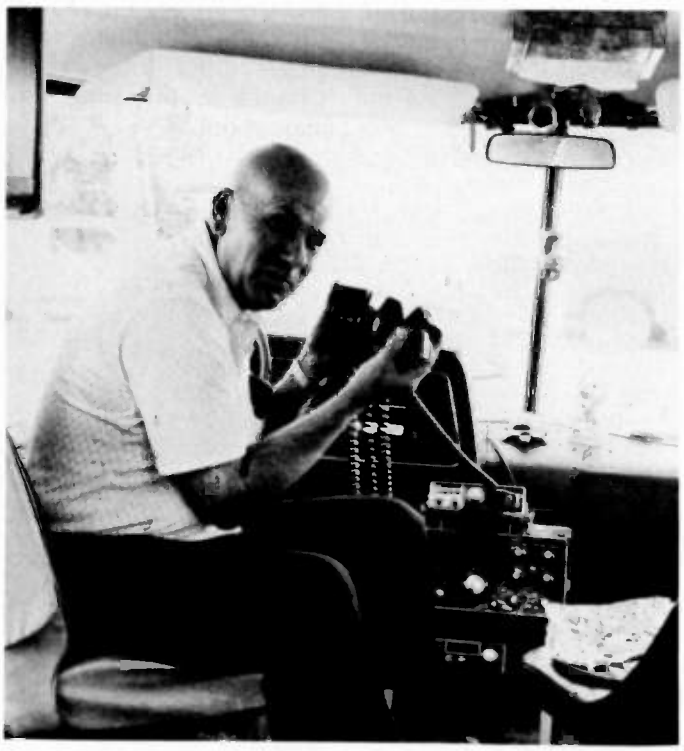
— expedition to Luckenbach

Permanent residents of Luckenbach, Texas, whose numbers fluctuate between three and five depending on the time of year and which way the wind is blowing, took the whole thing in stride on that May weekend.

And why not?

On previous weekends, for instance, thousands of country-and-western-music fans had jammed the tiny Texas hill country community to listen to their heroes, Willie Nelson and Waylon Jennings, sing the praises of Luckenbach ("where ain't nobody feelin' no pain") and drink beer.

Other weekends brought numbers of Bandidos (the Texas answer to California's Hell's Angels) roaring down Luckenbach's main street on their motorcycles for days of dancing and drinking beer.



"Tex" N5TX offers a handful of mikes from inside his mobile home's main operating and driving location. The vehicle served as one of the many operating points during the weekend.

And, on weekends between, there is a constant stream of curious tourists, carrying cans of beer and admiring such well-known landmarks as the town's lone parking meter, the recently installed pay telephone (the only one in town), or the bust of the late Hondo Crouch, who helped rescue Luckenbach from becoming a ghost town by buying it—lock, stock, barrel, and egg-delivery route.

What was so special about the arrival on the weekend of May 12-13, 1979, of several dozen radio amateurs (with their elaborate equipment and antennas) for the first DXpedition to Luckenbach? For the locals, not much—except for another increase in beer sales. Few passersby noticed the sounds of CW signals drifting over the row of faded green outhouses across from the combination general store and bar.

But if the regulars were being blasé about the DXpedition, amateurs around the world were not. They were lined up, waiting their turn for a contact with W5TEX, the Voice of Luckenbach, for the weekend. When the pileups cleared at noon Sunday, after twenty-eight hours of operation, some 2,200 amateurs had qualifed for special certificates issued for the occasion. And some of those pileups were so massive, operators and loggers occasionally had to summon help.

One of those waiting to land W5TEX was UA9DO in Moscow, who read about the DXpedition in a US ham radio magazine. That particular QSO was the longest distance worked during the weekend. (One Texas ham wondered why the Russian apparently was getting better and speedier delivery of the magazine than were the locals.)

Other DX logged included WA4JHS/MM1 in the Mediterranean, SVØAH in Greece, YU2RAW in Yugoslavia, and EA9FE in Africa, all on 10 meters.

And there was the bewildered WB2RLK/VE1 in Nova Scotia, who could not immediately grasp the details of his QSO with Luck-

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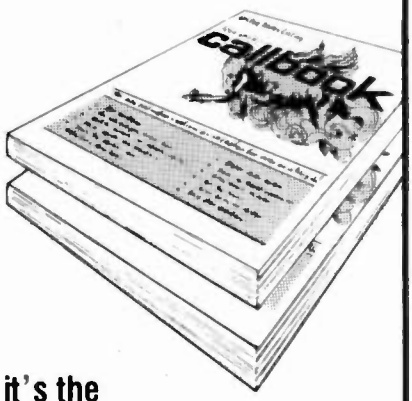

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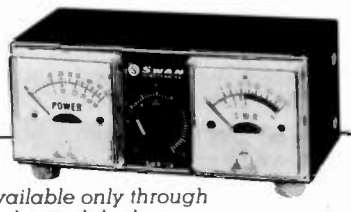

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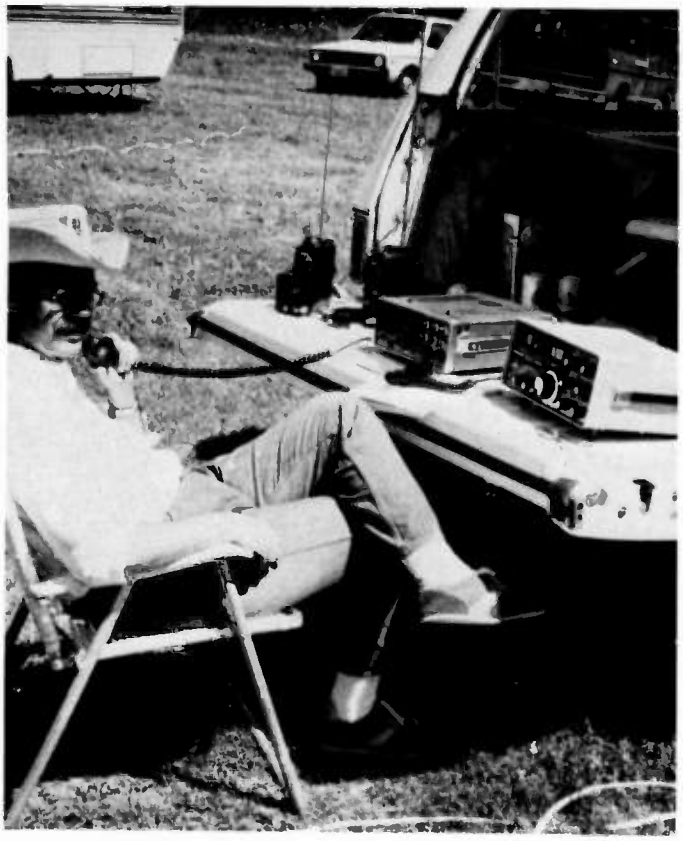

Larry N5LL handles the 10-meter and 6-meter FM positions from a relaxed perch just aft of the tailgate of a vehicle.

"Cherokee" WD5JKW at the key on 15-meter CW, one of the most active operating positions in Luckenbach.

enbach. Dee WB5VWX and Floyd WB5PFR found an old set of bedsprings, took it outside, propped it up, loaded a Ten-Tec Argonaut into it through a tuner, and worked him on 10 meters, getting a respectable 5-by-5 report in return. They said later that they had to twice explain where they were and what was happening with their antenna; they quoted him as saying that "since he was working a station in Luckenbach, he could believe almost anything." That QSO netted him the only bedspring endorsement to be awarded on a certificate. The antenna was dismantled immediately afterward.

The whole event, staged by the Bexar County Repeater Organization in San Antonio, was timed to coincide with the annual return of the mud daubers—an occasion rivaled only by the return of the swallows to Capistrano or the return of the turkey vultures to Hinckley, Ohio. And the mud daubers (pronounced "muddobbers" locally) winged in promptly at noon on Saturday to be greeted with cheers (and another round of Lone Star beer) from the crowd that had gathered to mark the event.

Operations were set up in a former cow pasture, adjacent to the main street, vehicles were deployed around the area, and the place soon took on the air of Field Day. Stations were set up in mobile homes, travel-trailers, on the tailgates of pickup trucks, and in a nearby building.

Beams (lent by Wilson Electronics Corp.) and longwires were everywhere. In many instances, the beams were cranked by hand.

Using regular power sources instead of emergency generators, the operators jumped to their tasks just after breakfast on Saturday. Sixty-one operators and loggers manned the various points, with stations on all the high-frequency bands and on 6 and 2 meters in the VHF spectrum. Phyllis Dyer WB5ZFA put all the other operators to shame by handling 291 out of 582 contacts on 20-meter phone during the weekend. And there were 524 contacts on 40 phone, 498 on 15 phone, and 205 on 15 CW.

The idea for the outing came (as a joke) from a repeater organization member to Bob Schneider AI5Q, who was the net control station one night.

"Clem WB5VDL said he was turning the net back over to AI5Q, who was organizing a DXpedition to Luckenbach," Schneider recalled later. "Everyone heard it, and the next thing I knew, we were getting calls from as far away as Corpus Christi wanting to know about it."

From there the idea caught on and spread. The repeater group raised about $1,200 through a raffle to finance the costs.

Tentative plans call for the San Antonio group to mount its next DXpedition from deep in the heart of Texas—literally. The next outing has been scheduled for mid-1981 from a cavern below the surface of the earth—a cool spot on hot days.

Other sites being eyed are Terlinqua, Texas, near Big Bend National Park in far west Texas and the site of an annual chili-cooking competition, and Lost Pines, near Bryan, Texas. Legend has it that Lost Pines, located in an area of the state otherwise devoid of pine trees, came from seeds planted by the famous Johnny Pineseed, a descendant of Johnny Appleseed, who wandered that section of east Texas in the last century and whose exploits are expected to be the center of attention any day now, according to Schneider.

Any chance of a return trip to Luckenbach?

"That's possible, too," Schneider said. "They were glad to have us and happy about the publicity. We were so tame compared with the normal Luckenbach groups that we almost weren't noticed. We probably were the first group in three or four years that didn't have hair down to our shoulders." ■

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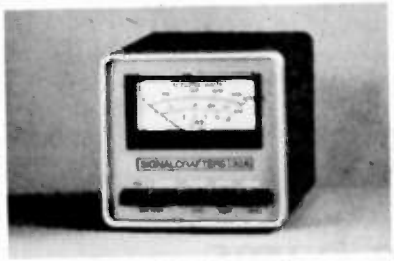

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Operating Overseas

—licensing facts for traveling hams

Early in 1977, after having passed the radio amateur examination in South Africa, I had to travel for my company to the German Federal Republic. In South Africa, I could find no information readily available on how to obtain permission to operate in other countries. A phone call to the DARC (the Deutscher Amateur Radio Club) amateur radio center, the Amateurfunk-Zentrum (AFZ) in Baunatal, West Germany, brought me all information on how to get a guest license.

After returning to South Africa, I discussed my experience with other hams. It became clear to me how many of us travel but leave our rigs behind and do not apply for permission to operate in the countries visited because there is just no one who knows who to contact for such permission. Subsequently, I wrote to the DARC and got photostats of all the guest license information available at that time (early 1978). The information supplied by the DARC is, of course, intended for German radio amateurs and is based mainly on arrangements the German Ministry of Posts has made with other foreign telecommunication authorities.

This was used as a basis for finding out the conditions under which foreign telecommunication authorities issue licenses to visitors. When I visited the UK and West Germany early last year, I was lucky to meet the General Manager of the Radio Society of Great Britain (RSGB), OM Dave Evans, in London, as well as the General Manager of the DARC in Baunatal. We discussed problems that visiting hams encounter, and I was now able to help the DARC update its guest license file with information from South Africa and elsewhere.

The information contained in this article has been gathered from various trips that other hams and I have made. Guest licensing is in a stage of rapid advancement as more hams travel and licensing authorities realize the needs and benefits—especially in developing countries.

Let's take now a look at how various countries grant licenses to visitors.

Reciprocal Agreement

Countries which base licensing for visitors strictly on reciprocal agreements only are, for example, Austria, Denmark, Great Britain, Switzerland, and the United States.

● *The United States:* Licensing for visitors is based on reciprocal agreements between two licensing authorities, in which both parties to the agreement state which license classes are equivalent and are recognized by each other.

● *Great Britain:* The Home Office in London is the British licensing authority dealing with application from visitors. Between the UK and South Africa, a reciprocal agreement has already existed for quite some time. However, a large number of radio hams traveling from South Africa to the UK were not born in South Africa. There are, for example, British passport holders who participated in the classes of the Johannesburg branch of the South African Radio League, as well as other non-S.A. nationals who passed the amateur radio operators examination in South Africa.

The agreement states that each license authority will recognize each other's exam certificate provided

the applicant is a national of the country where he passed the exam. I pointed out that this would exclude the non-S.A. citizens who are permanent residents in South Africa. The Home Office spokesman indicated that new consideration would be given to this matter. Nobody had realized that this wording could be discriminating.

Guest Licensing

The Ministry of Posts in the German Federal Republic, along with other European countries, started in the sixties to conclude agreements with other countries to cater to traveling German hams and for the visitors. The general liberalization in Germany and other countries led to a new type of permission to be introduced. The guest license (also called short-term permit in some countries) is not based on a bilateral agreement anymore but on the merits of the individual applicant. This eliminates a lot of paperwork and politics for the administrations.

Any radio ham holding a valid amateur license in his/her home country can apply for such a guest license. A basic requirement is that the examination passed in the home country be equal to or of a higher level than the class applied for in the country to be visited. For example, in the US the Technician class license is similar to the class "A" in the German Federal Republic, but the Novice license is not equivalent to the German class "C" because of differences of depth in the theory and the absence of a CW test in the "C" license.

Belgium, France, West Germany, and Israel are countries which issue guest licenses without a reciprocal agreement in force.

● *Australia:* A visitor permit is issued on application for a period of up to 12 months for a fee of $A12, provided the visitor is a bona fide tourist and does not intend to enter the country to take up employment. Radio hams arriving from countries where a reciprocal agreement exists with Australia will be given an Australian license even if they take up employment. Arrivals from non-agreement countries wishing to take up employment have to sit for the exam.

● *Swaziland:* A visitor permit is issued on application to hams originating from ITU-member countries for a period of up to 30 days free of charge (include an IRC for airmail reply). Applications for permanent callsigns from hams arriving to take up employment will be considered (through a security check) once they are resident.

Swaziland, a beautiful mountain kingdom with a wealth of tourist trade mainly from South Africa, is not super-rare DX, but there are many hams who do not have a QSL card.

The Swazi Telecommunications Department has been acquainted with amateur radio since its start and visitors have always been allowed to operate. Applicants, however, sometimes did not have an answer after waiting for six months and more. When in Mbabane, the capital, I went to see Mr. B. Manana, the man in charge, who explained the problem to me.

There was no application form available, and hams simply wrote letters indicating the period they wanted to operate and enclosed photostats of their current license. If all required information was provided, a permit was granted. Where the application was incomplete, it was filed. The basic problem was that applicants did not know what they were supposed to do.

I developed an application form which covered all questions to the satisfaction of the administration, and to my knowledge no completed application has since been unsuccessful.

● *Zimbabwe Rhodesia:* Short-term permits are issued free of charge on application from visiting hams originating in countries where no reciprocal agreement exists, provided the application is received at least six weeks before arrival in the country.

● *South Africa:* The South African Telecommunications Department bases its licensing decisions for visitors on reciprocal agreements only. At the AGM of the South African Radio League in Durban in 1979, a motion was passed unanimously to appoint a committee to investigate guest licensing for visitors to South Africa.

Reciprocal Licensing vs. Guest Licensing

Reciprocal Licensing. This has the advantage that US hams are granted the same privileges as visitors to the US. This is the same, of course, in all other countries which license strictly on a reciprocal system. Reciprocal agreements place a great administrative burden on the licensing authorities concerned, sometimes for the benefit of only a very small number of hams. The US is a world leader in reciprocal agreements, followed by Great Britain. This effort is very commendable, but not all administrations are prepared to conclude agreements with large numbers of other countries.

Guest Licensing and Short-term Permits. This takes a lot of the work load off the administration, and visitors from rare DX countries can be considered, which is, of course, a lot of fun for the hams in the country being visited. It gives the visitor a better opportunity to meet the locals and make friends. It also is exciting to hear an A2C station mobile in 3D6, a ZS6 call portable ZE, or (when I was in Germany) an A2CPS/DL/mobile on the air. Political differences between countries are not obstacles anymore, and applicants whom an administration might find undesirable can be rejected without any embarrassment.

Where Does the Information Come From?

In my travels, I make a point of visiting the license authorities to obtain application forms, discuss the various aspects of guest licensing, and to maintain a personal contact. You could do the same.

To provide up-to-date information for radio hams, each amateur society should have a current file based on travels by members. Awareness can be created by the editor of the national amateur magazine. In the South African *Radio ZS Magazine*, I have had various articles published which have helped hams to obtain reciprocal as well as guest licenses.

The *cq-DL* also has frequent reports of traveling hams who have visited rare countries, describing their experiences.

It is not in my scope to answer all queries of all US hams traveling the world. However, hams traveling in Southern Africa, including Botswana, Rhodesia, Bophuthatswana and Transkei can contact me for application forms and an information sheet. Please include $1(US) for postage and photostat expenses per country. (Any queries without 3 IRCs for return air postage cannot be considered.) A *must*: Include callsign, license class, proposed date of arrival, and period of intended stay. Please type, or use neat handwriting, and allow at least 60 days. ■

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Stalking the Elusive Ground Fault

—a real-life adventure

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Midnight, and after four hours, I had finally found the semicolon some nearsighted copyreader had overlooked in my BASIC manual. I pulled the plugs and put my toys away.

Early in the evening, there had been flashes of lightning in the area, and the general forecast was for possible thunder-showers. In this part of the Ozarks, that can be bad news, so I made the rounds. First, the garage, where my country-type water system was installed—check water pressure and then disconnect the pump; throw the master switch. Then to the radio shack—all gear disconnected from the power line, antennas properly grounded, everything there OK. Back in the house—two-meter gear disconnected, organ plug pulled, TV antennas and line plug out, hi-fi system disconnected—nothing running there but the electric clock built into the wall. Refrigerator and deep-freeze still connected; pull them only when lightning is making the dog howl. Nothing connected in my bedroom but a cheap radio and a fluorescent lamp; in my wife's room, I knew there was another fluorescent lamp and a clock-radio; they should all be OK. About twelve-thirty now, and it had been a long day. Even the dog was asleep.

Two-thirty. *"Bob, I need your help!"*

I reckon she did—house full of stinking electric-type smoke. Wife's fluorescent lamp in flames; electric clock dead. Bulb in the ceiling with a dull glow. Pulled beds and dressers around to get at various outlet boxes; nothing wrong. (Still not awake.) Out in the kitchen, refrigerator not running—oh, boy! Those things cost money! Utility room, deep-freeze not running; they're expensive, too. Pulled refrigerator plug. Pulled deep-freeze plug—hey! Lights came on bright.

So, problem solved. Pretty good for me. Back in the days when the Kaiser was invading Belgium and Rickenbacker was learning to fly, I used to be able to solve little problems like this, and I still could, by golly! So—must be the deep-freeze. Plugged the refrigerator back in; lights went out. Good grief, refrigerator *and* deep-freeze; half a year's social security!

Plugged in the coffee pot; the lights went out. Make coffee on the gas. Plugged in the toaster; the lights went out. The Kaiser was getting near Paris by this time, and it dawned on me that I still had a problem. (Rickenbacker was looking for the Red Baron.)

Out to the shack for a voltmeter. (Hey! It's cold out here for a guy my age running around in pajamas.) Then to the utility box to check circuits. No definite conclusion. Let's start at the beginning, the power pole out in the yard, where I had a master circuit breaker.

It's dark; screwdriver to get into box; careful, you drop that damned screw, you'll never find it in the grass. Box open, screw in bathrobe pocket, voltmeter in one hand, probes hunting screws on 220-volt line, flashlight on probes, need light on voltmeter, need two more hands; it's dark. Got reading—110 on one side, 125 on other side of line. So what does that tell me that I hadn't already guessed? Try to shake 75 years out of my mind—doesn't shake.

Replaced cover on circuit-breaker box. Returned to house to drink coffee my wife thoughtfully brewed on gas range. Stopped shivering after a while. Let's analyze this thing. Garage and water system completely disconnected—couldn't be anything wrong there. In the shack, maybe? Told wife to go back to bed. Pulled master circuit-breaker in house and went out to shack with toaster in hand. Plugged in toaster, lights got a little brighter; plugged toaster in on the other line, lights went out. Ah ha! Trouble in

the shack. I knew early in the game that it was a ground-fault problem I was looking for, but how to find it in my pajamas at four o'clock on a cold morning? Better call the power company, if our rural phone is working. First, though, let's be sure.

Pulled the master switch in the shack, went back in house, threw that breaker back on, and plugged in the toaster. The lights went out. So it isn't the shack, it isn't the house, it can't be the garage; what the heck was that power company number?

Electric company office fifty miles away, but it's an "800" number. Found it; telephone is working. Ringing. Ringing. Ringing. Very sleepy voice answering. I tell him I have a problem. He asks what's wrong. I tell him. He says I have a problem.

After a while he wakes up, too, finds out where I live, and says he will send a crew. The last time the power company "sent a crew," it turned out to be a couple of smart young linemen who wanted to teach "grandpa" how to suck eggs, but maybe they've got more than one crew. Time passed. I got dressed. Warmer now; stopped shivering.

Lights coming down the gravel road. Stopped at my driveway. Glory-be, help has arrived. This is a different crew: Didn't believe in arguments at five o'clock in the morning, agreed I had a ground-fault problem, noted the ladder against the house and commented that I had already checked that connector. Told them that I had, but suggested they check it anyway. Said they would, but would "check our stuff first." Restarted their truck motor and fired up a pretty good searchlight, put on spurs, and climbed the utility pole. Wiggled the connector on our incoming ground line and the lights in the house flickered! Tightened connector and told me to try my toaster. Tried toaster; it heated and lights stayed on. Plugged in the refrigerator and the angels were singing and so was the frig. Tried deep-freeze; wife's face fell—no new deep-freeze.

Line crew replaced connector, also another like it on the transformer pole a few yards away (sort of sleep insurance).

Greeted the sun with coffee all around. Line crew told me that they had just got into bed after an emergency in a town across the county when they got the call sending them to me. Figured now it was too late to go home and to bed; might as well get ready and go to work.

Wife gets ready and leaves for work. I don't work (so she tells me). Dig into clock radio. Transformer shot. Got one, little bit too big, but it will do until I get a proper replacement. Installed transformer and clock back in business. Hooked it up in bedroom, shut off radio, wouldn't shut off! Now what? Disconnected clock, remembered gremlins, reconnected clock, switch now works.

Dig into fluorescent light. Loading coil a bundle of tar with two leads sticking out. Checked with a voltmeter and had continuity. Whadayaknow; just melted the leads and the tar and made a stink. Cleaned tar, soldered new leads, potted coil in epoxy, replaced bulb, light works. Still stinks.

Wife says I'm a genius. Don't tell her that I'm not smart, just cheap! ■

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An Operating Console with Class

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Take a look at the W8GI operating console in Photo A. Total cost of this console arrangement was $85. It is easy to build, and it makes moving of the equipment and console to other places simple, as the whole arrangement breaks down into lightweight pieces. You don't have to heave around a heavy desk, you can customize it to your purposes, it is expandable, and you can remove any unit without changing a panel or removing screws. It takes out all the haywire in the shack, puts all your operating aids such as maps in clear view at all times, keeps your *Callbooks*, pencils, etc., handy, makes operating a pleasure, gives your equipment a professional look, and last but certainly not the least, it will keep the wife happy.

This article is not intended to be a detailed construction article. It is only an idea article with enough details to enable you to customize your own installation. Nearly everyone can use a few of the ideas to expand a present operating setup. The shelf-group idea can be applied to any desk—*et voilà*—you have a

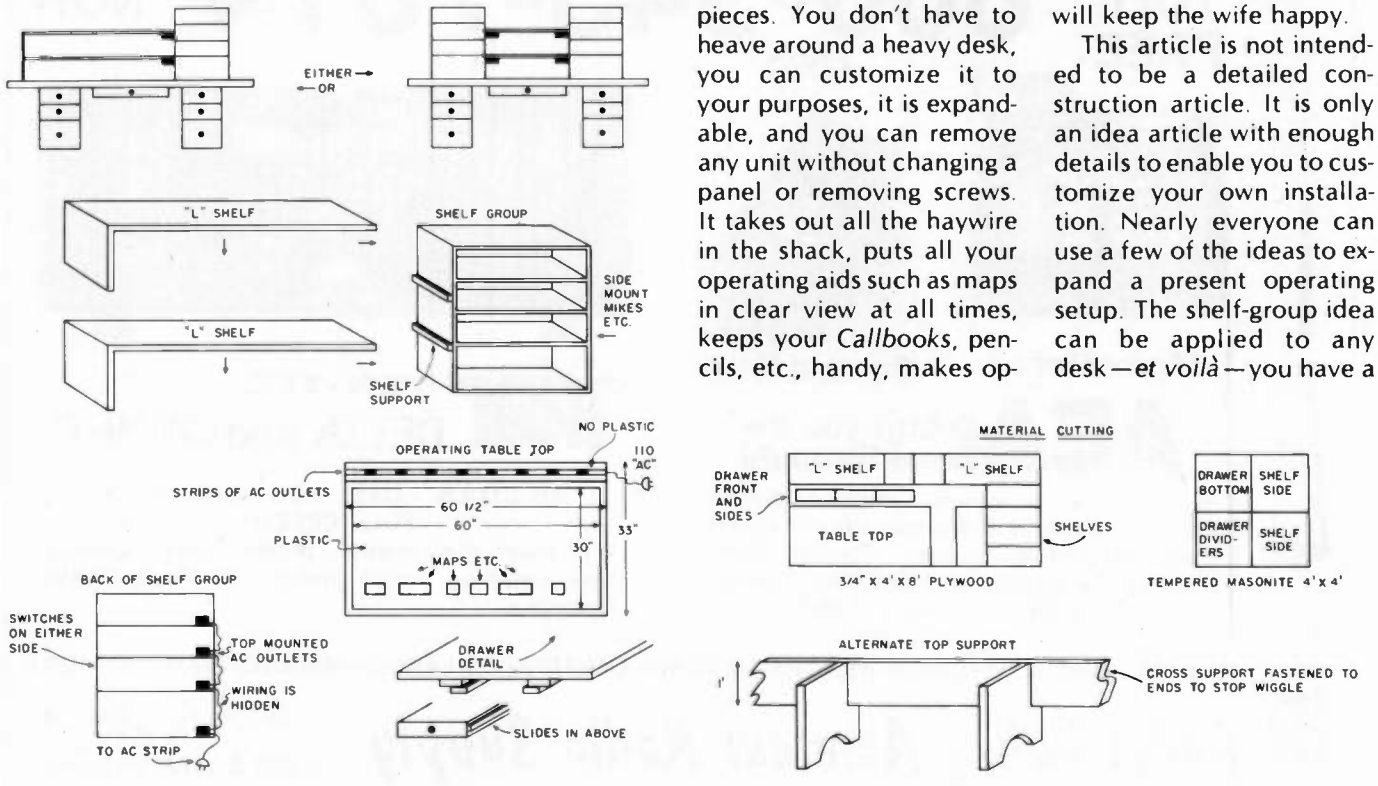

Fig. 1. Suggested layouts and construction details.

custom setup with a minimum of work and cost.

The only tools you need are an electric hand saw, plane, file, hammer, nails, small screws, stain, and sandpaper. Material required is a 3/4" × 4' × 8' piece of plywood, a 4' × 4' piece of tempered Masonite™, a piece of storm-door plastic to fit the top of your console, two three-drawer unfinished cabinets, 18 feet of 1/4" × 1" stripping or screen molding, and a strip of 110 V ac plugs. All the material was purchased at our local K-Mart store. You can eliminate the three-drawer cabinets by buying a 4' × 4' piece of plywood and making your own ends.

The first step is to decide how large you want your operating table. I chose 33" × 60" because it is wide enough and long enough, and just fits a standard 30" × 60" storm-door plastic panel. This makes it cheaper, and you do not have to cut the plastic. You should decide what shelf-group you want, and design it with the number of shelves you want—with the depth, width, and height you desire. Be sure to consider possible later expansion.

The old Crosley Model 52 and other units are on an L shelf that simply sits on a support on the side of the shelf-group, and the L portion rests on the operating table. You can add as many of these L shelves as you want by installing another small support on the side of the shelf-group and adding another L shelf that sits on top of the first. Details of this arrangement are shown in Fig. 1. Be sure to leave room at the top of the operating units for free air circulation. Notice the shelf-group on the right that is within easy arm's reach. The L shelves are supported on one end by a 1-inch square × 10-inch support glued or bolted onto the side of the shelves.

Masonite is used for the sides of the shelf-group because it is only 1/8-inch thick, and thus you can mount short-sleeved switches without any trouble. The microphones are mounted on one side of the shelf. Top-mounted ac outlets are positioned on the rear of each shelf and are wired together, starting at the top and ending at the bottom with a pigtail plug lead that goes to the ac strip on the rear of the table. The wiring is concealed on the inside back of the cabinet. Glue a piece of felt on the bottom of the shelves, as this will stop scratching of the plastic top and keep it from sliding.

Fig. 1 shows suggested layouts and some construction details. Also shown is a layout that will enable you to get all the pieces out of a single sheet of plywood and one piece of tempered Masonite.

The following are helpful hints that resulted from my experiences when building the console. You can use 1/4" × 1" stripping or screen window trim to put a finish on the edge of the plywood. One side of the plywood is fine-finished, and all it needs is fine sanding and a light coat of stain. Drill the holes in the plastic top along the edges before you put it on top of the operating table, as when the drill goes through, you have small chips that are unsightly and raise the plastic.

Place your operating aids, maps, DX prefixes, charts, etc., on the table and arrange to suit. Be sure they are back far enough from the edge of the plastic top. When you get the final arrangement, take small pieces of tape and hold them in place, because if you don't, when the plastic top is dropped down the air will rush out and disturb everything. Mount the ac plug strip across the back of the table and right up against the plastic top, so that there is no hole to collect dirt. Don't forget to put an extension long enough to reach your 110 V ac line before you snap the strip plugs closed. You will have an inch or so of table showing, but this is unseen.

Happy console-building. It's easy—it's fun—it's rewarding. ■

Photo A. The W8GI operating console.

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This seven-digit capacitance meter will allow you to accurately check the capacitance of almost any capacitor quicker than you can read the printed value. It also shows leaky capacitors and the polarity of polarized capacitors. It covers 2 pF to 999 uF in only two ranges and consumes almost no power. All this for only $1.28 (2ICs—46¢, 1 diode—16¢, 5 resistors—25¢, 1 DPST switch—39¢).

There must be some catch—of course, there is. You must already own a digital frequency counter. My tester was built to be used in conjunction with a homemade seven-digit counter using an ICM 7207/7208 counter chip salvaged from a Conar model 202 frequency counter, but it should work equally well with other counters.

Theory

Ok, let's see how it works. When a discharged capacitor has a fixed voltage applied through a fixed series resistance, it will charge at a rate directly proportional to its capacitance value. What we will measure is the time it takes to charge our unknown capacitor to some predetermined value.

That's where the frequency counter comes in. We use a flip-flop to obtain a pulse whose width is a function of the charging time and then the counter to count how many clock pulses can pass during the time interval of that flip-flop pulse. A combination of clock frequency, charging voltage, series resistance, and trigger point is chosen so that one clock pulse passes for each 1 pF in the low range, or one clock pulse for each 1000 pF in the high range. With this arrangement, our counter gives a direct capacitance readout.

The capacitance measurement must be synchronized with the count interval of the frequency counter. See Fig. 1. Counting is enabled when pin 13 of the ICM 7208 is brought low (logic 0). Intersil calls this the inhibit input pin. This function is frequently called the gate, and on some counters may be a logic 1 signal. If your counter uses a logic 1 gate, then the optional IC1a gate connection in Fig. 1 can be used to invert the gating signal. Commonly used gate times are 0.1 second and 1 second. The gate time interval does not affect the capacitance measurement except to limit the maximum value of capacitance which can be measured.

When the gate signal

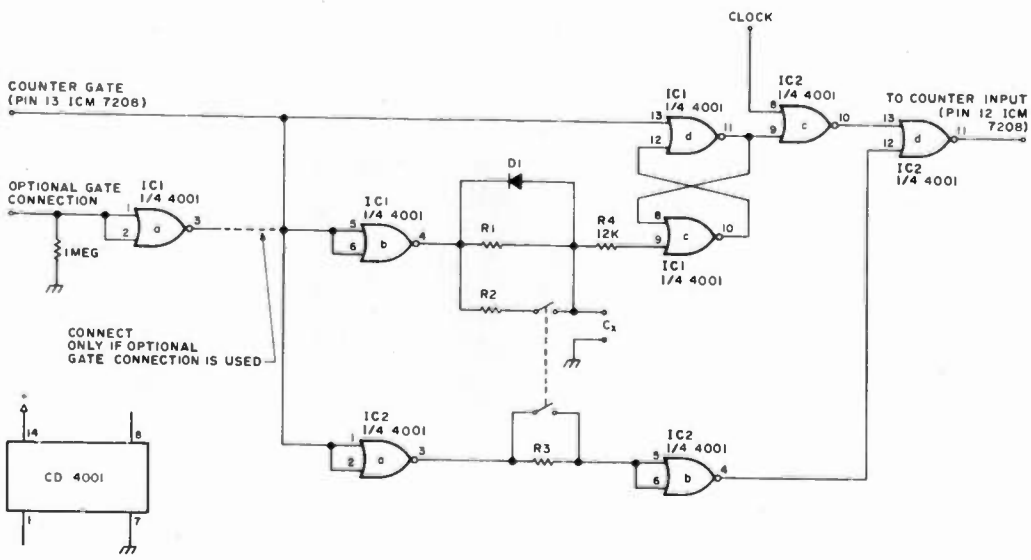

Fig. 1. Capacitance checker schematic.

goes low, the counter is ready to count pulses. IC1b goes high and starts charging the unknown capacitor through R1 or R2. The flip-flop formed by IC1c and IC1d was reset to a low output when the gate was high. Now its output changes to high after the time delay of charging the capacitor up to the flip-flop changeover point. This time delay is directly proportional to the capacitance value and is the basis of our measurement.

IC2c is initially on while the flip-flop output is low and will allow clock pulses to pass until the Cx time delay expires and the flip-flop goes high. However, IC2d blocks the clock pulses from the counter until the gate goes low and a slight time delay imposed by IC2a, R3, and IC2b expires. This time delay compensates for the input capacitance of IC1c (about 5 pF) and circuit stray capacitances. This allows us to measure accurately right down to 2 pF. R3 is determined experimentally and is about the same as R1. If errors below 100 pF are of no concern, IC2a, IC2b, and R3 can be eliminated. D1 allows a quick discharge of Cx and can be any small switching diode.

Now, about the clock. (Ah, another catch not included in the $1.28!) It must be a stable source of pulses compatible with CMOS logic. The frequency doesn't matter much, but if it is much above 5 MHz, the CMOS chips have trouble. If it is too low in frequency, the ability to measure small capacitors become jeopardized. About 1 MHz seems ideal. Stability should be at least 1%, so a crystal source is best.

Your counter already has a crystal oscillator in it which can probably be used. If it is in the 5-6-MHz range, then a divide-by-5 (½ 74C90) will do the job. I happened to have a crystal marked 1001 kHz and used that in a separate oscillator (½ 4001). Almost any crystal in the 2-10-MHz range could be used with an undertone oscillator.[1] So, I'll leave the source of the clock pulses up to you.

Calibration

Now for calibration. This instrument has two ranges. The low range displays pF and the high range pF × 1000. On the low range, the idea is to have one clock pulse for each pF. Therefore, the time delay for R1 and Cx needs to be the time of one cycle of the clock for each pF. On the high range, the time delay for R2 and Cx needs to be one thousandth of the time for one cycle of the clock for each pF.

For example, with a 1-MHz clock the cycle time is 1 us. Therefore, the time delay for the low range for a 1-pF Cx should be adjusted with R1 to be 1 us. The time delay for the high range for a 1000-pF Cx should also be adjusted with R2 to be 1 us. Thus, with a 1-MHz clock, the maximum value that can be measured with a 0.1-second gate is 99,999 pF or about 0.1 uF. With a 1-second gate, we can go to 999,999 pF or 1 uF. On the high range, we can go to 99 uF with a 0.1-second gate and 999 uF with a 1-second gate. On the high range, the error caused by the input capacitance of IC1c is negligible and R3 is switched out! The values of R1 and R2 depend on the clock frequency and also the characteristics of the particular 4001 chip. The chip characteristics will vary quite a bit from one to another but are stable and predictable in each chip.

Calibration obviously requires some sort of standard. I have found capacitors marked ±10% to be far off the printed value.

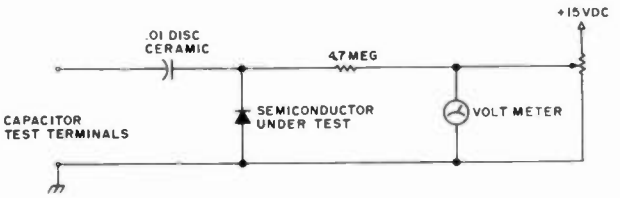

Fig. 2. Semiconductor junction voltage-variable capacitance characteristics test setup.

Also, ±5% capacitors vary considerably. The values marked on most electrolytics are only approximations. I have found silver mica and disc ceramic capacitors which are marked ±2% to be very close, so I use these for calibration.

With 1000 pF ±2% at Cx, I adjust R1 for a counter display of 1000. Then I crosscheck with a 27-pF ±2% silver mica and bingo—27! Once calibrated on the low range with these capacitors, I measure a 0.22-uF molded capacitor (.218752) and select the high range and adjust R2 for a readout of 219.

Obviously, the accuracy is limited in this calibration scheme to the tolerance of the best capacitors you can find. I think, however, that you will find the tester very useful and accurate enough for anything but laboratory work if calibrated to within 2%. With the particular 4001 I have in service and the 1.001-MHz clock, R1 is about 1.04 megohms and R2 is about 800 Ohms. Both R1 and R2 are fixed, with small potentiometers (not included in the $1.28!) in series for fine adjustment. R3 is fixed at 1 megohm.

When connected to a counter, with no capacitor under test, this tester will always indicate a 1 on the last digit. R3 is selected so that a very small capacitor (such as 5 pF) reads correctly. A 1 pF or less then indicates 1 and anything larger will indicate correctly.

With large capacitors there will be a large number of digits displayed. You should ignore all except the first three significant digits. The rest will change after each sampling period, but they have no meaning since you only calibrated the instrument to 1 or 2%. I have never found the reading to fluctuate as much as 1%, and frequently it fluctuates less than .01%.

Operation

The power source for your tester should be stable and can be drawn from your counter if it is between 3 and 15 volts dc. Current drain is negligible.

Now that it is all built and calibrated, let's look at some operating considerations. Leads from IC1c to the test jack should be short to prevent hum pickup. Also, you should keep external leads to the capacitor very short and keep hands off during sampling to keep hum out. Furthermore, you should mount IC1 in a socket to make it easier to replace after you ruin it by not observing a few simple precautions.

Note that the test point connects to an input gate of the CMOS chip. R4 should provide input gate protection up to about 120 volts. Testing a capacitor in a hot circuit can zap the 4001; placing a charged capacitor to the terminals can zap it, too. Large static discharges will also spell the end of the 4001 and you'll be out 23¢ or so. While these precautions seem worth mentioning, in over a year of frequent use I have never harmed the 4001.

If your counter has a 0.1-second gate, you will want to use it most of the time. This means the longest you will have to wait for

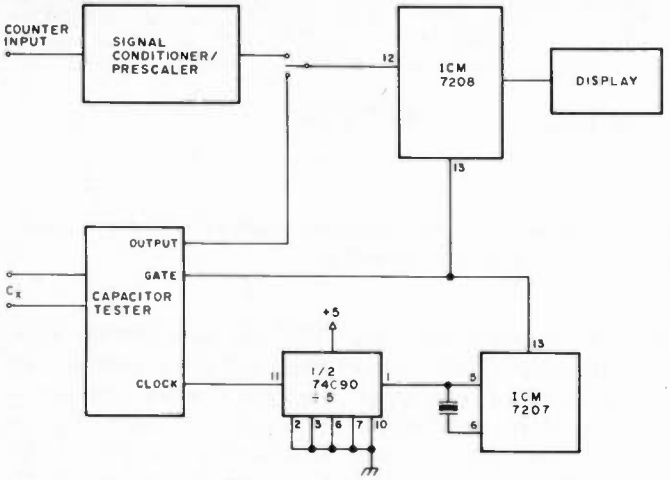

Fig. 3. Suggested interconnections for capacitance checker, counter, and timebase.

your reading is 1/5 of a second. With a 1-second gate, it might take 2 seconds. A leaky capacitor will indicate much too high of a value. Just a small amount of leakage will cause a little disc ceramic to read out 999 uF. You will not see this often, but when you do, throw that one away.

Polarized electrolytic capacitors usually have leakage when the correct polarity is not observed. If you test one by connecting it to the test terminals in both directions and get the same reading each time, it is probably non-polarized. If you get considerably different readings, the smaller reading is correct and indicates the correct polarity. Of course, the correct way to connect electrolytics is the − (minus) to ground and the + (plus) to the test point.

Lots of fun can be had testing trimmer capacitors, crystal holder capacitances, transistor input/output capacitances, twisted wires, coax, etc. All can be easily measured. The voltage-variable capacitance characteristics of semiconductor junctions can be easily observed by using the hookup shown in Fig. 3. Keep all leads as short as possible to prevent hum pickup.

I have found that selected zener diodes exhibit very nice large capacitance varactor characteristics up to their zener voltage. Selected silicon transistors with their base/collector junction reverse biased make nice, small-capacitance varactors. And, of course, you can test a standard varactor to see if it covers the desired tuning range for a voltage tuning application. The best application of all is to turn that junk box full of poorly marked capacitors into a supply of useful components of known values.

You don't have a frequency counter? Shame! Run right out and buy one, or better yet, build one such as the $50 Mini-Counter[2] and incorporate this tester inside. For $1.28 (or so) you can't afford not to! A suggested interconnect block diagram with the ICM 7207/7208 pair is shown in Fig. 3.■

References

1. "Undertones," Joe Westenhaver W4FEC, *73 Magazine*, October, 1980.

2. "Build this $50 Mini-Counter," Gary McClellan, *73 Magazine*, December, 1979.

Jerry W. Campbell K4ZHM
Route 4, Box 126
Nicholasville KY 40356

Better Pilot Lights

— LEDs are the "in" thing

After having a vfo pilot lamp burn out prematurely in my T-599D, I decided to replace the lamp and red lens with an LED. Referring to Fig. 1(a), the red lens is held in place with a small amount of cement, and is illuminated by a lamp positioned close to it.

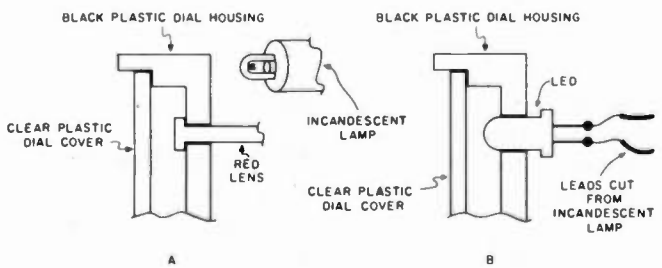

Fig. 1. (a) Cross-sectional view of Kenwood's vfo pilot light system. (b) Cross-sectional view of LED vfo pilot light system.

The red lens may be removed easily after cutting away the cement. After removal of the red lens, the hole is slowly enlarged with a reamer to the point where the LED fits snugly in the hole (caution should be exercised, as the plastic plate is very soft and one easily can exceed the desired hole diameter).

Referring to Fig. 1(b), with the LED in place, the clear plastic dial cover should fit properly in the black plastic housing. Next, apply some cement to the rear of the LED and housing to hold the LED in place.

The leads cut from the lamp are soldered to the LED. It is necessary to insert a 1200-Ohm, ½-Watt resistor in series with one of the leads to the LED. It is convenient to place the resistor on the solder terminal that the lamp leads are attached to, and in series with either lead.

I found this modification to be an improvement, as the LEDs are brighter and should last much longer. ■

Paul Danzer N1II
2 Dawn Road
Norwalk CT 06851

Caution: Solid-State Finals

—learning to live with no-tune radios

Here you are—your brand new Mark XVIII Loudenputer unpacked, connected to the power supply, and your old tri-band beam plugged in. Key down; measure the power output—only 15 Watts instead of the rated 100 Watts. Check the instruction manual and notice that the power rating holds for a 50-Ohm load. You have been using the beam for five years with your old Heath or Swan without a matchbox so you know the antenna is OK. Guess you will have to send the new rig back for repair.

Before you go running down to the post office or UPS, perhaps you ought to take a second look. Your new rig has solid-state finals, and your old rig a pair of 6146s. There is a considerable difference.

Design Differences

A typical tube final is shown in Fig. 1(a). The tubes, which are the source of rf power, feed an adjustable network which matches the tube output impedance to the load. This load is not a 50-Ohm dummy load but a real-life antenna whose impedance may vary drastically with the operating frequency and with weather conditions such as wind and temperature.

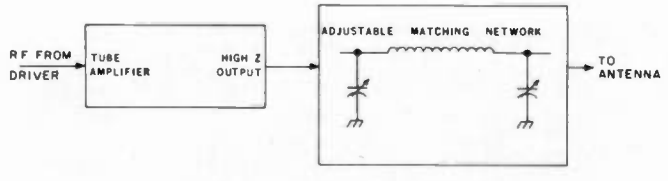

Fig. 1(a). A typical tube final.

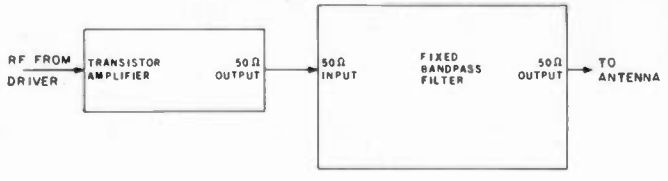

Fig. 1(b). A solid-state rig.

The solid-state rig is shown in Fig. 1(b). A set of transistors feeds a fixed bandpass filter. This filter changes only as you switch bands. The key difference (and advertised advantage) is that no tuning is required. Just change bands, dial up the operating frequency, perhaps peak a preselector, and transmit. In fact, except for a desire to see what is going on, there is no apparent need for a collector current meter since there is no dipping or peaking required.

This basic design difference leads to what has been called the "A-OK into dummy load" syndrome. In the example given above, the rig probably puts out the full rated power when connected into a dummy load. With a practical antenna, however, low power, tripping breakers, or even self-destruction of the finals may result. More insidious is the potential for the generation of spurious signals due to antenna mismatch, even though the rig is perfectly clean (and has been type-accepted) when connected to a dummy load.

Why Does It Happen?

Solid-state amplifiers are designed as broadband amplifiers followed by a bandpass filter under the assumption that a purely resistive 50-Ohm load is connected to the output. If the amplifier is not connected to an ideal load, i.e., the load is not 50 Ohms resistive or contains reactive components, the bandpass filter is no longer terminated in its design conditions, and it may no longer act as the needed filter. In addition, the filter also is designed to be driven by a fixed source (the transistors), and if the transistors are operating at a higher or lower power level (Fig. 2), the filter is again not operating under its de-

signed conditions. This leads to the remarkable situation in which some rigs may operate perfectly well when tuned up at full power but put out spurs if you try to operate at low power.

A number of rigs which have power-foldback protection suffer doubly from this effect. When connected to a moderate swr load (say, 3:1 or higher), the swr is sensed, and in order to protect the finals, the drive to the finals is now decreased. This means that the bandpass filter is no longer fed by transistors operating with the design output impedance and, in addition, the filter is connected to a load far different from the 50-Ohm design load.

What Choice Do You Have?

Since most if not all of the new rigs have solid-state finals, we have to live with the problem. There are, however, a number of things you can do to put out full power, protect your finals, and prevent spurs from occurring.

1) You probably will have to use an antenna tuner or matchbox. The disadvantage of having more knobs to turn is not that serious, since you no longer have to dip and peak your final. Caution: Tuning for minimum swr or maximum power output may not be enough. You may have to build or buy a noise bridge and preset the tuner on your favorite operating frequencies.

2) You may have to operate the rig near full power all the time. Run a test. If your swr varies drastically as you reduce the drive to your rig, you may be putting out spurs at the lower power levels. Similarly, don't overdrive it. The couple of extra Watts you get beyond the manufacturer's ratings may all be out of the band.

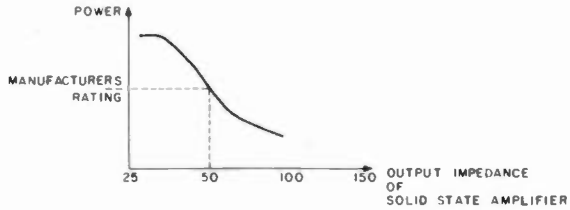

Fig. 2. Impedance change vs. power level.

3) Be careful in selecting a linear amplifier. Untuned inputs on grounded-grid linears may have been perfectly acceptable with vacuum-tube exciters. However, if your solid-state rig has power-foldback or some other protection and the linear does not have a 50-Ohm input impedance, you either might not be able to drive the linear to full power or you might have to use a matchbox between the rig and the linear.

4) Be careful (especially on VHF) of mating a rig to an amplifier. Tube equipment was tolerant. Transistors are not. If your new little handie-talkie does not have sufficient protection, the finals may vaporize in the time it takes the relay in the amplifier to switch. Be cautious and talk to someone who has seen this combination working before.

5) Read and reread the instruction manual. If you don't understand, or if information is not included, call the distributor or manufacturer. Users groups can be very helpful. There is no reason for you to guess how to use it when there are five thousand identical rigs being used. ■

✓ Reader Service—see page 146

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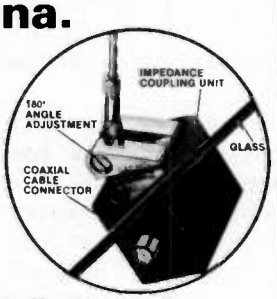

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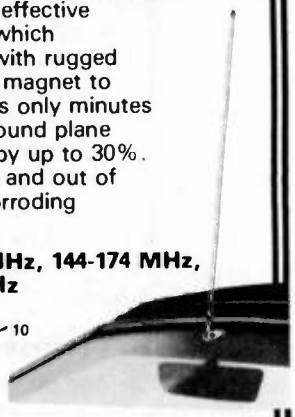

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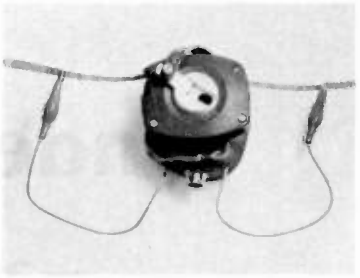

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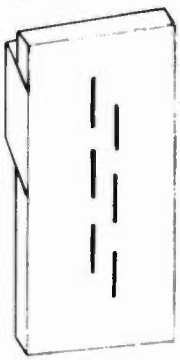

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Under Software Control

— a repeater control system with minimal hardware

This computer program, which runs on a MOS Technology KIM-1 microcomputer, will replace all the control circuitry normally required for a small repeater system. This system features a smart CW ID, a courtesy beep, remote control, time-out timer, and an ID interval timer, all implemented without any external hardware.

The KIM-1 microcomputer is an ideal system for this type of application, with its built-in I/O ports and interval timers; all the necessary hardware for undertaking this project is provided as an assembled and tested unit.

When it was decided to undertake this project, the highest priority was given to implementation with a

Location	Function
002D	Length of kerchunk delay
004F	Setting of time-out timer in minutes
00B0	Setting of ID interval in minutes
0283	CW speed
0284	CW tone
02C1	Space for breakers
02C6	Length of courtesy beep
02D3	Length of transmitter tail

Note: Changing the CW speed will affect all timing parameters, except the two clocks, in the same manner as the speed is changed.

Table 1. Program timing variables.

Ltr	Code	Ltr	Code	Ltr	Code
A	60	B	88	C	A8
D	90	E	40	F	28
G	D0	H	08	I	20
J	78	K	B0	L	48
M	E0	N	A0	O	F0
P	68	Q	D8	R	50
S	10	T	C0	U	30
V	18	W	70	X	98
Y	B8	Z	C8	0	FC
1	7C	2	3C	3	1C
4	0C	5	04	6	84
7	C4	8	E4	9	F4
/	94				
Space	00				FF

End of Message

To program your repeater call, look up each letter of call in table above and put code into KIM starting at 0068; for a space between words, put a 00. Remember, at the end of the message, to put an FF in memory.

Table 2. ID code table.

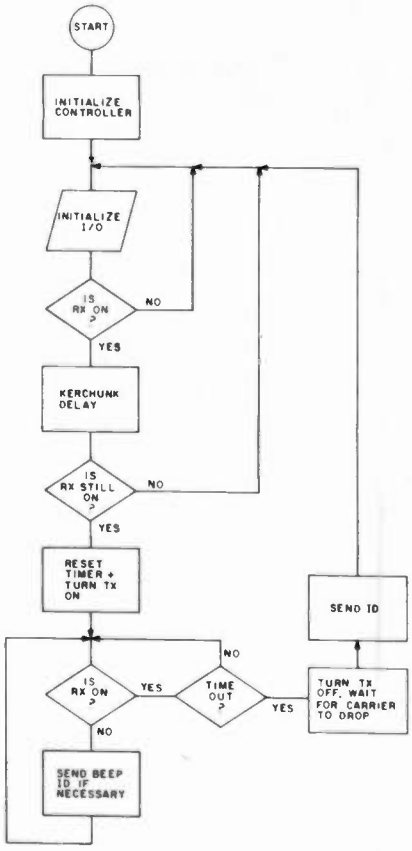

Fig. 1. Executive routine flowchart.

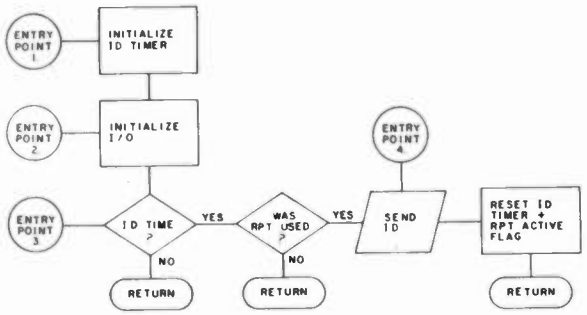

Fig. 2. Initialization routine flowchart.

minimum amount of support hardware and a maximum amount of work being done by the software. That goal has been successfully reached here without any compromises in the performance of this repeater control system.

The control system will send the required repeater ID in CW. The audio tone required is generated internally by the microprocessor. The repeater system, when not active, will ID only if the system has been keyed within the current ID interval; otherwise it will ID after the next keying. When the repeater is being used, it will ID only after the courtesy beep has been sent, minimizing the chance of the IDer's audio covering a user's transmission through the repeater. The ID interval is currently set at 7 minutes, but the control system can be set at from 1 to 60 minutes in one-minute intervals.

If the repeater is timed out by a signal staying on too long on the input frequency, when the signal is removed, the system will immediately ID, informing the user that he timed the repeater out. The time-out interval is currently set at 3 minutes; this can be set at from 1 to 60 minutes in one-minute intervals.

Two interrupt-driven real-time clocks have been implemented in software using one of the KIM-1's programmable interval timers. The other programmable interval timer is used to generate the required audio tones.

A kerchunk filter has also been added which prevents the repeater from being keyed by a signal on the input frequency of the repeater for less than one second in duration. This kerchunk filter does not affect the operation of the repeater once it has been activated.

A remote-control feature has also been provided for in this control system to turn the repeater on and off when this is necessary.

The program provided here has all of the timing parameters set for a very pleasing sound on the air. Almost every timing parameter in the controller program can be changed very easily, however, should you desire to change it. Table 1 shows all of the important locations that can be changed and what effect they will have on system operation.

Figs. 1 through 6 are the flowcharts for the program modules which comprise this system. These flowcharts, combined with the freely-commented program listing, should make the understanding and modification of this control system relatively easy.

The flowchart for the executive routine is shown in Fig. 1. The starting location for this routine is at 0000, and this also is the entry point for activating the

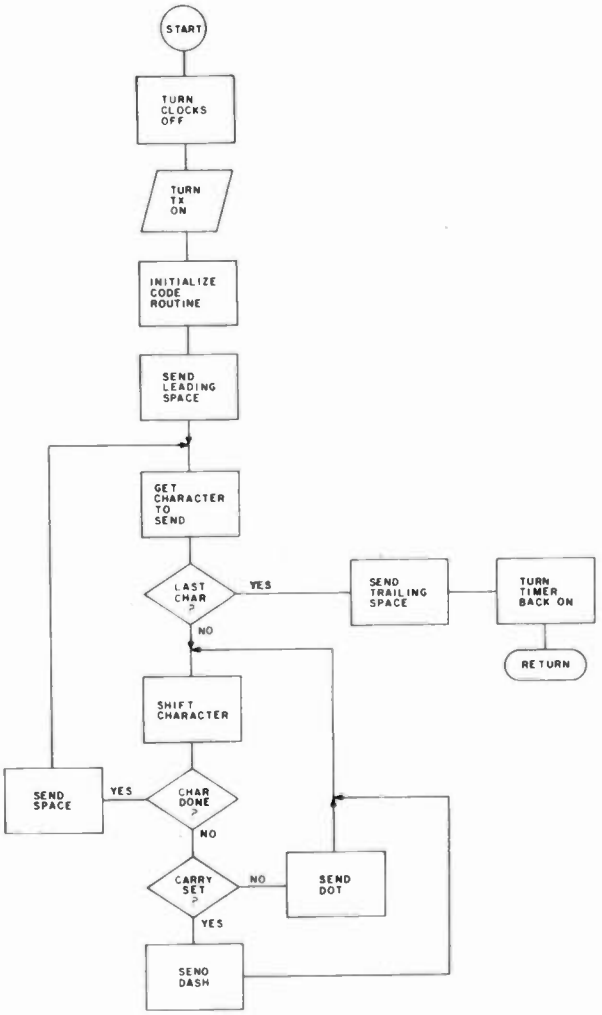

Fig. 3. CW ID routine flowchart.

control system. The executive routine is where this system spends most of its time. It is this routine which provides the logic for how the repeater will respond to an incoming signal. Any lines of the program that need to be used frequently have been coded as subroutines. The time-out routine is located in the executive routine, as is the kerchunk filter. The executive routine and the courtesy-tone routine together determine when to ID.

After the executive routine, next in memory is the code for the CW ID. The ID must start at location 0068 and must not exceed location 007F. Table 2 gives all the information needed to program your own callsign into the system.

The next subroutine we come upon is the receiver mask routine. No flowchart is provided because of its small size and simple coding. This is where the system determines if the repeater's receiver is being activated.

The initialization routine, a flowchart of which is shown in Fig. 2, starts at location 009A. This routine handles all of the input and output port initialization and control of the CW IDer. There actually are four entry points to this subroutine; they all are labeled in the program listing along with their use.

The subroutine for sending the CW ID is located starting at 0200. The flowchart for this routine is shown in Fig. 3. This routine is a much-modified version of a program published in

Program listing.

```
                                Executive Routine
0000  A9 00     LDA #$00     LOAD NMI INTERRUPT VECTOR TO
0002  8D FA 17  STA 17FA     ADDRESS OF REAL TIME CLOCK
0005  A9 03     LDA #$03     ROUTINE (0300)
0007  8D FB 17  STA 17FB
000A  8D FF 17  STA 17FF     LOAD IRQ INTERRUPT VECTOR TO
000D  A9 80     LDA #$80     ADDRESS OF REMOTE CONTROL
000F  8D FE 17  STA 17FE     ROUTINE (0380)
0012  A9 F4     LDA #$F4     TURN INTERRUPT TIMER ON
0014  8D 0F 17  STA 170F
0017  20 9A 00  JSR 009A     INITIALIZE I/O & RTC
001A  20 00 02  JSR 0200     SEND ID (INITIALIZE TONE)
001D  20 A0 00  JSR 00A0     INITIALIZE I/O
0020  20 8F 00  JSR 008F     LOAD & MASK FOR RX INPUT
0023  D0 03     BNE 0028
0025  4C 2C 00  JMP 002C     JUMP TO TX TURN ON ROUTINE
0028  58        CLI          CLEAR INTERRUPT
0029  4C 1D 00  JMP 001D     INITIALIZE I/O & LOOK AT RX AGAIN
002C  A2 10     LDX #$10     KERCHUNK DELAY (INITAL TURN ON)
002E  20 79 02  JSR 0279
0031  20 8F 00  JSR 008F     LOAD & MASK FOR RX INPUT
0034  F0 03     BEQ 0039     IS SIGNAL STILL PRESENT
0036  4C 1D 00  JMP 001D     No, IGNORE KERCHUNK
0039  20 B0 03  JSR 03B0     YES, INITIALIZE 3 MINUTE TIMER
003C  A9 04     LDA #$04     TURN TX ON
003E  8D 00 17  STA 1700
0041  20 8F 00  JSR 008F     LOAD & MASK FOR RX INPUT
0044  F0 06     BEQ 004C     IS RX OFF
0046  20 C0 02  JSR 02C0     YES, SEND COURTESY TONE
0049  4C 31 00  JMP 0031     GO LOOK FOR NEXT SIGNAL
004C  A5 8D     LDA 008D     NO, CHECK 3 MINUTE TIMER
004E  C9 03     CMP #$03
0050  F0 03     BEQ 0055     IS TIME UP
0052  4C 41 00  JMP 0041     NO, CONTINUE LOOKING
0055  A9 00     LDA #$00     YES, TIME OUT ROUTINE
0057  8D 00 17  STA 1700     TURN TRANSMITTER OFF
005A  20 8F 00  JSR 008F     WAIT FOR CARRIER TO DROP
005D  D0 03     BNE 0062
005F  4C 5A 00  JMP 005A
0062  20 BC 00  JSR 00BC     SEND ID AFTER TIMEOUT
0065  4C 1D 00  JMP 001D     RETURN TO MASTER EXECUTIVE LOOP

                                ID Code
0068  90 40 00 70 90 E4 A8 08 08 94 50 68 C0 00 A8 48 40 FF
      D  E     W  D  8  C  H  H  /  R  P  T     C  L  E

                            Receiver Mask Routine
008F  EA        NOP          SPACE FOR RX DEBOUNCE IF NEEDED
0090  EA        NOP
0091  EA        NOP
0092  EA        NOP
0093  EA        NOP
0094  AD 02 17  LDA 1702     LOAD INPUT PORT
0097  29 20     AND #$20     MASK FOR RX INPUT
0099  60        RTS

                          Initialization Routine
009A  A9 00     LDA #$00     ENTRY POINT TO INITIALIZE ID TIMER
009C  85 81     STA 0081
009E  85 82     STA 0082
00A0  A9 FF     LDA #$FF     ENTRY POINT TO INITIALIZE I/O
00A2  8D 01 17  STA 1701
00A5  A9 00     LDA #$00
00A7  8D 00 17  STA 1700
00AA  8D 03 17  STA 1703
00AD  A5 82     LDA 0082     ENTRY POINT FOR ID TIME CHECK
00AF  C9 07     CMP #$07     NUMBER OF MINUTES BETWEEN ID'S
00B1  F0 03     BEQ 00B6
00B3  10 01     BPL 00B6
00B5  60        RTS
00B6  A5 8E     LDA 008E     NOW CHECK RPT ACTIVE FLAG
00B8  C9 00     CMP #$00
00BA  D0 0D     BNE 00C9     NO, RETURN
00BC  20 00 02  JSR 0200     YES, ID (ENTRY POINT FOR T-O ID)
00BF  A9 00     LDA #$00     RESET ID TIMER
00C1  85 82     STA 0082
00C3  85 81     STA 0081
00C5  A9 FF     LDA #$FF     RESET RPT ACTIVE FLAG
00C7  85 8E     STA 008E
00C9  60        RTS

                                Code Routine
0200  A9 00     LDA #$00     TURN OFF REAL TIME CLOCK
0202  8D 07 17  STA 1707
0205  A9 04     LDA #$04     TURN TRANSMITTER ON
0207  8D 00 17  STA 1700
020A  A2 0C     LDX #$0C     INITIALIZE CODE ROUTINE
020C  BD 8F 02  LDA 028F,X
020F  95 E2     STA 00E2,X
0211  CA        DEX
0212  10 F8     BPL 020C
0214  A2 08     LDX #$08     SEND LEADING SPACE
0216  20 79 02  JSR 0279
0219  A2 03     LDX #$03     SPACE BETWEEN LETTERS
021B  20 79 02  JSR 0279
021E  20 8A 02  JSR 028A     GET CHARACTER TO SEND
0221  AA        TAX
0222  E6 E2     INC 00E2     INCREMENT POINTER TO NEXT CHARACTER
0224  C9 60     CMP #$00     CHECK TO SEE IF CURRENT CHAR. IS SPACE
0226  D0 03     BNE 022B
0228  4C 19 02  JMP 0219
022B  C9 FF     CMP #$FF     CHECK TO SEE IF END OF MESSAGE
022D  D0 03     BNE 0232
022F  4C 50 02  JMP 0250
0232  8A        TXA
0233  85 DF     STA 00DF     TEMP STORAGE OF CHARACTER TO SEND
0235  06 DF     ASL 00DF
0237  F0 E0     BEQ 0219     DONE WITH CHARACTER
0239  B0 0D     BCS 0248     GO SEND DASH
023B  A2 01     LDX #$01
023D  20 5B 02  JSR 025B     SEND DOT
0240  A2 01     LDX #$01
0242  20 79 02  JSR 0279     SEND SPACE
0245  18        CLC
0246  90 ED     BCC 0235
0248  A2 03     LDX #$03     REALLY DO A DASH
024A  20 5B 02  JSR 025B
024D  18        CLC
024E  90 F0     BCC 0246
0250  A2 08     LDX #$08     TRAILING SPACE
0252  20 79 02  JSR 0279
```

the *First Book of KIM*.* This program now has the ability to take strings of code directly from memory and send them out as CW and the ability to insert spaces between words and indicate the end of the message. In addition, the portions of this module which actually generate the audio tones have been changed to use the programmable interval timer normally used by the KIM-1's cassette I/O routine. This change freed up the other interval timer which can be used to interrupt-drive another program. This timer is then used in the real-time clock subroutine. Subroutine calls are made frequently to routines in this module to handle various timing delays and to generate the courtesy beep.

The courtesy-tone routine which starts at location 02C0 is shown in the flowchart in Fig. 4. The length of the time allotted for breakers before the courtesy beep, the duration of the courtesy beep, and the length of the repeater's transmitter tail are all controlled in this routine. All the timing for these functions can be changed in this routine, if desired. When the repeater system is in use, this subroutine calls the CW ID module.

The flowchart for the real-time clock routine is shown in Fig. 5. This routine is a continually-running interrupt-driven clock, driven by the NMI interrupt vector. This routine is a much-modified version of another program which appeared in the *First Book of KIM*. This real-time clock routine con-

*The *First Book of KIM*, Butterfield, Ockers, and Rehnke, O.R.B, Argonne IL 60439.

```
0255  A9 00     LDA #$00      TURN INTERRUPT TIMER BACK ON
0257  8D 0F 17  STA 170F
025A  60        RTS           RETURN
025B  86 DD     STX 00DD      MARK SUBROUTINE
025D  A5 E6     LDA 00E6
025F  8D 47 17  STA 1747
0262  A9 01     LDA #$01
0264  8D 01 17  STA 1701
0267  EE 00 17  INC 1700
026A  A6 E7     LDX 00E7
026C  CA        DEX
026D  D0 FD     BNE 026C
026F  2C 47 17  BIT 1747
0272  10 F3     BPL 0267
0274  C6 DD     DEC 00DD
0276  D0 E5     BNE 025D
0258  60        RTS
0279  86 DD     STX 00DD      SPACE SUBROUTINE
027B  A5 E6     LDA 00E6
027D  8D 47 17  STA 1747
0280  2C 47 17  BIT 1747
0283  10 FB     BPL 0280
0285  C6 DD     DEC 00DD
0287  D0 F2     BNE 027B
0289  60        RTS
028A  A6 E2     LDX 00E2
028C  B5 68     LDA 0068,X
028E  60        RTS

                Code Initialization

028F  00 05 3B 03 44 BB C0 C0 C0 C0 C0 00

                Courtesy Tone Routine

02C0  A2 10     LDX #$10      SET UP 1 SECOND DELAY
02C2  20 79 02  JSR 0279
02C5  A2 02     LDX #$02      SEND TONE
02C7  20 5B 02  JSR 025B
02CA  20 B0 03  JSR 03B0      RESET 3 MINUTE TIMER
02CD  20 AD 00  JSR 00AD      CHECK FOR TIME TO ID
02D0  EA        NOP
02D1  EA        NOP
02D2  A2 30     LDX #$30      SET UP REPEATER TAIL
02D4  20 79 02  JSR 0279
02D7  60        RTS

                Real Time Clock Routine

0300  48        PHA           SAVE THE ENVIRONMENT
0301  8A        TXA
0302  48        PHA
0303  98        TYA
0304  48        PHA
0305  A9 83     LDA #$83
0307  8D 04 17  STA 1704
030A  2C 07 17  BIT 1707
030D  10 FB     BPL 030A
030F  E6 80     INC 0080
0311  A9 04     LDA #$04
0313  C5 80     CMP 0080
0315  D0 41     BNE 0358      ONE SECOND NOT UP, EXIT INTERRUPT
0317  A9 00     LDA #$00      RESET ONE SECOND COUNTER
0319  85 80     STA 0080
031B  18        CLC
031C  F8        SED           SET FOR DECIMAL ARITHMETIC
031D  A5 81     LDA 0081
031F  69 01     ADC #$01      INCREMENT SECONDS COUNTER
0321  85 81     STA 0081
0323  C9 60     CMP #$60      INCREMENT MINUTES?
0325  D0 13     BNE 033A      NO, SERVICE 3 MINUTE TIMER
0327  A9 00     LDA #$00      YES, RESET SECONDS COUNTER
0329  85 81     STA 0081
032B  A5 82     LDA 0082
032D  18        CLC
032E  69 01     ADC #$01      INCREMENT MINUTES COUNTER
0330  85 82     STA 0082
0332  C9 60     CMP #$60      RESET MINUTES COUNTER?
0334  D0 04     BNE 033A      NO, SERVICE 3 MINUTE TIMER
0336  A9 00     LDA #$00      YES, RESET MINUTES COUNTER
0338  85 82     STA 0082
033A  A5 8C     LDA 008C      3 MINUTE TIMER
033C  18        CLC
033D  69 01     ADC #$01      INCREMENT SECONDS COUNTER
033F  85 8C     STA 008C
0341  C9 60     CMP #$60      INCREMENT MINUTES?
0343  D0 13     BNE 0358      NO, EXIT INTERRUPT
0345  A9 00     LDA #$00      YES, RESET SECONDS
0347  85 8C     STA 008C
0349  A5 8D     LDA 008D
034B  18        CLC
034C  69 01     ADC #$01      INCREMENT MINUTES COUNTER
034E  85 8D     STA 008D
0350  C9 60     CMP #$60      RESET MINUTES?
0352  D0 04     BNE 0358      NO, EXIT INTERRUPT
0354  A9 00     LDA #$00      RESET MINUTES COUNTER
0356  85 8D     STA 008D
0358  D8        CLD
0359  A9 F4     LDA #$F4      TURN INTERRUPT TIMER BACK ON
035B  8D 0F 17  STA 170F
035E  68        PLA           RESTORE THE ENVIRONMENT
035F  A8        TAY
0360  68        PLA
0361  AA        TAX
0362  68        PLA
0363  40        RTI

                Remote Control Routine

0380  AD 02 17  LDA 1702      CHECK FOR TURN ON COMMAND
0383  29 01     AND #$01      GROUND PBØ TO TURN RPT ON
0385  F0 03     BEQ 038A      JMP TURN ON
0387  4C 8E 03  JMP 038E      NO, JUMP SHUTDOWN
038A  58        CLI           TURN ON, CLEAR INTERRUPT
038B  4C 00 00  JMP 0000      RESTART PROGRAM
038E  A9 00     LDA #$00      SHUTDOWN, TURN TX OFF
0390  8D 00 17  STA 1700
0393  58        CLI           CLEAR INTERRUPT
0394  4C 94 03  JMP 0394      SHUTDOWN LOOP

                3 Minute Timer Reset Routine

03B0  A9 00     LDA #$00
03B2  85 8C     STA 008C      RESET SECONDS
03B4  85 8D     STA 008D      RESET MINUTES
03B6  85 8E     STA 008E      SET RPT ACTIVE FLAG
03B8  60        RTS
```

tains two independently running real-time clocks, each of which is capable of keeping time from 0 seconds to 1 hour and then resetting. These two timers comprise the ID interval timer and the time-out timer.

Immediately following the real-time clock routine is the remote-control routine. The flowchart for this routine is shown in Fig. 6. This routine is entered after the computer receives a request for an interrupt from the IRQ interrupt line on the KIM-1. To take the repeater off the air, all you need to do is to have your remote control circuitry give a logic 0 pulse to the IRQ line. The remote-control routine will then put the program in a tight loop, not allowing the repeater to be activated. To turn the repeater back on, your control circuitry must apply a logic 0 to PB0 of the KIM and a logic 0 pulse to the IRQ interrupt line. The control system will then exit the tight loop and restart the control program. The repeater will immediately come on the air with the CW ID. This routine might seem overly simple to some, but it gets the job done quite nicely.

The last subroutine is the three-minute time-reset routine. This routine has not been flowcharted because of its simplicity. The only function of this routine is to reset the three-minute timer upon initial repeater key-up and after the courtesy beep.

If you look at the program listing, you will notice that all of page 1 in the KIM-1 memory is empty. At present, this area is available entirely to the stack. All of this space is not needed for the stack, and the

Hex dump.

```
0000  A9 00 8D FA 17 A9 03 8D FB 17 8D FF 17 A9 80 8D
0010  FE 17 A9 F4 8D 0F 17 20 9A 00 20 00 02 20 A0 00
0020  20 8F 00 D0 03 4C 2C 00 58 4C 1D 00 A2 10 20 79
0030  02 20 8F 00 F0 03 4C 1D 00 20 B0 03 A9 04 8D 00
0040  17 20 8F 00 F0 06 20 C0 02 4C 31 00 A5 8D C9 03
0050  F0 03 4C 41 00 A9 00 8D 00 17 20 8F 00 D0 03 4C
0060  5A 00 20 BC 00 4C 1D 00
0080                                                 EA
0090  EA EA EA EA AD 02 17 29 20 60 A9 00 85 81 85 82
00A0  A9 FF 8D 01 17 A9 00 8D 00 17 8D 03 17 A5 82 C9
00B0  07 F0 03 10 01 60 A5 8E C9 00 D0 0D 20 00 02 A9
00C0  00 85 82 85 81 A9 FF 85 8E 60
0200  A9 00 8D 07 17 A9 04 8D 00 17 A2 0C BD 8F 02 95
0210  E2 CA 10 F8 A2 08 20 79 02 A2 03 20 79 02 20 8A
0220  02 AA E6 E2 C9 60 D0 03 4C 19 02 C9 FF D0 03 4C
0230  50 02 8A 85 DF 06 DF F0 E0 B0 0D A2 01 20 5B 02
0240  A2 01 20 79 02 18 90 ED A2 03 20 5B 02 18 90 F0
0250  A2 08 20 79 02 A9 00 8D 0F 17 60 86 DD A5 E6 8D
0260  47 17 A9 01 8D 01 17 EE 00 17 A6 E7 CA D0 FD 2C
0270  47 17 10 F3 C6 DD D0 E5 60 86 DD A5 E6 8D 47 17
0280  2C 47 17 10 FB C6 DD D0 F2 60 A6 E2 B5 68 60 00
0290  05 3B 03 44 BB C0 C0 C0 C0 C0 00
02C0  A2 10 20 79 02 A2 02 20 5B 02 20 B0 03 20 AD 00
02D0  EA EA A2 30 20 79 02 60
0300  48 8A 48 98 48 A9 83 8D 04 17 2C 07 17 10 FB E6
0310  80 A9 04 C5 80 D0 41 A9 00 85 80 18 F8 A5 81 69
0320  01 85 81 C9 60 D0 13 A9 00 85 81 A5 82 18 69 01
0330  85 82 C9 60 D0 04 A9 00 85 82 A5 8C 18 69 01 85
0340  8C C9 60 D0 13 A9 00 85 8C A5 8D 18 69 01 85 8D
0350  C9 60 D0 04 A9 00 85 8D D8 A9 F4 8D 0F 17 68 A8
0360  68 AA 68 40
0380  AD 02 17 29 01 F0 03 4C 8E 03 58 4C 00 00 A9 00
0390  8D 00 17 58 4C 94 03
03B0  A9 00 85 8C 85 8D 85 8E 60
```

lower portion of page 1 is available for future expansion.

In order to use this control system in your repeater, a word is in order about connecting to the KIM-1 and interfacing into the receiver and transmitter. First, the NMI interrupt line (pin 6, KIM-1 expansion connector) should be connected to PB7 (pin 15, KIM-1 application connector). This will allow the real-time clocks to function.

Next, PA0 (pin 14, KIM-1 application connector) should be connected to the repeater's transmit audio, as this line will have the CW tones on it. The next line that you need to hook up is the transmitter keying line. This line is PA2 (pin 3, KIM-1 application connector). This line provides a logic 1 when the transmitter is supposed to be on. You will have to interface this to turn your transmitter on.

This connection cannot be a direct one as a KIM-1 I/O pin will sink only about 1 mA of current. In the repeater I used to develop this controller, my transmitter was solid state and drew 15 mA to ground to key the transmitter. A buffer IC was connected to PA2 and this was sufficient to sink the 15 mA directly. Depending on the type of transmitter you are using, you may need to have a buffer IC drive a transistor or even a buffer IC to drive a transistor and have the transistor drive a relay to operate your transmitter.

Next, you need to connect a COR output from your repeater's receiver to PB5 (pin 16, KIM-1 application connector). Your COR output must be a logic 0 when receiving a signal. When the receiver is squelched, the voltage on the COR output line going to the computer should be less than 5.5 V to prevent possible damage to the computer. In my system, using a transistorized receiver, I hooked up a COS (carrier-operated switch) to the receiver and connected that transistor directly to PB5. In order for this system to work, the grounds of this controller, any interface circuitry, the receiver, and the transmitter should be connected together—no floating grounds are allowed. Also, the power line to the computer should be as well filtered as possible.

If you are using the remote-control portion of this control system, then you also must connect PB0 (pin 9, KIM-1 application connector) and IRQ (pin 4, KIM-1 expansion connector) to the appropriate points of your control circuitry. The last thing you need to do before putting this system on the air is to put a CW ID into the controller. This is explained in Table 2 and you can use the example in the program listing for DE WD8CHH/RPT CLE as further help.

This control system has been exhaustively tested and all of the bugs should be out by now. However, if you have a problem, contact me and I will provide whatever assistance I can. ■

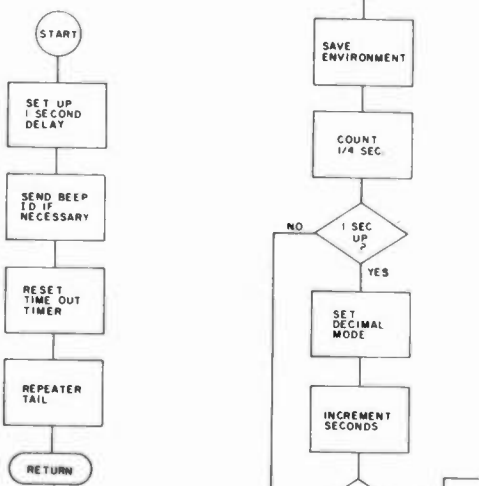

Fig. 4. Courtesy-tone routine flowchart.

Fig. 5. Real-time clock routine flowchart.

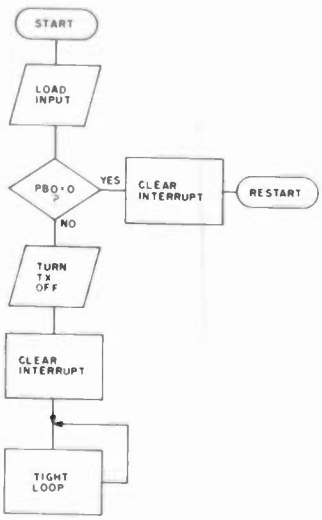

Fig. 6. Remote-control routine flowchart.

Mark Oman WA0RBR
528 Deines Ct.
Ft. Collins CO 80525

The Fun-Mitter— A Goof-Proof Rf Project

— fail-safe QRP rig uses Radio Shack parts

The purpose of this project was to build a simple transmitter that could be duplicated easily by any amateur.

My main interest as an amateur lies in designing and building my own equipment. During numerous on-the-air conversations, I discovered that home-brewing is not a forgotten art and that many hams are still interested in building at least some piece of equipment for use in the shack. However, it seems that a good portion of newcomers (and not-so-newcomers) are frustrated when trying to find a project that is simple enough to understand, is cheap, and will produce a useful item which is not time-consuming to build, debug, and get operational.

This 5-Watt, 80/40-meter, CW transmitter is all of this and more. All of the parts can be purchased at your local Radio Shack, assembly time is less than an hour, and tune-up time is zero. Using a PC board practically guarantees that the transmitter will work the first time the key is closed. These features should make this a project that both the Novice and old-timer can enjoy.

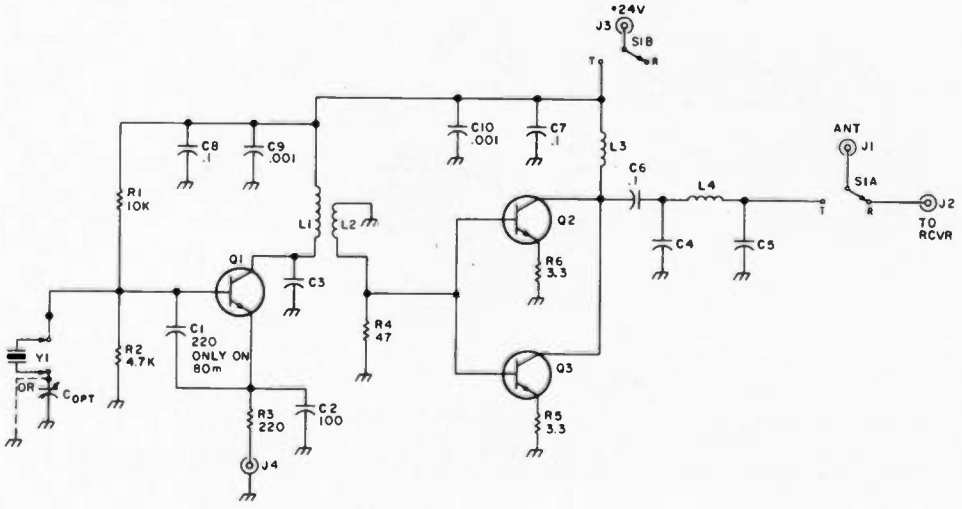

Fig. 1. Transmitter schematic.

My original design called for vfo control of the transmitter, but that required five rather than three transistors. Additionally and more importantly, the components needed to construct a stable vfo cannot be purchased at most Radio Shack outlets. To overcome these problems, crystal control was decided upon. At first thought, crystals conjure up an image of hours of operating without a contact as you wait for someone to happen upon your frequency. That simply isn't the case, as will be shown later. Also, since Novices now can use vfos, there are many crystals lying around in ham shacks everywhere.

The transmitter can be built as a basic unit or with

several options, as shown. The basic unit consists of the loaded PC board soldered to an antenna connector and power source. If the transmitter is to be used for serious operation—which it definitely is capable of—then the options, which require only a little more time and money, should be added. Options will allow T-R switching, some frequency variation, two bands in one box, and a package that is more pleasant to look at and show off.

Photo A. Completed transmitter.

Photo B. Back view.

The Circuit

As can be seen from Fig. 1, the transmitter meets the design goal of being simple. Only three transistors are used to generate the 5 Watts of output power. Resonant circuit inductors are formed using iron-core rf chokes. Common-value ceramic capacitors are used either singly or in parallel to obtain the needed capacitance.

Q1 operates as a Pierce oscillator at the crystal frequency. FT-243 crystals, which are inexpensive and plentiful, can be used. Output is taken from Q1 by a five-turn link over L1. Q2 and Q3 comprise the class C final amplifier and are operated in parallel. Parallel operation provides an easy method of obtaining the desired 5-Watt output.

The parallel combination of Q2 and Q3 presents about a 60-Ohm load to be matched to the 50-Ohm antenna load. This collector impedance is determined from the formula $RL = Vcc^2/2po$, where $Vcc = 24$ V and $po = 5$ Watts.

The impedance transformation is accomplished with a pi-network composed of L4, C4, and C5. This network also offers harmonic attenuation to the signal. The transmitter, as designed, easily meets the FCC regulations for harmonic radiation.

R5 and R6 are used to equalize current flow in the two transistors. In all of the units built thus far, I have detected no "hogging" of current by either transistor. Nothing special has been done in selecting matched transistors. If they run equally hot, they are matched well enough! Heat sinks are needed on both transistors to dissipate the heat generated. Since the type of heat sink needed is not available at Radio

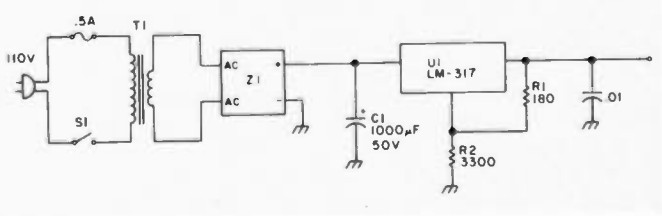

Fig. 2. Power supply schematic.

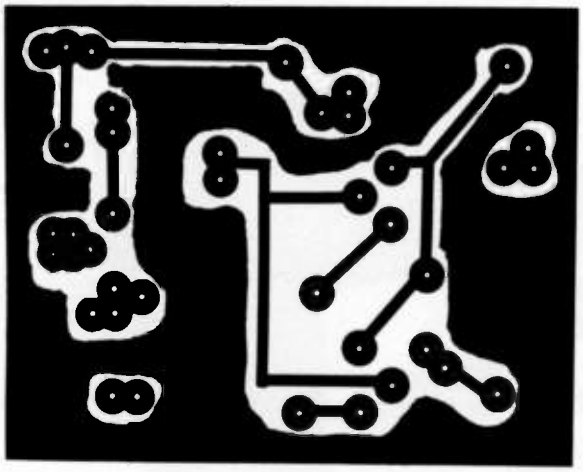

Fig. 3. PC board layout, foil side. (Single-sided, fiberglass, copper-clad board.)

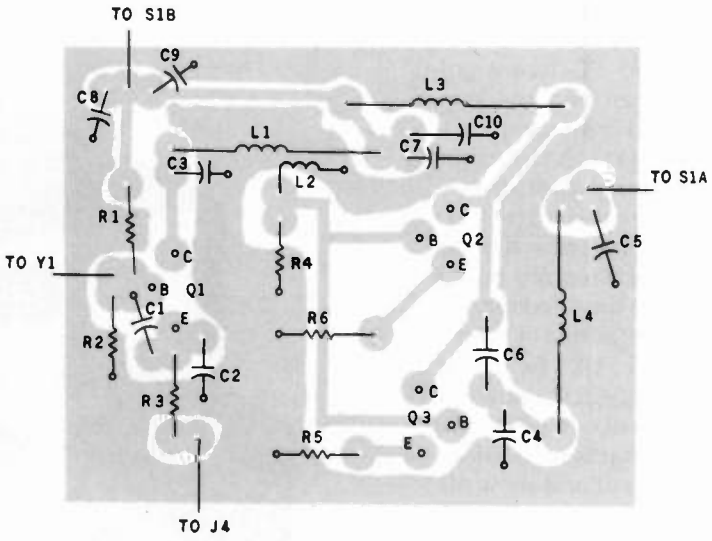

Fig. 4. Component locations.

Shack, they must be constructed by hand. Light gauge aluminum can be used by forming a tightly fitting cap over the transistor.

The design goal of using readily-available parts was realized throughout the rig. Radio Shack disc ceramic capacitors are used and have performed well. Unfortunately, there is a limited variety of these parts. To obtain the desired capacitance, the capacitors, where necessary, are soldered in parallel. This allows for the elimination of variable capacitors to tweak the tuned circuits to resonance. In all units assembled, the resonant circuits and matching networks have worked fine with no tweaking necessary.

To construct L1, remove the required number of turns from the Radio Shack choke. Use this removed wire to form the link winding, L2. Wind L2 over the Q1 side of L1. L3 should be made similarly except that no link is needed. The chokes work surprisingly well as resonant circuit inductors at 3.5 and 7 MHz.

Parts List
(Radio Shack parts numbers in parentheses.)

Fig. 1.

C1-C10	—Ceramic disc (272-xxx)
C3	—80m: 220 pF; 40m: 47 pF
C4,C5	—80m: 690 pF (220 and 470 pF in parallel); —40m: 420 pF (220, 100, and 100 pF in parallel)
Copt	—BC variable, approx. 30-200 pF
J1,J2	—SO-239 (278-201)
J3	—Phono jack (274-386)
J4	—Phono jack (247-252)
L1	—80m: 8.4 uH, 8 turns removed (273-101) 40m: 10.0 uH, no turns removed (273-101)
L2	—5 turns wound over side of L1
L3	—Approx. 30 uH, 40% of turns removed (273-102)
L4	—80m: 2.4 uH, 16 turns removed (273-101) 40m: 1.2 uH, 23 turns removed (273-101)
Q1	—RS-2033 (276-2033)
Q2,Q3	—RS-2038 (276-2038)
R5,R6	—Each is 3 10 Ohm, ½-W (271-001) in parallel
S1	—DPDT toggle (275-1546)

Fig. 2.

C1	—1000 uF, 50 V (272-1047)
R1,R2	—¼-W carbon (R2 can be made 5k variable to provide 3-30-V output)
S1	—SPST (275-324)
T1	—24 V lamp, min. (273-1480 or 273-1512)
Z1	—Full-wave bridge rectifier, 1.4 A, 100 piv (276-1152)

One departure from the norm in this project was the use of +24 V for supply voltage rather than the more common 12 volts. This was done for several reasons. It is much easier to build and get operational a 24-volt supply than it is the additional stages required to realize 5-Watts output using a 12-V supply. This also makes the transmitter simpler and cheaper (other design goals).

A schematic for a very simple 24-V supply is shown in Fig. 2. This supply can be made variable or fixed. It has performed flawlessly at currents up to 1.5 Amps. The regulator contains internal short-circuit protection and is self-contained.

If an ac-operated supply is not desired, four 6-V lantern batteries can be operated in series to provide the needed 24 volts. Many hours of transmitter operation can be achieved from such batteries. Alternatively, and probably cheaper, sixteen D-cells can be soldered in series for the supply voltage. Obviously, the 24-volt supply should not be a deterrent to building the transmitter. It can be used for later projects as well!

Construction

The transmitter is built on a 2¼" by 3" PC board. Assembly time is less than one hour due to the small number of parts used. A number of transmitter boards have been constructed and each one has worked fine when power was applied.

For best operating comfort, the transmitter PC board should be mounted in an enclosure—as mentioned earlier. Any size or type of enclosure will work fine. I used a Radio Shack type, which makes for a nice-looking and compact transmitter.

A crystal socket should be mounted on the front panel to allow for a change of frequency when desired. A variable capacitor can be mounted near the socket to allow for a small amount of frequency excursion from the crystal frequency. On 80 meters, about 1.5 kHz of change has been possible. On 40 meters, this increases

to about 3-5 kHz. The amount of frequency excursion will vary, depending mostly upon the crystal used.

Switch S1, a miniature DPDT toggle type, is used to switch the antenna between receive and transmit. All connections between S1, the PC board, and the SO-239 antenna connectors should be made with coax. RG-174 is preferred, but if it is not available, RG-58 will work fine. The only other additions necessary are a phono connector for voltage and a key jack.

If desired, the 40-meter PC board can be mounted in the same box as the 80-meter board to make a two-band transmitter. Another toggle switch will be needed to switch the two boards to the appropriate circuit points.

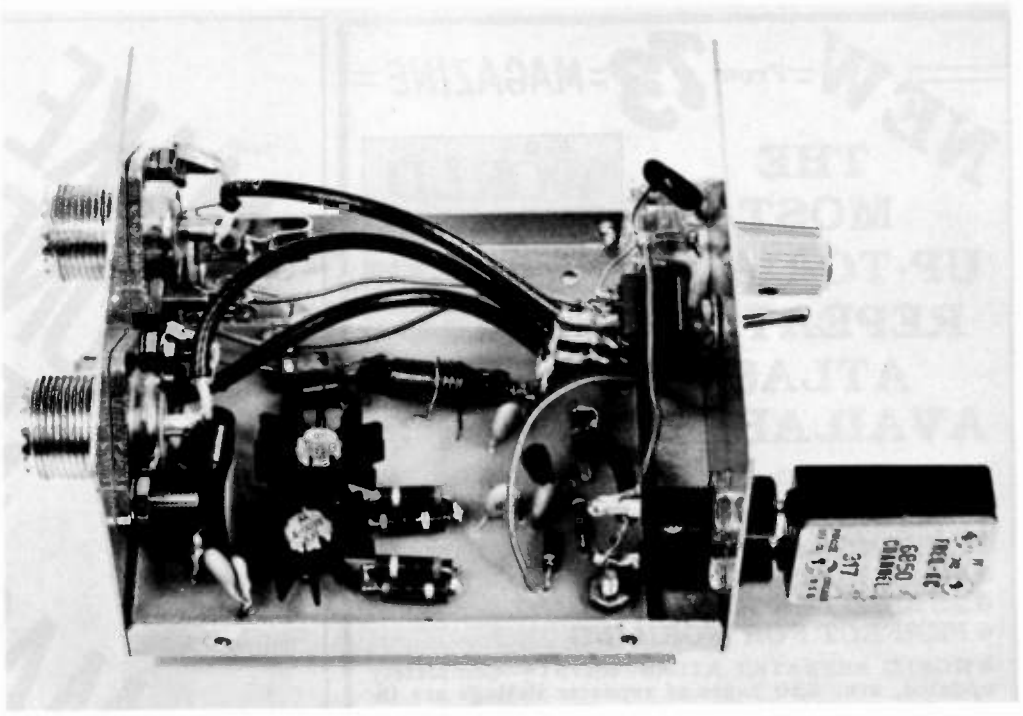

Photo C. Inside view.

Operation

After assembling the PC board and the supporting parts into a cabinet, the transmitter is ready for use. Initially, a dummy load should be connected to the antenna connector. This allows for testing without generating QRM on the air. The dummy load can consist of two 100-Ohm, 2-Watt resistors in parallel. If a VOM (ammeter) is available, it might prove advantageous to hook it in series with the plus side of the 24-V supply. Input power can then be calculated.

After the key is plugged in, the supply turned on, and the crystal installed, switch S1 to transmit and close the key. The VOM should read about 350 mA of current. This indicates an input power of approximately 8.5 Watts (Pi = E × I = 24 × .35). All of the transmitters I have built have had a minimum efficiency (Po/Pi) of around 60 %. This indicates an output power of around 5 Watts. The input (and output) power of your transmitter might vary depending upon the gain of the transistors used.

An antenna now can be hooked to the SO-239 antenna connector. At the same time, a short cable should be run between the receiver-out connector and your receiver.

You are ready now for on-the-air contacts. You probably will be as surprised as I was when you first use your new little powerhouse. Surprisingly, my best success has been in calling CQ. The response ratio has been close to 50%. Using one crystal on 80 meters has resulted in numerous contacts up to 1500 miles away with excellent reports in both strength and quality. The antenna used in conjunction with the transmitter has been a dipole at 20 feet.

Conclusion

The transmitter has met the objectives I set out to achieve. It has been fun to design, build, and to use. Hopefully, this article will encourage you to try to build some type of home-brew gear. A simple receiver board can be constructed easily and included with the transmitter. Such a receiver is currently being designed. Good luck in home-brewing! ■

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The magic of digital electronics is coming to ham gear. . . and you'll be able to read about these developments in 73. There probably will be more changes in ham equipment in the next few years than ever before in history. You'll see these changes coming in 73, where you'll read about the experiments and pioneering. 73 has more articles than any other ham magazine. . . often more than all the others combined.

When sideband got started it was moved along by the many pioneering articles in 73. In the 60s it was solid state, with several times as many articles on the subject than in all the other magazines combined. When repeaters and FM got going about ten years ago there were over five times as many articles on the subject published in 73 as in all other ham magazines combined . . . and you can see what changes **that** brought to hamming. Now we're looking at exciting developments such as narrow band sideband for repeaters. . . which might give us six times as many repeaters in our present bands. We're looking at automatic identification systems which may make it possible for us to read out the call letters of any station tuned in. . . and even the development of self-tuning receivers.

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LOOKING WEST

from page 14

great deal of time experimenting with antenna systems for VHF and HF. Bob designed and built one of the nation's most exotic repeater systems: WD9GOE, located in his hometown of Marissa, Illinois, some 70 miles outside St. Louis. He also spearheaded the now-annual ARCH Convention in St. Louis and has accomplished so much in his life that it could fill many volumes.

Bob's book is covered in the Review section of this issue of *73 Magazine*.

THE VOCOM ANTENNA DEPT.

Elsewhere in Illinois there exists a company that calls itself VoCom, and they have a rather interesting product. It's a 5/8-wave gain antenna that collapses to 8" and is designed to be used directly on a hand-held fitted with a BNC-type connector. I became interested in this product after moving to our new home. (One thing to mention on my new home: While set in a beautiful canyon, I actually purchased a $70,000 "dead spot" that came complete with "CC & Rs" which prohibit any outside antenna structure. Not that the latter would be of any distinct advantage over what I have in the attic, unless I erected a tower some 650 feet high. I knew what I was getting into when I bought the place and do not regret the move. I bank heavily on a remote-base system atop a nearby peak to keep in touch with the outside world.)

But now and again it's nice just to chew the fat simplex (direct), and my Wilson Mark II is just the ticket at those times. With the supplied rubber ducky, I found my simplex range to be under a mile. I tried a ¼-wave whip and got another mile out of that. In fact, with the ¼-wave, I could be heard through the nearby WR6AHM Magic Mountain repeater. Barely, I grant you, but readable. The Icom 22 and attic-mounted, 4-element beam put me in solidly, but are not convenient when one wants to lie in bed for a chat.

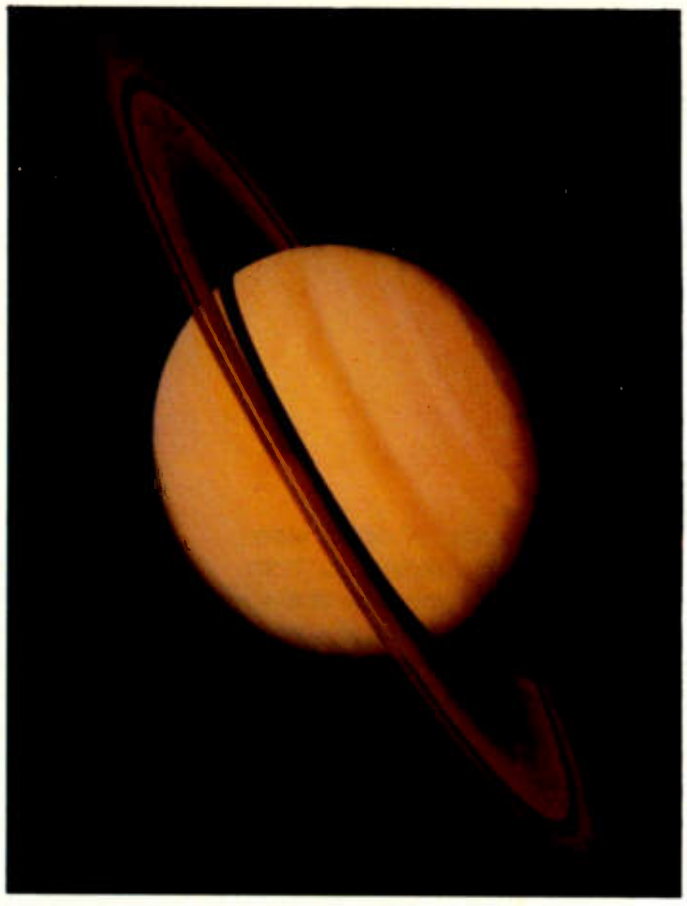
Anyhow, through a friend I heard about the VoCom antenna and procured one. I was very skeptical when it arrived. Taking it out of its shipping container, I found what appeared to be a TV rabbit ear antenna rod designed for an early model Sony TV, mated through a covered coil to a BNC plug. I was not all that impressed.

"Oh, well. What the heck. Let's give it a try," I said to myself. I tried keying up Magic with the ducky so that I would have a basis for comparison. As usual, there was no way to key up Magic with the ducky. Then I substituted the VoCom, extended it out to its full 47 inches and tried again. "You're full quieting, Bill. You using the beam?" was the first report. I was astounded. No way, I thought. I had the station stand by and tried the ducky. No luck. Back on the VoCom I was DFQ. "The bloomin' thing works!" I thought to myself.

Subsequent QSOs on 146.52 have proven to me that the manufacturer's performance claims are in the ballpark (which is something else rare in this age of hype and jive). Last night, under normal conditions, I completed a QSO with a station in the Simi Valley some 45 miles away. Signals were fair both ways. One of these days I'll publish a photo of these surroundings to show the terrain I am up against. If this antenna will work here, I think I can safely say that it will work anywhere. The VoCom HT Gain Antenna is available for $24.95 from VoCom, 65 E. Prospect, Suite 111, Prospect Heights IL 60070. In my opinion, it's worth the asking price and then some.

VOYAGER AND ATV DEPARTMENT

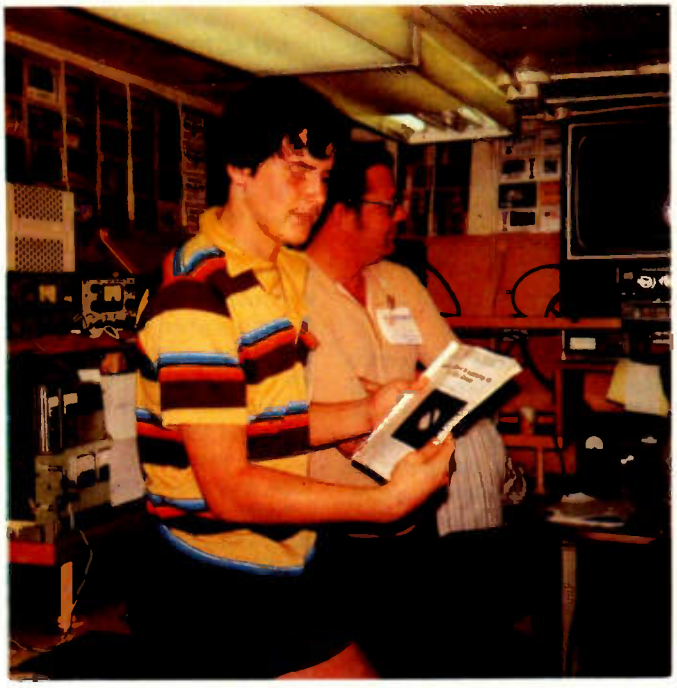
One of the most fascinating places in Southern California is the Jet Propulsion Laboratory in Pasadena. For well over a decade, JPL has been the scene of some of the greatest breakthroughs in the history of man's conquest of the "final frontier." Many of us grew up watching the epic of American space exploration unfold through the eyes of news correspondents and scientists in press conferences.



Saturn and its satellites Tethys (outer left), Enceladus (inner left), and Mimas (right of rings) are seen in this mosaic of images taken by NASA's Voyager 1 on October 30, 1980, from a distance of 18 million kilometers (11 million miles). The soft, velvety appearance of the low-contrast banded structure and increased reflection of blue light near the perimeter of the Saturn disk are due to scattering by a haze layer above the planet's cloud deck. Features larger than 350 kilometers (220 miles) are visible. The projected width of the rings at the center of the disk is 10,000 kilometers (6,000 miles), which provides a scale for estimating feature sizes on the image. Photo courtesy of NASA.

In November of 1980, we witnessed another chapter in this ongoing story as *Voyager 1* had a "Close Encounter of a Special Kind" with the planet Saturn. We saw the close-up photos of Saturn, its rings and its moons, in a manner never seen before. For all the questions answered by the *Voyager 1* flyby, new ones arose. We watched as *Voyager*, a billion miles off in endless space, performed its appointed task flawlessly, sending back television photos of the ringed world. From the comfort of our own homes, we watched as people such as NBC's Roy Neal brought these pictures to us via our own TV set. Together we lived through another great moment in man's conquest of the unknown.

Among the first to see some of these epic photos were those of us who are amateur radio operators. This because there exists at JPL one of the nation's most active amateur radio clubs, an organization well known for doing its part to help commemorate events such as this. In the past, whenever a close encounter such as this took place, the JPL Amateur Radio Club went on the air sending slow-scan photos and offering commemorative QSL cards which have become collectors' items. The *Voyager 1* Saturn flyby was no exception, as those of you who QSOed W6VIO (*Voyager* In Outerspace) during this time period are well aware. For the better part of November, W6VIO was operational on a daily basis. Hot from the JPL imaging department, photos were aired on various amateur bands worldwide, using slow-scan television techniques. But that was not all. For the *Voyager 1*



One of the visitors to W6VIO during the Saturn encounter was Mike Davis WD6FFV. Many of you will remember Mike. Two years ago, at age 13, he coordinated the rescue of three people aboard a sinking boat in the Caribbean.

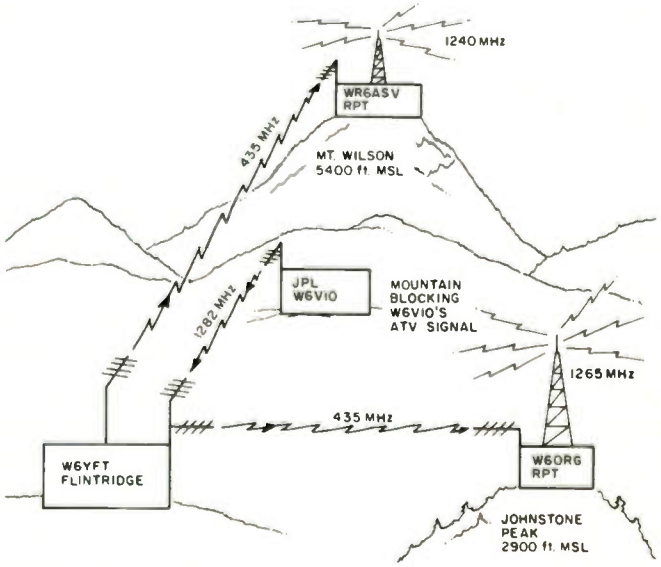
Those JPL employees operating at W6VIO did so on their own time. These two manned the 220-FM position and ate lunch at the same time. Talk about dedication!

Saturn encounter another dimension was added: regional fast-scan television using facilities provided by Tom O'Hara W6ORG of P.C. Electronics and the Southern California ATV Club.

The fast-scan installation was rather unique. The idea was to get the video signals from W6VIO into two area ATV repeaters, one located on Johnstone Peak near Pomona, California, and the other on Mt. Wilson. As you can see from the accompanying pictorial, while JPL may lie in the shadow of Mt. Wilson, it is not line-of-sight to it. JPL also is effectively blocked from Johnstone Peak by other hills. One of the places it could see easily, however, was the Flintridge area, so a decision was made to install an intermediary link at the home of Dr. Dale Hauck W6YFT. Television was then generated at W6VIO, relayed to W6YFT and into the two crossband ATV repeaters, affording the ever-growing ATV community out here a chance to see things first hand.

The fast-scan operation was every bit as successful as was the slow-scan. There were reports of reception as far away as Riverside and San Diego, and it was of good quality color photos many times accompanied by descriptive audio of what was being seen. The fast-scan was so well received that plans already are being made to repeat the setup next summer when *Voyager 2* encounters the ringed planet and scientists again try to unravel some of the mysteries of space. In the meantime, if you were among those fortunate enough to QSO W6VIO, I urge you to send for one of their QSL cards. Be sure you are a "logged contact," and send your own QSL confirming the contact along with a #10 self-addressed, stamped envelope to W6VIO at their *Callbook* address. When you receive yours, you might want to frame it. Not only to protect it, but so that it will stand out among the rest as a symbol of your personal participation in a rather monumental achievement of mankind.

The slow-scan ATV setup at W6VIO was simple but effective. From this position, pictures were seen worldwide.



CONTESTS

from page 19

Work as many QCWA members as possible and apply for the several Special QCWA Certificates which you have qualified for in the QCWA Parties: Worked 50 States, Worked 60 Chapters, Worked 100 Members, and Worked 500 Members.

ARRL INTERNATIONAL DX CONTEST — CW
0000 GMT February 21
2400 GMT February 22

The ARRL-sponsored contest is open to all amateurs worldwide. Note that the basic contest format has been returned to that of 1979, with W/VE stations working the world and everybody else working W/VE stations only. The changes to single-band categories and the expanded awards program proved very popular and remain unchanged. Use all bands, 1.8 to 30 MHz.

Operating categories include: single operator allband and single-band, multi-operator single transmitter or multi-transmitter, QRP single transmitter only with 10 Watts input or less (5 Watts output or less).

Your callsign must indicate your DXCC country (KL7XYZ/2 in NJ, FG@AAA/FS on St. Martin, etc.). One operator may not use more than one callsign from any given location during the contest period. The same station may be worked only once per band. No crossmode, crossband, or repeater contacts. Aeronautical and maritime mobile stations outside the USA and Canada may be worked for QSO credit only by W/VE stations. All transmitters and receivers must be located within a 500-meter diameter circle, excluding directly-connected antennas. This prohibits the use of remote receiving installations. However, multi-operator stations may use spotting nets for multiplier hunting only.

EXCHANGE:

W/VE stations (includes 48 contiguous United States and does *not* include Canadian islands of St. Paul and Sable) send RST and state/province. DX stations send RST and transmitting power as a 3-digit number.

SCORING:

W/VE stations count 3 points per DX QSO. The multiplier is the sum of DXCC countries (except US and Canada) worked per band. DX stations score 3 points per W/VE QSO. The multiplier is the US states (except KL7 and KH6), VE1-7, VO, and VE8/VY1 worked per band. Maximum of 57 per band. Final score is total QSO points times the total multiplier.

AWARDS:

Various plaques and certificates to top scorers. Certificates to each DX entrant making more than 500 QSOs. ARRL affiliated clubs compete for gavels on three levels: unlimited, medium, and local clubs. Details should have appeared in the January, 1981, *QST*.

ENTRIES:

All entrants are encouraged to use forms available from ARRL (include an SASE or one IRC). Logs should indicate times in GMT, bands, calls, and exchanges. Multipliers should be clearly marked in the log the first time worked. Entries with more than 500 QSOs must include cross-check sheets. All operators of multi-operator stations must be listed. Entries must be postmarked by April 7, 1981, and addressed to: ARRL, 225 Main Street, Newington CT 06111. Any entries received after mid-July may not make *QST* listings. Usual entry conditions and disqualification criteria.

G-QRP-CLUB
CW ACTIVITY WEEKENDS
0900 GMT February 28
2300 GMT March 1
0900 GMT September 12
2300 GMT September 13

All amateur radio amateurs interested in QRP are invited to take part in the club's activity weekends. No special exchange information was mentioned in the information provided by the club. The operating schedule for the two weekends is as follows:

3560 kHz = 0900-1000, 1700-1800, and 2200-2300 GMT

7030 kHz = 1200-1300, 1500-1600, and 1900-2000 GMT

14060 kHz = 1000-1100, 1400-1500, and 2100-2200 GMT

21060/28060 = 1100-1200, 1600-1700, and 2000-2100 GMT

Reports on the Activity Weekends are welcomed by Christopher J. Page G4BUE.

In addition to the above, members of the G-QRP-Club have a weekly Activity Period on Sundays from 1100-1230 and from 1400-1530 GMT on the International QRP frequencies (3560, 7030, 14060, 21060, and 28060). All radio amateurs interested in QRP are invited to join in.

For information regarding membership in the G-QRP-Club, write: George Dobbs G3RJV, 17 Aspen Drive, Chelmsley Wood, Birmingham, England B37 7QX. The club publishes a quarterly magazine called *SPRAT* and promotes an extensive awards program for QRP achievements.

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 8½" × 11" sheet of paper and use upper- and lowercase letters where appropriate. Also, please make a "1" look like a "1," not an "l," which could be an "el" or an "eye," and so on. Hard as it may be to believe, we are not familiar with every piece of equipment manufactured on Earth for the last 50 years! Thanks for your cooperation.

I need information on using a solid-state oscillator in HBR receivers by Ted Crosby. I will answer and send postage. Thanks.

Owen Laughlin KA8CXK
719 Hemphill
Ypsilanti MI 48197

I need a working charger for the Motorola HT-220 transceiver. I am a senior citizen ham, so I need a low price, please.

Bob Clark W5BTZ
8260 Wateka Road
Richardson TX 75080

I need a copy of the manual for the Gonset GSB-201—an original or photocopy would be OK. I'll be happy to pay for all costs.

Steven Bein K6MBP
3044 Danalda Dr.
Los Angeles CA 90064

I have a Hammarlund Super Pro receiver, military no. BC-779-B. It does not cover 10 or 15 meters, which I would like to have. It has one band marked 100-200 KC and the other, 200-400 KC. There was a conversion kit but the company no longer has them.

If anyone has a conversion kit for this receiver or a BC-794-B or BC-1004 C, even though it doesn't work, and if the price is right, I would like to get it.

Donald B. Watkins
428 Oak St.
Warren AR 71671

I need a schematic and/or manual for a keyboard having the following markings: #2815051-01A. Unit has 91 keys and PC board has LICON 80-55157CS1-1 on it. It may have been used in a UNIVAC system. I will reimburse copying cost, will copy and return promptly, or purchase manual.

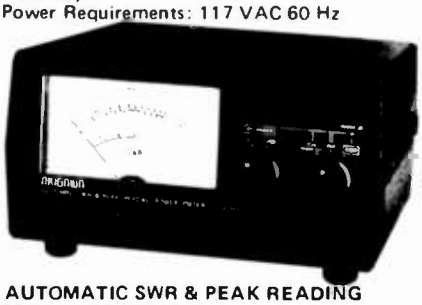
John Zowtiak N7BFX
750 Little Matterhorn Dr.
Salt Lake City UT 84107

Where can I get a replacement cabinet back for my Hallicrafters Model S38-B shortwave receiver? Mine was damaged and I've been unable to get a replacement from Hallicrafters. There must be distributors somewhere that have some of these and would be glad to sell them.

Duerson Prewitt K4ZCD
129 N. Maysville St.
Mt. Sterling KY 40353

AUTOMATIC SWR & PEAK READING HF POWER METER
MODEL APM-1H $99.95

Frequency Coverage:	1.8 – 60 MHz
Input Impedance:	50 – 52 ohms
Power Range:	0 – 200, 1000, 2000W
SWR Range:	1:1 – 10:1
Power Modes:	Average & PEP
Accuracy:	±10%
Power Requirements:	117 VAC 60 Hz



AUTOMATIC SWR & PEAK READING VHF POWER METER
MODEL APM-1V $99.95

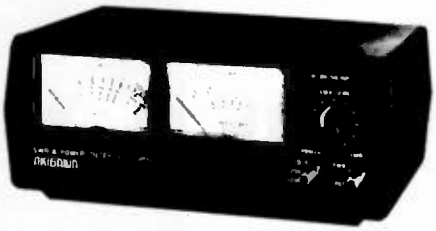
Frequency Coverage:	50 – 150 MHz
Input Impedance:	50 – 52 ohms
Power Range:	0 – 20, 200W
SWR Range:	1:1 – 10:1
Power Modes:	Average & PEP
Accuracy:	±10%
Power Requirements:	117 VAC 60 Hz

FLAT RESPONSE SWR & POWER METER FOR HF
MODEL PM-2H $89.95

Frequency Coverage:	1.8 – 60 MHz
Input Impedance:	50 – 52 ohms
Power Range:	0 – 200, 1000, 2000W
SWR Range:	1:1 – 3:1
Accuracy:	±10%
Power Requirements:	None

FLAT RESPONSE SWR & POWER METER FOR VHF
MODEL PM-2V $89.95

Frequency Coverage:	50 – 150 MHz
Input Impedance:	50 – 52 ohms
Power Range:	0 – 20, 200W
SWR Range:	1:1 – 3:1
Accuracy:	±10%
Power Requirements:	None



SWR & POWER METER FOR HF/VHF
MOOEL PM-3HV $54.95

Frequency Coverage:	3 – 150 MHz
Input Impedance:	50 – 52 ohms
Power Range:	0 – 20, 200, 1000W
SWR Range:	1:1 – 5:1
Accuracy:	±10%
Power Requirements:	12 VDC

Illuminated meters for mobile operator

SWR & POWER METER FOR HF/VHF
MOOEL PM-4HV $44.95

Frequency Coverage:	3 – 150 MHz
Input Impedance:	50 – 52 ohms
Power Range:	0 – 20, 200, 1000W
SWR Range:	1:1 – 3:1
Accuracy:	±10%
Power Requirements:	None

Velcro for mobile mounting

Best Amateur Radio Accessories

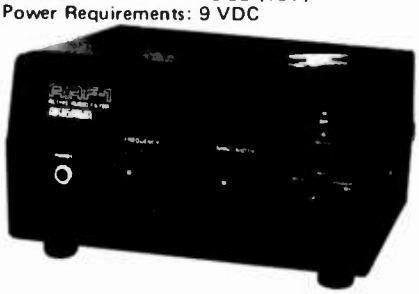
AKIGAWA

Manufactured By:
AKIGAWA ELECTRONICS CORPORATION

Oistributed Exclusively By: ✓56
MACAW ELECTRONICS INCORPORATED
P.O. Box 66, Carlsbad, Calif, 92008
Phone (714) - 434-1078
Telex 181743 MACAW CSBD

MIKE COMPRESSOR WITH LINEAR AMPLIFIER
MODEL MCLA-1 $89.95

Compressor Section	
Frequency Range:	100 – 10000 Hz
Distortion:	Within 0.4%
Linear Amplifier Section	
Frequency Range:	300 – 10000 Hz
Gain:	25 dB (12V)
Power Requirements:	9 VDC



ACTIVE AUOIO FILTER
MODEL AAF-1 $89.95

Filters:	Band Pass+Notch
Center Frequency Shift Width:	200 – 2500 Hz
Input Impedance:	8 – 600 ohms
Output Impedance:	8 ohms
Output Power:	1W max.
Power Requirements:	9 VDC 150 mA

SWR & POWER METER FOR MOBILE
MODEL PM-5H (HF) $49.95
MODEL PM-5V (VHF) $49.95

Frequency Coverage:	1.8 – 30 MHz (PM-5H)
	50 – 150 MHz (PM-5V)
Input Impedance:	50 – 52 ohms
Power Range:	0 – 20, 200 W ±10%
Power Requirements:	12V DC

Complete with directional coupler unit

PRESELECTOR
MODEL PR-1 $109.95

Frequency Coverage:	3 – 30 MHz
Gain:	20 dB at 7 MHz, Variable
RF Attenuation:	–20 dB & –10 dB
Input/Output Impedance:	50 – 75 ohms
Relay Power Capability:	200W CW
Power Requirements:	117 VAC 60 Hz

(Prices are suggested list and are subject to change without notice.)

W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

from page 11

The crowding of Tokyo has forced much of the growth to go underground. This is a small part of the four-floor shopping complex which is involved with the Sunshine Prince hotel, where we stayed. There are two McDonalds restaurants in this one complex! There is also an almost infinite number of other restaurants, running from snack bars to very posh eateries. Multilayered underground shopping malls are growing rapidly in Tokyo.

Hmmm, octopus chips! Well, much better than cow chips, anyway . . . and free!

This is one of the Golden Arches attached to the hotel. It was a handy place to get milk. Not being a big Coke fan, I didn't pursue the nickel Coke offer. I did invest in their egg McMuffin for breakfast now and then.

Obviously, eating is an all-consuming interest for me. Here's a typical department store basement with its hundreds of food concessions. The happy innocents running these booths put out free samples to attract business. They also attract frugal Yankees, who are able to make a whole meal out of the samples.

Here's one of the food displays. The tempura jumbo shrimp are $7.50.

The subway system is easy to use, though it takes guts to try it the first time. You get the hang of it quickly. It's clean, fast, and well marked.

Each station is marked in both Japanese and English, with the stations at the ends of the line indicated so you know which train to take.

Yep, ice cream, too. The sundae prices are a bit high, but not out of line with the New York prices at $3 for the big banana split. Soft ice cream cones are usually around 75¢ and are sold all over the place.

You like grapes? Here are boxes of grapes. . . absolutely delicious grapes. The green ones are $20 a box and the smaller box of purple grapes is only $12.50.

To help dispel the idea that eating in Japan is expensive, here is a picture of a musk melon. This is a typical fruit product that I saw in dozens of fruit stores and fruit counters in department stores. To translate the Yen into dollars divide by 200. Thus, this melon is a mere $50 in American money.

In the Akihabara (radio row) section of Tokyo, there are hundreds of shops selling radios, parts, hi-fi, computers. . . everything in consumer electronics. With a bit of shopping, you can knock around 35% or so off the US prices, so I loaded up with new gadgets from Casio and Sharp. That's Sherry looking over the cassette bargains.

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.

MIAMI FL
FEB 7-8

The 21st annual Tropical Hamboree and 1981 ARRL Florida State Convention will be held on February 7-8, 1981, at the Flagler Dog Track, Miami FL. Registration is $3.00 in advance and $4.00 at the door. Swap tables are an additional $12.00 for both days, $7.00 for Saturday only, and $6.00 for Sunday only. Events will include tech talks and forums, over 100 exhibit booths, 400 swap tables, ladies' programs, group meetings, and many awards. There will be free overnight RV parking for self-contained units at the site (advance registration is recommended). Special gatherings are planned for QCWA/OOTC/SOWP and DXers. For further information and special hotel rates, write Dade Radio Club, PO Box 350045 Riverside Station, Miami FL 33135.

MANSFIELD OH
FEB 15

The Mansfield midwinter hamfest auction will be held on February 15, 1981, at the Richland County Fairgrounds, Mansfield OH. Doors will open to the public at 8:00 am. Tickets are $1.50 in advance and $2.00 at the door. Features will include prizes, an auction, and a flea market, all in a large heated building. Talk-in on 146.34/.94. For additional information, advance tickets, and/or tables, send an SASE to Harry Frietchen K8HF, 120 Homewood Road, Mansfield OH 44906, or phone (419)-529-2801.

FAYETTEVILLE WV
FEB 15

The Plateau Amateur Radio Association will hold its 3rd annual hamfest on Sunday, February 15, 1981, at the Memorial Building, Fayetteville WV. The doors will open at 9:00 am and admission is $2.50, with children admitted free. Flea market tables are $2.00. Activities (all indoors) will include ARRL displays, forums, exhibits, door prizes, and XYL programs. Hot food, refreshments, and free parking will be available. Talk-in on 146.52 and 146.19/.79. For more information, contact Bill Wilson WA8YTM, 302 Central Avenue, Apartment #2, Oak Hill WV 25901, or phone (304)-469-9910 or (304)-574-1176.

VERO BEACH FL
FEB 21-22

The Treasure Coast Hamfest will be held on February 21-22, 1981, at the Vero Beach Community Center. Admission is $3.00 per family, in advance, and $4.00 at the door. Features will include prizes, drawings, and a QCWA luncheon. Talk-in on 146.13/.73, 146.52/.52, 146.04/.64, and 222.34/223.94. For information, write PO Box 3088, Beach Station, Vero Beach FL 32960.

LIVONIA MI
FEB 22

The Livonia Amateur Radio Club will hold its 11th annual LARC Swap 'n Shop on Sunday, February 22, 1981, from 8:00 am to 4:00 pm, at Churchill High School, Livonia MI. There will be plenty of tables available. Other features include door prizes, refreshments, and free parking. Talk-in on 146.52. For further information, send an SASBE (4" x 9") to Neil Coffin WA8GWL, c/o Livonia Amateur Radio Club, PO Box 2111, Livonia MI 48150.

AKRON OH
FEB 22

The Cuyahoga Falls Amateur Radio Club will hold its 27th annual electronics equipment auction and flea market on Sunday, February 22, 1981, at North High School, Akron OH, from 8:30 am to 4:00 pm. Tickets are $2.50 at the door and $2.00 in advance. Even though it is suggested that you bring your own tables, some will be available for $2.00 each. Featured will be refreshments and prizes, including a first prize of a Kenwood TS-130S and two more prizes of Icom IC-2ATs. There will be plenty of room for buyers and sellers, including free parking. Talk-in on 146.04/.64. For more details, write CFARC, PO Box 6, Cuyahoga Falls OH 44222, or phone K8JSL at (216)-923-3830.

LANCASTER PA
FEB 22

The Lancaster Hamfest will be held on February 22, 1981, at the Guernsey Pavilion, located at the intersection of Rtes. 30 and 896, east of Lancaster PA. General admission is $3.00, except children and XYLs. Doors will open at 8:00 am. All inside spaces are available by advance registration only and are $4.00 each for an 8-foot space, which includes a table. There is a limit of 2 non-commercial or 6 commercial tables; the registration deadline is February 13, 1981. All vendors must set up between 6:00 am and 8:00 am on Sunday; reservations will not be held past 9:00 am without prior arrangement. Free tailgating will be available in a specified area outside if weather permits. Food will be served at the hamfest. Also, there are excellent restaurants and accommodations in the area. Call (717)-768-8271 for motel reservations under Sercom. Talk-in on 146.01/.61. For more information, write Sercom, Inc., PO Box 6082, Rohrerstown PA 17603.

VIENNA VA
FEB 22

The Vienna Wireless Society will hold its annual WINTERFEST™ on February 22, 1981, at the Vienna Community Center, Park Street, Vienna VA. The event will begin at 8:00 am.

MARLBORO MA
FEB 22

The Algonquin Amateur Radio Club will hold its annual indoor ham radio flea market on Sunday, February 22, 1981, at the Marlboro Jr. High School, off Rte. 85 on Thresher Avenue, Marlboro MA. Doors will be open from 10:00 am to 2:00 pm and sellers will be admitted starting at 9:00 am. Admission is 50¢. Tables reserved by February 15, 1981, are $5.00; after that date, they are $7.50. Talk-in on .52. For more information or reservations, contact Charles McCarthy W1BK, 128 Forest Avenue, Hudson MA 01749.

MINONG WI
FEB 22

The Wild Rivers Amateur Radio Club will hold a mid-winter swapfest on Sunday, February 22, 1981, from 10:00 am to 3:00 pm at the Minong Village Hall, Minong WI, 45 miles south of Duluth-Superior, 90 miles north of Eau Claire on Highway 53, and 135 miles from Minneapolis-St. Paul. Admission is $1.00 and tables are free. There will be a raffle drawing for a scanner. Talk-in on .28/.88 and .52. For information, contact Roger Doehr W9DLY, Route 5, Box 452, Hayward WI 54843.

LAPORTE IN
FEB 22

The LaPorte Winter Hamfest will be held on February 22, 1981, at the LaPorte Civic Auditorium (main floor), LaPorte IN, 50 miles southeast of Chicago.

Donations are $2.00 in advance or $2.50 at the gate. There will be plenty of room, good food, and tables which are $1.00 each. Talk-in on .01/.61 and .52. For more information, write LPARC, PO Box 30, LaPorte IN 46350.

GLASGOW KY
FEB 28

The Mammoth Cave Amateur Radio Club will hold its annual Glasgow swapfest on Saturday, February 28, 1981, from 8:00 am to 5:00 pm CST at the Glasgow Flea Market Building, 2 miles south of Glasgow on Highway 31E. There will be a large heated building with plenty of free parking. Each exhibitor will be provided one free space with table and chair. Additional spaces are available for $3.00 each. The building will be open for exhibitors at 7:00 am CST. There will be no forums or meetings—just door prizes, free coffee, and a large flea market. Admission is $2.00. Talk-in on .34/.94. For additional information, contact WA4JZO, 121 Adairland Ct., Glasgow KY 42141.

DAVENPORT IA
MAR 1

The Davenport Radio Amateur Club will hold its tenth annual hamfest on March 1, 1981, from 8:00 am to 4:00 pm at the Davenport Masonic Temple, Highway 61 (Brady Street) and 7th Street, Davenport IA. Tickets are $2.00 in advance, $3.00 at the door. Tables are $4.00 each with a $2.00 additional charge for an electrical hookup (limited number). Features will include over $2,000 worth of major prizes. Hotel discounts and refreshments will be available. There will be a pre-hamfest Saturday night banquet with Paul Graver, midwest ARRL SCM, as guest speaker. Banquet tickets are $8.00 and reservations must be paid by February 18, 1981. Talk-in on 146.28/.88, W0BXR. For advance tickets, dinner, and table reservations, write Dave Johannsen WB0FBP, 2131 Myrtle, Davenport IA 52804.

GRAND JUNCTION CO
MAR 7

The Grand Mesa Repeater Society will hold the second annual indoor Western Slope Swapfest on March 7, 1981, at the Lincoln Park Barn, 12th and Gunnison, Grand Junction CO. Doors will be open from 10:00 am through 4:00 pm and admission is free. Swapfest tables are $4.00 in advance. Attractions will include commercial exhibitors, a flea market, an auction, and prizes. Raffle tickets for the grand prize of a Tempo S-1 are $2.00 each. Talk-in on 146.22/.82. For further information, send an SASE to Larry Brooks WB0ECV, 3185 Bunting Avenue, Grand Junction CO 81501, or call (303)-434-5603.

MAUMEE OH
MAR 22

The Toledo Mobile Radio Association, Inc., will hold its 26th annual auction and hamfest on Sunday, March 22, 1981, at the Lucas County Recreation Center, Key Street, Maumee OH. Hours are from 8:00 am to 5:00 pm. The free auction starts at 10:00 am. There will be ample free parking all day and overnight. Tickets are $2.00 in advance and $3.00 at the door. Flea market tables are available; displays are limited to electronics and ham gear. There will be commercial exhibits, refreshments, door prizes, and a big raffle—all inside. Prizes include a Kenwood TS-130 with power supply, two Icom IC-2AT HTs, a Bird Wattmeter, and many more. There will be an additional ladies' program. Bring your YL, XYL, or OM and make a day of it. Talk-in on 146.52/.52. Area repeaters are 146.01/.61, 146.19/.79, 146.34/.94, 147.87/.27, and 147.975/.375. For additional information, write J. Honisko N8BGH, 1733 Parkway Drive N., Maumee OH 43537.

AWARDS

from page 23

enclose only three (3) IRCs with your application.

Joe Onizuka JE1WIH mailed me information about the NKDXC Award. Unless you work a lot of Japanese stations, the requirements are not as easy as it seems.

NKDXC AWARD OF JAPAN

The Northern Kyushu DX Club, Inc., issues the NKDXC Award to any licensed amateur or SWL station in the world.

Applicants must submit proof of confirmation of QSO with at least 20 different stations which enable you to spell "NORTHERN KYUSHU DX CLUB" using the last letter of each callsign. A station may be used only once in your spelling effort.

There are no band or mode restrictions, but special endorsements will be rendered for single mode or band achievements.

Do not forward QSLs. GCR apply. Forward your verified list with five (5) IRCs to: NKDXC Award Manager, PO Box 11, Yawata, Kita, Kyushu, Japan 805.

50-MHZ DX AWARD OF JAPAN

The award is issued in four levels of difficulty: Class EX—applicant must make 20 DX country contacts; Class A—applicant must make 10 DX country contacts; Class B—5 DX countries must be worked; and Class C—only 2 DX country contacts need be made.

While applicants are not required to submit QSL cards, they must have them on hand and verified by at least two amateurs or a local radio club secretary. Keep in mind, however, that all contacts must be made on six (6) meters, 50 MHz, utilizing any mode authorized.

Forward your claim and award fee of 8 IRCs or $3.00 to: Eiichi Konno JA7GZA, Awards Manager, 8-3 Tenjinmae, Henaizumi-town, Nishiiwai-gun, Iwate 029-31, Japan.

TEXAS INDEPENDENCE DAY

Brenham Amateur Radio Club will be operating its second annual special event QSL station to commemorate Texas Independence Day and its observance at the site where independence was declared from Mexico on March 2, 1836, Washington on the Brazos, Texas.

We plan to operate from 1600 UTC, Saturday, February 28, until 2300 UTC, Sunday, March 1, during times when the bands are open (no nets are scheduled) on the following frequencies plus or minus QRM: 3944, 7244, 14,344, 21,144, 21,444, and 28,544 kHz.

For an historic QSL card and information brochures, amateurs are asked to please QSL with an SASE (4¼" × 9" or larger) to BARC, WB5STR/5, PO Box 44, Brenham TX 77833.

Amateurs who worked WB5STR/5 last year should so indicate on their QSL and will be recognized this year.

We are grateful to Robert Fitzwilliam of Kay, Texas, for the use of his call which will be used with the phonetics, Washington on the Brazos, 5, Star of the Texas Republic.

LOVE OUR LIBRARY

The Lawrence County Amateur Radio Association is sponsoring a Valentine's Day theme special event from downtown New Castle, Pennsylvania, at our new public library on February 13-14, 1981.

We will be operating from the new library and the theme will be "I love my new library." The call in use will be KA3X, and the operating frequencies are: 147.795/.195 (our local repeater), 29.000, 21.400, 14.300, 7.250 and (CW) 7.125 MHz.

All frequencies plus or minus QRM (except 2 meters). Operating times are 1400-2200 GMT. Your QSL and $1.00 will bring a certificate.

For further information, contact John Hudak KA3X, 422 Galbreth Avenue or Zach Allerton KB3MC, 124 Richelieu Ave., New Castle PA 16101.

HAM HELP

I am in need of a schematic for a Micro-Z FM36 frequency counter with prescaler. I will be glad to pay copying costs and postage.

Dennis L. Cornell WD4HRO
7835 Captain St.
Millington TN 38053

Simon Langton Grammar Schools in Canterbury, England, are celebrating the centenary of the founding of the school in 1881. To this end, we shall be operating a special events station, active on all HF bands under the call GB4SLS, on February 22-28, 1981. During this time, we are anxious to contact as many past pupils of the school as possible, especially those who are licensed amateurs and residing in the United States.

Anyone interested in making a sked with us should contact either me or G3LCK, c/o G3OSL, Simon Langton Grammar School for Boys, Nackington Road, Canterbury, Kent, England.

Andrew P. Smith G4BBW
40 Virginia Road
Tankerton, Whitstable
Kent, England

I've had a bundle of letters and calls from readers requesting a source for the positive resist that I used in my article on easy PC artwork (*73*, June, 1980).

Yesterday, I found a source that you may want to know of since I am buying a private-label brand locally. The national brand is by GC Electronics, Rockford, Illinois. The catalog number is 22-233.

Route Electronics, Rt. 22, Springfield NJ, sells it for $13.60 for a large aerosol can. They do not mail order.

Ed Eggert W3HIK
2220 Marietta Ave.
Lancaster PA 17603

I need a copy of a complete schematic diagram or a manual for a Hallicrafters SX-100 receiver. I would prefer to copy at my end, but would pay for other costs.

K. Gilhuly KA8EWH
650 Ann Street
Harbor Springs MI 49740

I have a Regency HR-2A 2-meter transceiver that is sick. Anyone who can provide a circuit and servicing information would greatly assist me. I will pay for all expenses to copy them.

Harvey Horn WB2NMN
21 Skylark Lane
Stony Brook NY 11790

Searching for pre-32S-1 Collins transmitter in any condition to put on RTTY. If you have an old Collins AM/CW transmitter gathering dust and would part with it reasonably cheap, please send specifications, condition, and price. XYL is contemplating murder if I spend much money. I also need a CV-89 RTTY TU. Thanks.

Roger L. Arnold N5CAO
214 Hill Lane
Red Oak TX 75154

I need a schematic for a Kuhn model 357C VHF receiver and would like to copy and return a service manual for IC-21/DV-21 2m VHF gear.

Jung Y. Lem KB6BO
5222 Coringa Dr.
Los Angeles CA 90042

Does anyone have schematics for a Utica 650A 6m transceiver and a Gonset Super Six converter? Expenses will be reimbursed.

Howard Robb AF0W
340 So. 5th
Bird Island MN 55310

I would like to get in touch with someone who has completed the 220 transverter by Frank Kalmus WA7SPR in the October, 1979, issue of *73*.

Paul Ashmore WA9HEP
833 S. Chestnut
Litchfield IL 62056

Does anyone have any info on a lower sideband addition for a MULTI-2000? Also, who is handling the MULTI-2000 now? Any help would be appreciated.

Lloyd W. Locke K1COS
236 Walnut St.
Reading MA 01867

FUN!

from page 26

9) A4XAA is:

1) The call used during a world-famous 1956 DXpedition
2) The Sultan of Oman
3) A four-land call that will eventually be assigned by the FCC.
4) A made-up callsign

10) Which of the following is a former reciprocal callsign held by Jordan's King Hussein, JY1?

1) EP1JY
2) 4Z4KH
3) RG8U
4) 7X2HM

ELEMENT 3—TRUE-FALSE

		True	False
1)	The newly self-proclaimed "Shah of Iran," son of the late Shah, is a ham.	____	____
2)	Until his recent automobile "accident," YN1AS was former Nicaraguan dictator Anastasio Somoza.	____	____
3)	The DX Country Club Award is sponsored by *73 Magazine*.	____	____
4)	KA2BQ is a DX callsign; KA2BQV is not.	____	____
5)	To officially qualify as DX, a signal must travel more than 150 miles, no matter the mode or frequency.	____	____
6)	WWV, JJY, LOL, MGM, BOT, and RID are all standard time and frequency stations.	____	____
7)	The DX Operating Code says you should always call a DX station *exactly* on his frequency.	____	____
8)	KP2 is the new prefix for KV4.	____	____
9)	BV2A and BV2B are the only licensed ham stations in the Republic of China. Both stations are operated by the same person.	____	____
10)	"QDX?" is a Q signal meaning, "Is there any DX on frequency?"	____	____

ELEMENT 4—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 amateur radio. (Illustration 2)

A) Five hundred miles is DX in this region 6 45 20

B) Popular DX mode 28 29 21 64 32

C) Twenty meters, for instance 42 60 74 76

D) "Shared" band 41 26 4 66 50

E) DXer's "shoes" 59 9 35 19 77 7

F) FCC authorization 49 73 51 5 40 23

G) Semi-automatic key 39 58 10

H) Conversation 12 33 43

I) Scarce DX 37 56 2 75

J) Distress Signal 71 22 13

K) Splatter 3 55 27

L) DE 72 1 52 44

M) Lots of DX in a row 8 61 25 62 53 36

N) When to work DX 34 24 57 46 31

O) Lids 54 63 17 18 11

P) Venezuelan prefix 78 15

Q) Temerarious DXer 48 47 65 67

R) To tell a DXer something 69 14 16

S) Computerized DX 70 30

T) Irish prefix 38 68

THE ANSWERS

Element 1:
See illustration 1A.

Element 2:
1—3. More than one budding DXer has made his first African contact through this fine service. Net time is 1800 UTC, daily.
2—3. A DXer's best friend.
3—1. Obviously not the 21st cycle in the history of the Earth, but only since man started counting—around 1750.
4—2. You may need a "long radio antenna" for this band, but that has nothing to do with LORAN.
5—4. If you chose "Cuba," I'll bet you didn't get your General ticket while the FCC was using its circa 1968 tests. A question similar to this one went a long way to giving the FCC its reputation for using tricky testing techniques.
6—4. Since six is allocated to broadcasting and other services throughout the most of the world, there aren't even 100 6-meter countries on the air.
7—1. When DXing on 80, it pays to know the allocations.

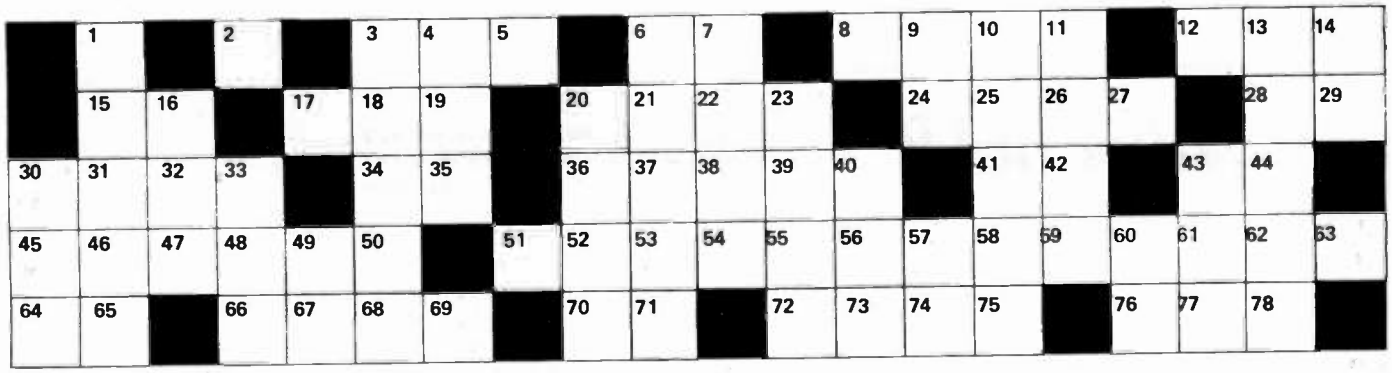


Illustration 2.

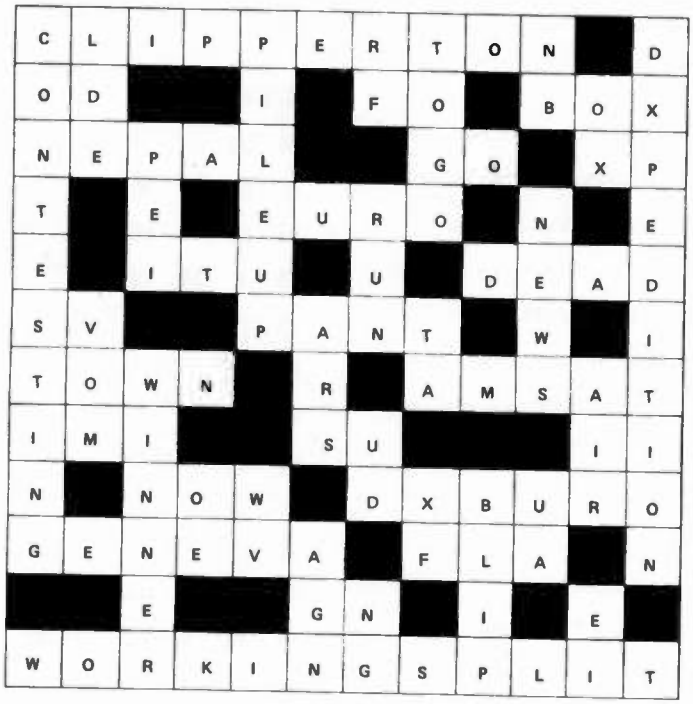


Illustration 1A.

8—3. But avid DXers also have many other picturesque terms for list-takers.
9—2. Ever get the feeling there's enough royalty in ham radio to form a club?
10—1. More royalty! King Hussein held this Iranian call before Khomeini. Ayatollah you so.

Element 3:
1) True—His call was EP1MP. Guess he's EP1MP/SU now.
2) True—And he was listed in *QST* as a Silent Key.
3) True—The more realistic DXCC.
4) True—KA2BQ would be one of the "U.S. Personnel in Japan." KA2BQV would be an amateur in New York or New Jersey.
5) False—If you ran ½ milliwatt at 300 GHz, twenty feet would be DX!
6) False—"BOT" and "MGM" are not stations.
7) False—Not really. The DX station's frequency should be left clear so everyone can hear him. In reality, this never happens.
8) True—Why? Only the FCC knows for sure.
9) True—Tim Chen, operator of both stations, uses BV2A on CW and BV2B on phone.
10) False—And "QRX?" means, "Are there any receivers on frequency?"

Element 4:
A—UHF, B—PHONE, C—BAND, D—FORTY, E—LINEAR, F—TICKET, G—BUG, H—QSO, I—RARE, J—SOS, K—QRM, L—FROM, M—STRING, N—OFTEN, O—GOONS, P—YV, Q—RASH, R—SAY, S—IO, T—EI. The completed message reads: R R QRK UR SIGS QSA VY ONE FOOT FROM PHONES ON GREBE FB OM HEARTY CONGRATULATIONS THIS IS FINE DAY. So began the first amateur European-American QSO on November 27, 1923, an exchange between French station 8AB and U.S. 1MO that opened the age of ham DX.

SCORING

Element 1:
Twenty points for the completed puzzle, or ½ point for each question correctly answered.

Element 2:
Two points for each correct answer.

Element 3:
Two points for each correct answer.

Element 4:
Two points for each correct definition. Give yourself 10 extra points if you unscrambled the message.

Okay, DXers, let's see how you *really* measure up. Remember, big guys, your 100-foot towers won't help you here!

1-20 points—Once heard a DL on 20
21-40 points—80 countries worked, 25 confirmed
41-60 points—DXCC material
61-80 points—250 + countries confirmed
81-100 + points—Honor Roll candidate

Next month: How Hams View Themselves

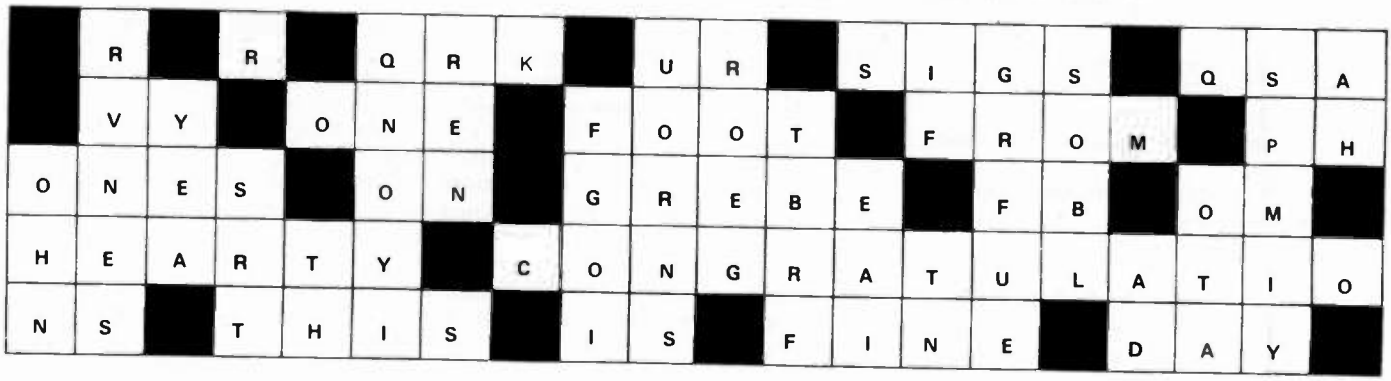


Illustration 2A.

HAM HELP

I have some two-meter crystals that I would like to sell or trade. Frequencies available are: T 146.880, TR 146.250/.850, TR 147.840/.240, R 147.330, R 146.060, T 146.460, R 147.060, T 146.040, and T 147.930.

All above fit in HC-25/U holders. Specs are transmit fundamental mode and parallel resonant with 30-pF load. Divide transmit frequency by 12 to obtain crystal frequency. Receive specs are overtone mode, series resonant. Subtract 10.694 MHz and divide by 3 to obtain crystal frequency.

Crystals I need are 146.01/.61, 146/.47, 146.22/146.88, 146.28 transmit, and 146.46 receive.

If anyone will trade or tell me the going price of used good crystals or knows who can tell me, it will be greatly appreciated.

Kevin Neal
Route A, Box 221A
Flippin AR 72634
(501)-453-8412

I need a complete schematic of the Hallicrafters S-118 receiver.

Keith Stowell WA0YQO
10 E. 40th-409
Kansas City MO 64111

REVIEW

from page 65

front-panel keyboard which selects all of the radio's functions. All memory data and command instructions are permanently programmed into the memory unit which is an integral part of the microprocessor IC. As such, the 2008 cannot be altered to receive or scan frequencies other than those in its regular VHF/UHF bands.

The rig is unique in the fact that it is the only available synthesized scanner which does not have a searching capability. This should not prove to be much of a handicap, however, as many people who purchase a scanner are interested only in hearing the action on a predetermined set of frequencies. Thus, it is an ideal unit for the person who desires the convenience and economy of frequency synthesis, but who doesn't need a searching capability.

An interesting feature on this unit is a recessed button on the rear panel marked "Reset." This button is similar to the Clear key on a calculator and functions to erase all data which is stored in the scanner's eight-channel frequency/status memory. This is used to erase incorrect information on those few occasions when the microprocessor fails to initialize.

Memory data is retained when the unit is unplugged and during power outages by using a 9-volt battery stored in an easily-accessible compartment on the rear panel. During normal usage, the battery will last up to one year. If the radio is to remain out of service for more than several months, however, it is best to remove the battery to avoid possible damage due to electrolyte leakage.

An innovation over previous Realistic models is the selectable scan-delay circuit, which allows the user to program a two-second delay on individual channels. The channel lockout function is accomplished in a similar manner, using the front-panel keyboard. Delays and lockouts remain programmed even when the scanner is turned off.

Frequency and status information is presented on a bright, blue fluorescent display which includes the channel number and indication whether the channel is programmed with a delay or lockout, and the six-digit frequency readout.

The PRO-2008's more common features include on-off/volume and squelch controls, a 3" front-mounted speaker, front-mounted headphone jack, scan/manual control, telescoping indoor antenna, external antenna jack, and ac power cord (the scanner is not designed for dc mobile operation).

The scanner's circuitry is composed of an LSI microprocessor system, LSI phase-locked loop (PLL) frequency generation system, eight integrated circuits, 24 transistors, and 40 diodes. These semiconductors, along with a host of passive components, team up to bring you a superheterodyne dual-conversion receiver capable of synthesizing 18,160 frequencies.

The synthesizer circuitry is capable of being programmed to receive any frequency in the 30-50- and 144-174-MHz bands in 5-kHz steps, and between 410-512 MHz in 12.5-kHz steps.

The receiver sensitivity (for 20-dB signal-to-noise ratio) is 1.0 uV on the VHF and low bands, and 2.0 uV on UHF. This proved to be adequate for local reception using the built-in antenna. For serious listening, an external antenna is highly desirable.

Selectivity ratings for signals within 9 kHz of the intended frequency are down 6 dB, and those signals within 17 kHz are reduced at least 50 dB.

The scanner operates at a rate of 10 channels per second.

Audio output is two Watts maximum with the internal speaker. The unit consumes about 15 Watts when operating.

The large volume and squelch controls make for easy adjustment. Each control is marked with numerical logging indicators, making it easy to return to a particular volume/squelch setting.

Frequency coverage of the 2008 is a real plus; it will receive signals in the entire 410-420-MHz US Government band. While the lack of a searching function tends to limit the advantage of having this band, it didn't take me long to find a few noteworthy stations hiding out in this "forbidden" part of the spectrum. With a little luck and a copy of one of the better known federal frequency guides, anyone should be able to make a number of educated guesses concerning active frequencies in this band. Verifying your guesses is the fun part!

All in all, the Realistic PRO-2008 seems to be a good choice for the amateur who desires a synthesized scanner for use at home, office, or around the shack. While it has its shortcomings, it should be seriously considered by anyone who is planning on buying a quality crystalless base station VHF/UHF receiver.

The Realistic PRO-2008 is priced at $259.95. For further information, contact *Radio Shack, 1300 One Tandy Center, Fort Worth TX 76102.* Reader Service number 479.

Louis A. Smith II N3BAH
Latrobe PA

GDX-1 DISCONE ANTENNA

With the flurry of activity in VHF/UHF scanner radios, it isn't surprising that someone has come out with a high quality discone antenna. Most antennas for scanner reception at present are simple vertically-polarized dipole clusters.

But the GDX-1 from TET-America is a different breed. Not only does it provide wideband reception, but it also is suited for transmitting as well.

Discone antennas are inherently wideband. The GDX-1 is designed for continuous coverage from 80-480 MHz. Feedpoint impedance is 50 Ohms unbalanced, so no matching balun transformer is necessary. The connector is a standard SO-239. Gain is stated as 3.0 dB, with a vswr typically less than 1.5:1 throughout its passband.

During transmit, the GDX-1 will safely handle 500 Watts PEP making it suitable for virtually any communications application. The antenna is deceptively sturdy, weighing a healthy 2.9 kg (6.4 pounds).

Our Field Test

The GDX-1 arrives in disassembled form with an instruction/parts-list sheet. Step-by-step assembly is a snap following the sequence. Hole tolerances are excellent, with elements and hardware lining up perfectly.

Our model, one of the first off the assembly line, had an unfortunate problem: The connector was threaded in metric! We notified the factory and were assured that subsequent runs had the problem corrected.

The parts count worked out perfectly after we figured out that a "biss" is a bolt and a "clipper" is a clamp. Something was lost in the translation. Purists may find the clamps slightly loose, but they may be bent slightly to tighten down on the elements.

The elements are solid rod, and high-quality tooling is apparent throughout the antenna. It is obviously thoughtfully designed and manufactured.

On the air, the GDX-1 performed better than most monitor antennas and had the additional flexibility of being frequency-agile continuously from 80-480 MHz. This allows operation on 3 amateur bands as well as reception on the 225-400 MHz military aeronautical band. (It's better not to transmit there!)

All things considered, especially with the assurance that the metric oversight has been rectified, the GDX-1 is capable of excellent performance as well as rugged immunity to wind. For further information, contact *TET USA, Inc., 425 Highland Parkway, Norman OK 73069.* Reader Service number 477.

Robert B. Grove WA4PYQ
Brasstown NC

MFJ-1040 DELUXE RF PRESELECTOR II

An unusual combination of accessories in one cabinet has been released by MFJ, a company noted for their large catalog of accouterments for radio communications.

The new 1040 Deluxe Rf Preselector II houses both a flexible receiver preselector and an adjustable-delay relay to protect the delicate circuitry when used with a transceiver. Very thoughtful and very effective.

Designed with applications agility in mind, the 1040 features at least 20 dB of preamplification. More important, the 1040 doesn't introduce considerable circuit noise as do some other rf preamplifiers.

Q is sharp, awarding the listener with good out-of-band rejection of unwanted signals. Gain may be continuously varied by a potentiometer or attenuated by 20 dB in one increment by pressing a button.

Circuit protection is automatic; when transmitted rf is detected by a high-gain sampling circuit, the antenna relay is automatically switched, bypassing the preamp. A front-panel pot may be adjusted to tune the receive delay—a sort of VOX—to prevent constant relay dropout during SSB excursions. Delay may be varied from 0 to about 2 seconds.

The dc amplifier used to control the relay consists of two direct-coupled bipolar transistors; sampling from the antenna circuit is through a 12-pF capacitor and rectified by two 1N34 diodes.

The preamplifier circuit is built around a 40673 dual-gate MOSFET. Preselection is accomplished in four bands (1-54 MHz), switching among four standard rf chokes, each of which becomes part of a tuned tank when connected across the 320-pF main tuning capacitor.

Rear-apron connectors in a row (SO-239s and phono jacks in parallel) allow selection between two antennas and two receivers by front-panel push-buttons.

When the 1040 is switched on, a red LED signals the status. When switched off, the antenna circuit automatically bypasses the electronics so that the rig feeds the antenna straight through.

The preselector may be powered by an external source of 9 to 18 volts dc or by its companion ac adapter.

Our Test

We were impressed at the small size and large flexibility of the MFJ-1040. Two tests were performed, one with a general coverage receiver, the other in a full transceive mode.

First, the 1040 was connected to the antenna input of a Kenwood R-1000 receiver; a 135-foot dipole was connected to the input of the preselector.

With the preselector still switched off, signals came into the receiver, business as usual. But with the preamplified preselector switched on and adjusted to frequency, dead bands came alive! Keep in mind that 20-dB gain is equivalent to more than 3 S-units, and that amount of signal brought up out of the noise can be heard!

Tuning the receiver throughout the range of the 1040 (up to 30 MHz—we did not try it through 54 MHz although there was no question that it would work there), we determined that its gain was high and its selectivity was sharp. Out-of-band images and intermod were reduced considerably and in many cases eradicated. The continuous adjustability of the gain stage made custom preamplification a snap.

The contacts on the antenna-selecting push-buttons showed good isolation; high-level signals were barely detectable when the receiver switch was pushed to an alternate output.

A rear-apron jack provides the ability to remote-control the unit from a pair of shorting (or grounding) contacts in the transceiver.

Next, the 1040 was connected to the station rig, a Triton II. Since the preselector is rated to withstand 350 Watts PEP, we weren't concerned that we might cause injury pumping 150 Watts or so into the unit.

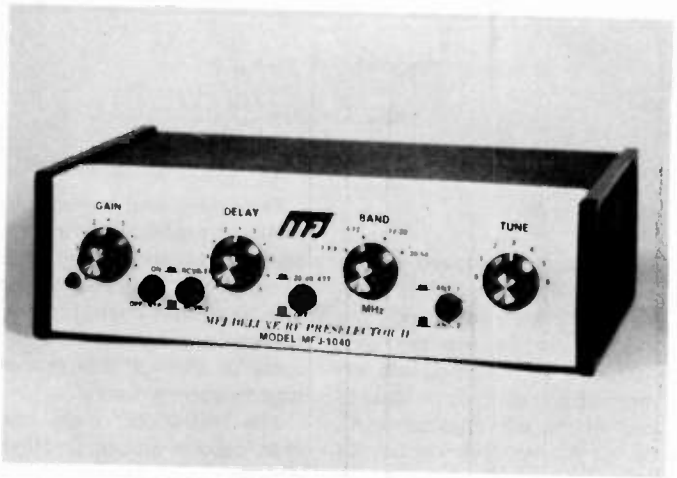
Trying the combination first on ten meters, we were astounded at the increase in signal levels *without* a corresponding increase in background noise. Double-checking this performance, we cranked the Triton's gain control down to just below signal threshold; switching the 1040 on, signals came in loud and clear!

We repeated the exercise on all five bands with equal success.

Next, we decided to try to burn the unit out with rf! During transmit, the relay responded instantly. Releasing the mike button, we heard the reassuring sound of the relay drop back to receive, accompanied by signals once again.

Transmitting again, we varied the settings of the VOX delay control as we spoke into the microphone and then released the button. Delay times were adjustable from 0 to roughly 2 seconds, which would accommodate any amateur mode: CW, AM, FM, SSB, RTTY, and even SSTV!

For older rigs of questionable sensitivity, or even when used with modern rigs where threshold signals must be improved, the MFJ-1040 is hard to beat. Its preselection should improve the performance of virtually any receiver or transceiver operating within its design range. For further information on this $99.95 product, contact *MFJ Enterprises, PO Box 494, Mississippi State MS 39762.* Reader Service number 476.



The MFJ-1040 Deluxe Rf Preselector II.

Robert B. Grove WA4PYQ
Brasstown NC

THE PRACTICAL HANDBOOK OF AMATEUR RADIO FM AND REPEATERS

Anyone who regularly reads Bill Pasternak's *Looking West* column in this magazine undoubtedly will have more than a passing interest in his new book, *The Practical Handbook of Amateur Radio FM and Repeaters*, written with Mike Morris and published in 1980, at $9.95, by TAB Books. Actually, anyone who has more than a passing interest in FM and repeaters will find this book a valuable addition to his technical library. This 538-page volume is more than just a practical handbook—it's a complete one! Among the topics covered are the history of repeaters and FM, how to determine your needs when planning a repeater, frequency coordination, ATV and RTTY repeaters, and a wealth of other general topics.

There are several chapters on the "people" end of repeaters, with extensive detail for repeater users and repeater owners. There is solid useful information on handling malicious interference and the "wild turkey." Hams looking for specific technical information won't be disappointed either; using no references other than this book, you could build a sophisticated repeater system incorporating every bell and whistle known to the repeater world. The operative word here is thorough!

Perhaps your interest in FM and repeaters is limited to kerchunking local machines with the synthesized transceiver you got for Christmas. Maybe you are a trustee or technical consultant for a big repeater operation. Whatever your level of interest or expertise, this book will enrich the hours you spend involved with FM and repeaters. For further information, contact *TAB Books, Inc., Blue Ridge Summit PA 17214.*

Paul Grupp KA1LR
***73 Magazine* Staff**

THE ARRL OPERATING MANUAL

The ARRL Operating Manual, recently published, continues the League's tradition of supplying the ham with some of the best book bargains available today on the subject of amateur radio. Inexpensively priced at $5.00, this large-format, paperbound edition is a compendium of up-to-date information on all phases of amateur radio.

What the League's *Handbook* does for the technical aspects of our hobby, the *Operating Manual* does for the stylistic. In short, it can help almost anyone become a better operator, and it will be particularly useful to those of us who find ourselves getting involved in some new aspect of the hobby such as computer RTTY, OSCAR, traffic handling, or even contesting.

The *Manual* provides an interesting solution to the problem of publishing an authoritative text on all the diverse aspects of our hobby. Rather than trying to do the impossible (finding one author conversant with all phases of ham life), the *Operating Man-*

ual incorporates the talents and knowledge of fourteen authors, each of whom writes a chapter on his/her specialty. The result is a definitive collection of chapters on subjects as diverse as traffic handling and DXing, written by enthusiasts who know what they're talking about.

Other subjects covered include: rules and regs., SWLing, emergency communications, contesting, awards chasing, FM and repeaters, VHF/UHF operating, satellites, visual communications, and microcomputers.

In addition to being well edited, the *Operating Manual* is liberally illustrated. The extensive use of figures, photos, tables, charts and even an occasional cartoon provides a refreshing change from the staid layouts of other League publications.

For example, the chapter on contesting has several sample logs and dupe sheets. The chapter on DXing includes sample propagation charts, a tabular listing of countries organized by rareness of prefix, a list of international ten-meter beacons, and a sample azimuthal, equidistant map of the world used to determine great-circle bearings. The chapter on visual communications features slow-scan TV picturers, weather satellite photos, and even some efforts at RTTY art.

These chapters are typical of the treatment most topics receive in the *Manual*. While it is impossible to discuss all the subtleties of some of the more technically complex topics in a single chapter, the *Manual* does provide the neophyte with more than enough information to allow him to get oriented in unfamiliar terrain. In this vein, each chapter usually suggests additional reading material or supplies lists of information sources.

The ARRL Operating Manual is filled with good things, and the very richness of its content reflects the incredible diversity of our hobby. It will be a valuable reference work for anyone exploring the vast landscape of amateur radio. If you are as concerned about your operating style and skill as you are with the purity of your emissions, or if you plan to become involved in some new aspect of the hobby, you'd do well to get a copy. The chances are good that it will answer lots of questions you've had in your mind. For further information, contact the *ARRL, Newington CT 06111*.

Chris Brown KA1D
***73 Magazine* Staff**

10-METER FM FOR THE RADIO AMATEUR; THE 10-METER FM HANDBOOK

One of the most interesting aspects of ham radio is building or modifying your own equipment. Unfortunately, equipment has gotten so complex and expensive that most hams have restricted their building and modifying activities to small accessories for their stations. Digital clocks and electronic keyers abound, but if a device is part of the station's rf chain, the chances are that it has the nameplate of a commercial manufacturer affixed to it, and its owner shakes with fear at the thought of taking a soldering pencil closer than three feet to his/her thousand-dollar electronic baby. Now, that's all well and fine; with today's crowded band conditions, I am somewhat relieved that such fine commercial gear is available. Most hams do not have the facilities to build and properly adjust their own SSB equipment to the level of quality available from manufacturers, and even if we could compete technically, we'd find the expense (time as well as money) prohibitive.

OK, so we intellectually accept the need for that expensive little box on the ham-shack table, but somehow that doesn't stop the urge to warm up the soldering iron and jump into something feet first. You say you have three digital clocks and two electronic keyers, and you still want to build something? I know the feeling. Relax. How about 10 FM?

Yup. There is a lot of FM activity up around 29.6 MHz. Very little QRM, the atmosphere is freewheeling, the technology is up to date, and yet the equipment is very cheap. If you know someone who is active on 10-meter FM, the chances are good that he uses a converted CB. Whatever he is using, he'll tell you that he is having a lot of fun.

What all this is leading up to is the recent release of two rather good books on the subject of 10-meter FM. If this mode interests you, you really should have copies of them. While each author emphasizes a different aspect of the mode, both give an excellent introduction to all the various facets of 10-meter FM. Both cover repeater operation, frequencies, antennas, equipment, and equipment conversion.

How do they differ? Dave Ingram's book goes into greater detail on a wider variety of subjects, but Bob Heil's book (the *Handbook*) is the most complete source of information available on converting CB rigs that use the popular PL02A three-crystal-synthesizer configuration. If you are planning to convert a rig that uses this configuration, Bob Heil's book will prove to be extremely useful. If you are planning to get on the air using a different approach, or just want to know more about this mode, Dave Ingram's book might be more interesting to you. Both books tell you all you need to know to begin enjoying 10-meter FM, and at $4.95 each, these 1980 publications are relatively inexpensive; I'd get both of them! For further information, contact *Melco Publishing, PO Box 26, Marissa IL 62257* for Bob Heil's book and *TAB Books, Inc., Blue Ridge Summit PA 17214* for Dave Ingram's book.

Paul Grupp KA1LR
***73 Magazine* Staff**

DIGITAL ELECTRONICS: A HANDS-ON LEARNING APPROACH

Digital electronics has really arrived, and it's here to stay; it's getting hard to find a piece of ham gear that doesn't incorporate some digital circuitry. All of us have absorbed a remarkable amount of the new technology, but many hams have wished for a complete, step-by-step introduction to the subject. If you learned electronics the way I did, by reading whatever books and magazine articles you could get your hands on, you just might find this book useful. The author assumes that the reader has no previous knowledge, so nothing is skipped or glossed over. He begins by explaining how resistors and diodes work, but when you are through with the book you'll be comfortable with microprocessors. Best of all, the book is a true hands-on approach, so most subjects include a carefully explained project to carry out on a solderless breadboard. You say you don't have a solderless breadboard? Shame on you! As the author points out, if you really want to learn about this stuff, you are going to have to jump in and *do* it.

Fortunately, doing it is exactly what the author has in mind, and he has provided lots of valuable information on the mechanics of building digital circuits. He has thoughtfully included chapters on troubleshooting, circuitboard construction, and even the electronic color code. He starts with very simple projects, but the meat is there too; after working your way through this book you won't have to make excuses for your lack of knowledge on the subject. The digital revolution has been going on for a long time now; why not join the fun! Copies of *Digital Electronics: A Hands-On-Approach* (by George Young, 1980) are available at $8.95 from the *Hayden Book Company, Inc., Rochelle Park NJ*.

Paul Grupp KA1LR
***73 Magazine* Staff**

HAM HELP

I recently purchased a Hy-Gain model 623 23-channel AM/SSB CB rig for conversion to 10 meters. Unfortunately, I have found no information on converting this radio. Does anyone have any information on this?

Wayne T. Mohrhauser NØBUY
Rt. 1, Box 134
Chester IA 52134

I need a copy of National Semiconductor's *Optoelectronics Handbook* for 1975. I would prefer to purchase one outright, but will pay a reasonable cost for a copy.

Lou Slaton WD5IBD
5959 Cyrus Ave.
Baton Rouge LA 70805

I need a schematic for a National NC-46 receiver. I will be glad to pay any expenses involved.

Floyd Williams
121 N 59th St.
Philadelphia PA 19139

NEW PRODUCTS

from page 30

board. It is designed for the 50, 144, and 220-MHz bands and may be modified for use on adjacent commercial and government bands. It is used for control links, repeater service, telemetry, and other applications for which a small unit is required. A multichannel adapter is also available to extend operation up to 5 channels.

Features include low-impedance dynamic mike and high level audio inputs; crisp, clear modulation; low spurious output; pre-wound coils; adjustable output level, and built-in test points for easy alignment. A commercial-grade, frequency-stability option is available.

Another new development at Hamtronics is the availablity of XV2 2-meter and 1¼-meter transmitting converter kits with 6-meter inputs.

For further information, contact *Hamtronics, Inc., 65F Moul Rd., Hilton NY 14468.* Reader Service number 481.

PALOMAR ENGINEERS TRANSCEIVER PREAMPLIFIER

Palomar Engineers has announced a new preamplifier which is continuously tunable and covers all amateur bands from 160 through 6 meters. It provides 20 dB of gain with a dual-gate FET for low noise figure. The gain and low noise figure improve reception on most receivers, particularly on the higher frequency bands. The added selectivity reduces image and spurious response.

Gain is continuously variable to prevent overloading the receiver. An rf-sensing circuit allows the unit to be used with transceivers; the preamplifier automatically bypasses itself during transmit. The fail-safe switching circuit handles transceivers to 350 Watts. Connectors are SO-239. The preamplifier measures 8" × 5" × 3" high and features brushed-aluminum control panels.

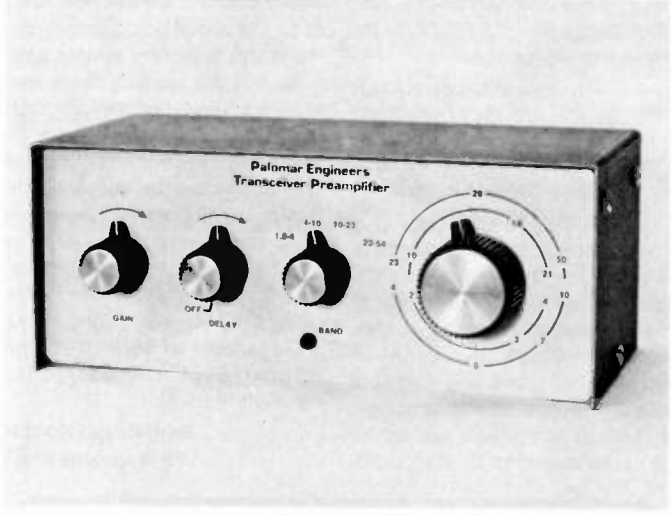
For a free descriptive brochure, write *Palomar Engineers, PO Box 455, Escondido CA 92025.*

CDE HAM ROTOR FOR THE VISUALLY-IMPAIRED OPERATOR

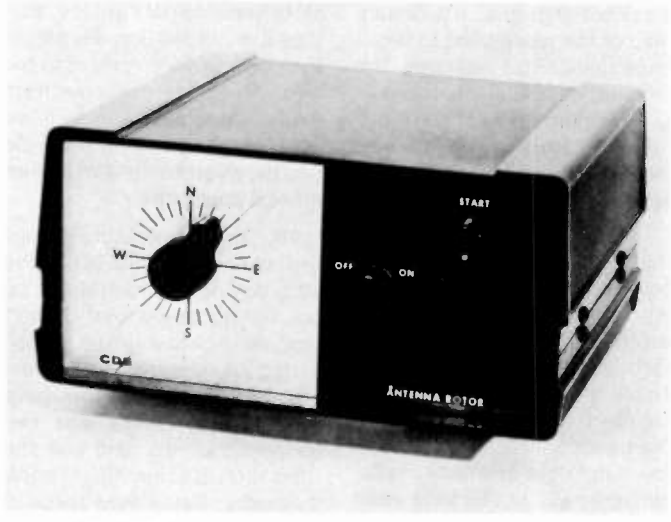
Cornell-Dubilier Electronics has produced a rotor system especially designed for sight-impaired amateurs. The Ham-SP is a combination of the Ham-IV rotator and a solid-state control unit.

All operation functions of the control unit, 360° compass dial, on/off switch, and push-to-start button, are marked visually as well as by Braille. To operate the system, the desired antenna direction is selected by turning the large dial. The start button is then pressed. Electronic circuitry will automatically retract the wedge brake and start the rotator turning to the desired direction. During the time the rotator is turning, a high-pitched tone is emitted. When the rotator reaches the predetermined direction, power is removed from the motor, it is allowed to coast down about 5 seconds, and then the wedge brake is engaged. When the rotator stops, the tone stops, indicating that the antenna is now at the desired location. (Neither the rotator nor the control unit are compatible with other CDE rotor systems.)

For further information, write to *Cornell-Dubilier Electronics, Department SP, 118 East Jones Street, Fuquay-Varina NC 27526.* Reader Service number 484.



The Palomar Engineers Transceiver Preamplifier.



The CDE Ham rotator for visually-impaired amateurs.

HAM HELP

I am in need of any libraries of *73, QST, HR, CQ,* or any other amateur or electronics oriented publications. Anyone wishing to clean out the bookshelves, please contact me on any offerings. Thank you!

Ralph Francavilla KA2BTD
154 Redneck Ave.
Little Ferry NJ 07643
(201)-641-9494

A disabled amateur needs the generous help of some warm-hearted hams. I had to move to small, limited space QTH, due to my roommate's marriage and my severe medical problems. I now live alone and ham radio is my only form of entertainment.

I need the donation of tower sections to erect a 50-foot tower with a rotor. If you can help, please write (I don't have a phone). Thank you.

Allen Halliday
64 West Center St., #3
Midvale UT 84047

I need manuals and schematics on the following equipment: Hickok 288X signal generator, 533A tube tester, and 760 video scanner, and alignment procedures on a Hallicrafters R-44/ARR-5 (the military version of the S-27). I will gladly pay postage and copying costs.

Bill Fraser KA0FEX
6220 Parkwood Rd.
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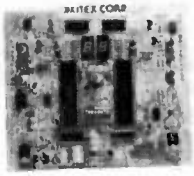

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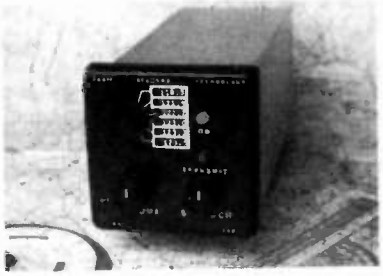

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RTTY LOOP

from page 16

terminal. "Stupid," you ask? Well, a dumb terminal, commonly called a glass Teletype, just inputs what you type and displays what it gets. Smart terminals can do all kinds of fancy editing and other neatniks. This one is somewhere in between. With the resident 6800 and some RAM it could be given some smarts with the appropriate programming, but remains of limited usefulness if what you really need is a computer terminal.

Next month I will take a look at some bells and whistles available for the ATR-6800 and describe a typical on-the-air session. It promises to be a real eye-opener!

LETTERS

from page 28

the communication. . . phase of the art." as listed in Part 97.1(d).

Thanks for lending an ear. I like *73* much better than "the other one," but I agree that perhaps you might have at least one feature for the beginner or Novice operator.

Cindy Dalmadge KA0IMG
Colorado Springs CO

NO PRICE

Your editorials are *first* reading! I agree—the advertisers who put no price on a new piece of gear make me so damn mad that I won't buy it.

I need an antenna switch and saw a new one advertised in *73* —but no price. Should I spend 15 cents and my time for a letter to the manufacturers?

I know what I can afford. So if it's out of my price class, I'd like to know *now*.

John Cowley WA6PBM
Rosamond CA

GOLDWATER

Enjoyed the article in the November *73* issue on Barry Goldwater K7UGA. I had a short QSO with him a few years ago.

Here is a man who has supported amateur radio in that maze of bureaucracy in Washington DC for many years. The Senator is a man who for years has told the general public just the way it is. We have too many politicians who beat around the bush and tell each group just what they want to hear, sometimes distorting the truth.

Wish we had more people in his position who would support our hobby. We as hams must speak up and band together before we find ourselves on the outside looking in.

Alfred L. Pedneau K5HKG
Pineville LA

BUY AMERICAN

Thank you for your comments in Never Say Die and especially DX. I feel the comments on the amateur situation are well taken. Just today I wrote another magazine to criticize an editorial on basically similar topics. This other magazine recommended dropping the code requirement and relaxing the testing standards to allow thousands of new "amateurs" to come into our ranks. The proposed reason for this was to help the American radio manufacturers compete with the Japanese companies.

It is my opinion that we already have too many undisciplined amateurs causing interference. Just recall the recent hurricane nets. If the code and theory requirements do nothing else, they do force one to discipline one's self to learn these.

In coming into amateur radio, I believed the purposes were those set forth in the FCC rules, not to see how many radios we can sell. I am pleased to hear about all the experimentation which amateurs are doing even in modifying new, commercially-built rigs.

Amateur radio can fulfill a useful purpose in the country as long as it remains organized and disciplined. This should be more than a hobby. Let us not invalidate our purposes by making it a glorified CB band.

This other magazine I referred to also indicated that Japanese equipment was better made than American. I have had the most recent solid-state HF rigs from Yaesu, Kenwood, and Drake, and find the TR7 to be better than any of the others. The Japanese rigs looked good and had all the bells and whistles, but my experience thus far has been that some of the knobs, such as noise blanker, speech processor, i-f shift, notch filter, etc., did not work or worked poorly. However, with the Drake, I had to pay extra for many items, but they seemed well engineered and worked well. It is not so much the looks but how it performs that counts. It seems in many cases that you still get what you pay for. I find nothing revolting in the suggestion we attempt to buy American first.

Tim Johnson N5BTE
Bristow OK

BLUE FROG

I read with interest your explanation of why your radar jamming didn't work as well as why commercial units don't work. I must agree that they do not. However, I can't agree with you on the reason why.

You state that if the jammer is a mere 3 kHz off of the radar gun frequency that the radar gun will not pick up the jammer. This is not so; radar guns are very wide on receive and drift a huge amount on transmit. The 3 kHz you mention is nothing. I can change the frequency of a gun oscillator that much by blowing on it. If you don't mind, let me explain the error of radar jamming and how to correct it.

First of all, the thing that people do not realize or tend to ignore is that police radar is built to display the fastest speed from many doppler signals. Now, if you jam at, say, 50 mph, as most commercial units do and drive over that speed, the radar unit will first pick up 50 because the jamming signal will be stronger than your reflection. But as soon as you come within normal range if you are driving faster then the jam speed, he will pick up your speed just like the jammer wasn't working.

So, the only thing you can do is to jam at a much higher speed than what you are traveling, hoping that the policeman will not believe his radar unit. Let's say you like driving at 70; you should jam at around 110 so that his unit will pick up 110 and he won't believe you are traveling that fast. He will then ignore the reading and you. But this only works with still radar. For moving radar you must use a different method.

Moving radar is really taking two readings, the police car speed and the combined speed of his car and your car. It first picks up the signal bouncing off a tree or grass, etc., and gives his speed, then it looks for a much higher speed which is that of your car approaching his. It then subtracts his speed from his and your combination which leaves your speed. But moving radar, like still, looks for the fastest speed.

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So, if you jam at 110 and drive 70 and he is moving 50 then his unit sees two speeds. The jam of 110 minus 50 which gives 60 and 120 minus 50 which gives 70. His unit will display 70 and you are in for another ticket. So, we are back to giving him a reading that he won't believe if you want to jam him.

Let's say you like to drive 70, then a good choice for a jam speed is 150. If he is driving 55 or less, then his moving radar will show 95 or more which he probably won't believe. The faster you travel, the faster you jam at. The best all around jam speeds seem to be between 150 and 170. This way you will get still, as well as moving units.

In cities or where the speed limit is something other than 55, you must modify this method to the best speed. Also, the modulation is important. The best results are gotten with a square wave with a 50% duty cycle. Radar units tend to ignore sine waves. I would dare say that if you modulated your 10-GHz transmitter the proper way and for the proper speed, it would do a fine jamming job even if it is in the ham band. A good modulator can be made from a 555 driving a voltage regulator driving the Gunn source.

All of what I have said is based on my personal experience. Some friends and I have worked many months with our own radar units to perfect a good jammer. It has never failed to jam any X-band radar unit I have come across and you should see the look on the small-town policeman's face when you drive through at 20 and he reads 90.

But all in all, it's not worth the risk because jamming is never a sure thing. The best thing to do is get the best detector on the market and take your chances.

I must say that you are welcome to print this but not my name or address. I don't need the law knocking at my door as well as the kooks of this world. So, for my protection, just sign me,

Blue Frog

OK, Blue, serves me right for listening to "experts" on radar. You sure won't see me messing around with jammers and then trying to explain in court that I really wasn't going 110, as the radar read out.—Wayne.

NO DUMBBELL

I have just completed a CW chat with a relatively new Extra whose fist was comparable to that of a brand new Novice!

The point I am trying to make is that this learned gentleman is being given the privileges of a full-blown Extra class amateur, but cannot perform the simplest of Novice requirements in the field of sending code. At the same time, I and many other Generals are being deprived of the few additional privileges of an Advanced class license because we don't know what a reflex klystron is used for, and because Dick Bash came up with an idea for teaching aspiring hams some inside facts about radio theory and how to pass the FCC tricky-tests.

The fact is that the ARRL and Ameco came out with FCC questions and answers a long time ago, with complete approval of FCC. I know, because I studied them until I could answer them forward and backward, and I studied every other piece of information I could get my hands on that dealt with the outline FCC said we would need to understand when we took the test. I knew how, when, where, and why but what I got was a set of questions that were far afield from the FCC outline and the test was as simple as if it had been written in Greek.

A friend heard about Bash and got his *Final Exam*, studied it diligently for weeks. You see, Mr. Bash teaches how problems are worked and why the answers are what they are. He teaches the subject while he gives the answers. My friend passed easily . . . so I got the Bash book.

My test came one month after by friend had taken his and by that time, the FCC had decided to go after Bash. Again, I had added Ameco and ARRL to my studies, along with the Bash book, but again they beat me to the draw and I got a set of questions printed on brand new, crisp paper. Three questions were similar to the ones in the Bash book but *six* were taken almost word for word from the ARRL questions and answers in the Extra class section of their training manual!

Another friend of mine went to Tulsa the following month, after having failed (as I did and all but one of the other Advanced aspirants did who took the test in Oklahoma City), but he ordered Mr. Bash's updated *Final Exam* that contained something like four hundred questions and answers! He, too, had studied every other book he could get his hands on. Imagine his chagrin when, for the third time he was handed a crisp, new set of questions, which dealt with doodads he had never heard of!

Let me close by saying that I am a retired airplane driver. I logged some twenty thousand hours of accident-free pilot time and taught scores of others to fly, including Military Cadets, but I can't design an airplane, weld a piece of tubing, splice a cable or spray paint a fuselage. I passed every written test I took from FAA on the *first* try, so I think I am no dumbbell!

If an Extra class amateur can get his ticket and all those privileges when he sends code like a new Novice, why are we Generals flunked because the FCC wants to annihilate Dick Bash for doing what ARRL has done for years and we don't happen to know what the angle of conduction is in a Class AB amplifier?

Loren Carlberg WB5WDG
Muskogee OK

CORRECTIONS

In my article and computer program, "The Odd Couple," in the November, 1980, issue of *73 Magazine*, page 110, a line of code was dropped somewhere. Please insert this statement so that the channel 6 calculation will work: 620 L = 23*F. Also, a parenthesis should be put around part of line 405: 405 J = 95.8 – (1.48*D)

For those not familiar with Level I "shorthand" and who are trying to translate the listing, see the accompanying table.

Level I	Level II Standard
CLS	clear screen
P.	PRINT
G.	GOTO
IN.	INPUT
( )+( )	Logical AND (see lines 130 and 1003)

Rich Casey WA9LRI
1818 Hemlock
Garland TX 75041

HAM HELP

If you were a civilian radar field service engineer working with the military, in uniform, overseas during WWII, please get in touch with me regarding possible official US recognition for your services. Thank you.

Bill Falk K7WJF
PO Box 171
Apache Junction AZ 85220

I am blind and bedridden with spinal arthritis for 11 years now. I am a UCLA grad, class of 1958, in History. I'd like to listen to good, clear shortwave overseas radio broadcasts if I could get a small shortwave radio receiver like a Kenwood, Drake, Sony, etc.

I am writing to *73 Magazine* in hopes that someone might help me get this radio donated somehow, used or new. I need a compact, solid-state radio since I am cramped for space in my small hospital room.

Richard Jastrow, Ward 800B
Long Beach General Hospital
2597 Redondo Ave.
Long Beach CA 90806
(213)-426-4936

I am in need of a schematic for a Yaesu FT DX-570. I will pay for a copy and postage. Thank you very much.

Todd Greenleaf KA1CFQ
108 Edward Ave.
Pittsfield MA 01201

I would like to contact someone who has been able to put the RT-594/ARC-38A on the air. Thank you.

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7450N	25	LM340K-24	1 35	CD4060	1 42	MM57100	4 50	
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7475N	49	LM340T-8	1 25	CD4068	40	MCM6675-1A	9 95	
7486N	86	LM340T-12	1 25	CD4069	40	9368	3 50	
7489N	1 70	LM340T-15	1 25	CD4070	50	4100	10 00	
7490N	43	LM340T-18	1 25	CD4071	45	416	16 00	
7492N	43	LM340T-24	1 25	CD4072	45			
7493N	43	LM350	5 50	CD4073	45	**CLOCKS**		
7495N	69	LM377	2 95	CD4075	45	MM5311	5 50	
74100N	1 35	LM379	5 00	CD4076	40	MM5312	3 90	
74107N	35	LM380N	1 00	CD4078	40	MM5314	3 90	
74121N	34	LM381	1 60	CD4081	35	MM5369	2 10	
74123N	59	LM382	1 60	CD4082	35	MM5843	14 45	
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74145N	77	LM723H/N	50	CD4490	5 50	CT7010	8 95	
74150N	1 20	LM733N	85	CD4507	1 00	CT7015	8 95	
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74154N	1 25	LM741N	35	CD4510	1 00	MM5375AG/N	4 90	
74157N	69	LM747H/N	75	CD4511	94	7205	18 50	
74161N	87	LM748N	50	CD4515	2 52	7207	7 50	
74162N	85	LM1303N	1 75	CD4516	1 10	7208	15 95	
74163N	87	LM1304	1 10	CD4518	1 50	7209	4 95	
74174N	96	LM1305	1 27	CD4520	1 02	OSO026CN	3 75	
74175N	85	LM1307	2 00	CD4527	1 51	OSO056CN	3 75	
74190N	1 15	LM1310	1 95	CD4528	1 60	MM53104	2 50	
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74365N	75	LM2902	2 25	CD40192	3 00	6522	9 95	
74366N	75	LM3900N	60	74C00	35	6800	9 95	
74367N	75	LM3905	1 75	74C04	40	6802	11 95	
		LM1896N	95	74C10	35	6820	4 95	
74LS00 TTL		MC1458V	55	74C14	89	6850	5 95	
74LS00N	29	NE550N	1 35	74C20	35	6800A	5 95	
74LS02N	29	NE555V	39	74C30	35	8085	12 95	
74LS04N	35	NE556A	85	74C48	1 95	8086	75 00	
74LS05N	25	NE565A	1 00	74C74	85	Z80	9 95	
74LS08N	35	NE566V	1 50	74C76	1 25	Z80A	11 95	
74LS10N	35	NE567V	1 00	74C90	1 25	8212	2 90	
74LS13N	55	NE570B	4 75	74C93	1 25	8214	3 95	
74LS14N	1 00	78L05	60	74C154	3 50	8216	2 90	
74LS20N	35	78L08	60	74C160	2 75	8224	3 45	
74LS27N	35	78M05	85	74C175	1 35	8228	4 95	
74LS28N	35	7510R	1 75	74C192	1 65	8251	6 95	
74LS30N	35	75491CN	50	74C221	1 90	8253	15 00	
74LS33N	60	75492CN	55	74C905	8 00	8255	5 75	
74LS38N	50	75494CN	89	74C906	75	8257	10 95	
74LS74N	85			74C914	1 95	8259	14 95	
74LS75N	65			74C922	5 00	1802CP plus	13 95	
74LS90N	60	**A to D CONVERTER**		74C923	5 50	1802DP plus	17 95	
74LS93N	75	8038B	4 50	74C925	7 50	1861P	9 50	
74LS95N	1 00	8700CJ	13 95	74C926	6 95	CDP1802CD	29 95	
74LS107N	45	8701CN	22 00	74C927	6 95	CDP1802D	35 00	
74LS112N	45	8750CJ	13 95			CDP1816P	7 95	
74LS113N	45	LD130	9 95	**INTERFACE**				
74LS132N	89	9400CJ/V/F	7 40	8095	65	**UART/FIFO**		
74LS136N	50	ICL7103	9 50	8096	65	AY5-1013	5 50	
74LS151N	90	ICL7107	14 25	8097	65	AY5 1014	7 50	
74LS155N	1 10			8098	65	3341	6 95	
74LS157N	1 10	**CMOS**		8109	1 25			
74LS161N	1 10	CD4000	25	8110	4 50	**PROM**		
74LS163N	1 10	CD4001	35	8113	3 00	1702A	4 95	
74LS174N	1 25	CD4002	35	8120	6 50	2708	7 50	
74LS190N	1 25	CD4006	1 10	8123	3 10	2716T1	18 00	
74LS221N	1 25	CD4007	35	8124	3 50	2716 5 Volt	13 50	
74LS258N	1 00	CD4008	1 20	8125	3 20	8/2716 5 Volt	89 00	
74LS367N	75	CD4009	45	8126	1 69	2732	55 00	
		CD4010	45	8128	2 75	2758	19 50	
LINEAR		CD4011	35	8197	1 69	8741A	55 00	
CA3045	90	CD4012	28	8198	1 69	8748	55 00	
CA3046	1 10	CD4013	47			8748-6	55 00	
CA3081	1 80	CD4014	1 25			8755A	55 00	
CA3082	1 90	CD4015	1 00	**MOS/MEMORY RAM**		N82S23	2 95	
CA3089	3 40	CD4016	55	2101-1	2 85	N82S123	6 50	
LM301AN/AH	35	CD4017	1 05	2102-1	1 95	N82S126	3 75	
LM305H	87	CD4018	94	2102AL-4	1 45	N82S129	8 50	
LM307N	35	CD4019	45	2102AN-2L	1 65	N82S131	8 50	
LM308N	1 00	CD4020	1 02	2104A-4	4 95	N82S136	8 75	
LM309K	1 25	CD4021	1 35	2107B-4	3 75	N82S137	8 75	
LM311H/N	90	CD4022	1 10	2111-1	3 75	DM8577	2 90	
LM3172	1 65	CD4023	28	2112-2	3 95	8223	2 90	
LM317K	3 75	CD4024	75	2114	3 75			
LM318	1 50	CD4025	28	2114L 300ns	4 25			

CONNECTORS

30 pin edge	2 50
44 pin edge	2.75
86 pin edge	4 00
100 pin edge	4 50
100 pin edge WW	5 25

IC SOCKETS

Solder Tail Low Profile

PIN	1 UP	PIN	1UP
8	15	22	30
14	14	24	35
16	16	28	42
18	27	36	58
20	29	40	57

2 level 14 pin are 20

WIRE WRAP LEVEL 3

PIN		PIN	
14	32	24	86
16	33	28	1 00
18	57	40	1 23

CRYSTALS

1 MHz	4 50
2 MHz	4 50
4 MHz	4 25
5 MHz	4 25
10 MHz	4 25
18 MHz	3 90
20 MHz	3 90
32 MHz	3 90
32768 Hz	4 00
1 8432 MHz	4 50
3 5795 MHz	1 20
3 6000 MHz	1 95
3 097152 MHz	4 50
4 4576 MHz	4 50
3 2768 MHz	4 50
5 0688 MHz	4 50
5 185 MHz	4 50
5 7143 MHz	4 50
6 5536 MHz	4 50
14 31818 MHz	4 25
18 432 MHz	4 50
22 1184 MHz	4 50

KEYBOARD ENCODERS

AY5 2376	$12 50
AY5 3600	17 95
AY5 9100	10 50
AY5 9200	16 50
74C922	5 50
74C923	5 50
HD0165-5	6 95
AY5 9400	10 50

D Connectors RS232

DB25P	3 62
DB25S	5 20
Cover	1 67
DE9S	1 95
DA15P	2 10
DA15S	3.10
Complete Set	9 50

Hitbok 3½ Digit LED multimeter $9.95
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Digital Clock Kit 14.95

8K 16K Eprom Kit
(less PROMS) $89 00
Motherboard $39 00
Extender Board $15 00

RESISTORS ¼ watt 5%

10 per type	03
25 per type	025
100 per type	015
1000 per type	012
350 piece pack	75
5 per type 6 75	

½ watt 5% per type 05

Televideo Terminal

Model 912	$845 00
Model 920	$945 00

Tiny Basic Experimenters Kit $10 00

KEYBOARDS

56 key ASCII keyboard kit	$67 50
Fully assembled	77 50
53 key ASCII keyboard kit	60 00
Fully assembled	70 00
Enclosure Plastic	14 95
Metal Enclosure	28 95

LEDS

Red TO18	15
Green, Yellow TO18	20
Jumbo Red	20
Green, Orange, Yellow Jumbo	25
Chiplite LED Mounting Clips 8/$1 25	
(specify red, amber, green, yellow clear)	

CONTINENTAL SPECIALTIES in stock
Complete line of breadboard test equip
MAX-100 8 digit Freq. Ctr. $149.95

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3 pos. slide 25
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Model 150 Bus Grabber Kit $369 00
Clock Colonoer Kit $23.05
2.5 MHz Frequency Counter Kit $37.50
30 MHz Frequency Counter Kit $47.75

TRANSFORMERS

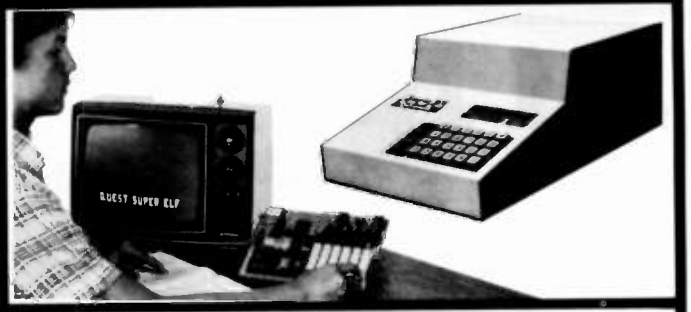
6V 300 ma	3 25
12 Volt 300 ma transformer	1 25
12 6V CT 600 ma	3 75
12V 250 ma wall plug	2 95
12V CT 250 ma wall plug	3 75
24V CT 100 ma	3 95
10V 1 2 amp wall plug	4 85
12V 6 amp	12 95
12V 500 ma wall plug	4 75
12V 1 amp wall plug	6 50
10/15 VAC @/16 VA wall plug	9 75

DISPLAY LEDS

MAN1	CA	270	2 90
MAN3	CC	125	39
MAN72/74	CA/CA	300	1 00
DL704	CC	300	1 25
DL707/DL707R	CA	300	1 00
DL727/728	CA/CC	500	1 90
DL747/750	CA/CC	600	1 95
FND359	CC	357	70
FND500/507	CC/CA	500	1 35
FND503/510	CC/CA	500	90
FND800/807	CC/CA	800	2 70
3 digit Bubble			60
10 digit display			1 25
7520 Claree photocells			39
TIL311 Hex			9 50
MAN3640	CC	30	1 10
MAN4610	CA	40	1 20
MAN4640	CC	40	1 20
MAN4710	CA	40	95
MAN4740	CC	40	1 20
MAN6640	CC	56	2 95
MAN6710	CA	60	1 35
MAN6740	CC	60	1 35

MA1002A, C, E	8.95
MA1012A	8.95
182P3 transformer	2.25
MA1012A Transformer	2.25

BSR Controller $39.95
Connect your computer to the BSR Home Control System. Computer controlled ultrasonic transmitter for your BSR. Software for 1802 user



RCA Cosmac 1802 Super Elf Computer $106.95

Compare features before you decide to buy any other computer. There is no other computer on the market today that has all the desirable benefits of the **Super Elf** for so little money. The Super Elf is a small single board computer that does many **big** things. It is an excellent computer for training and for learning programming with its machine language and yet it is easily **expanded with additional memory, Full Basic, ASCII Keyboards, video character generation, etc.**

Before you buy another small computer, see if it includes the following features: ROM monitor; State and Mode displays; Single step; Optional address displays; Power Supply; Audio Amplifier and Speaker, Fully socketed for all IC's; Real cost of in warranty repairs; Full documentation.

The **Super Elf** includes a **ROM** monitor for program loading, editing and execution with **SINGLE STEP for program debugging** which is not included in others at the same price. With **SINGLE STEP** you can see the microprocessor chip operating with the unique **Quest** address and data bus displays **before, during** and **after** executing instructions. Also, CPU mode and instruction cycle are decoded and displayed on 8 LED indicators.

An RCA 1861 **video graphics** chip allows you to connect to your own TV with an inexpensive video modulator to do graphics and games. There is a **speaker system** included for writing your own music or using many music programs already written. The speaker amplifier may also be used to drive relays for control purposes.

A 24 key **HEX keyboard** includes 16 HEX keys plus **load, reset, run, wait, input, memory protect, monitor select** and **single step**. Large, on board displays provide output and optional **high and low address**. There is a 44 pin standard connector slot for PC cards and a 50 pin connector slot for the Quest Super Expansion Board. Power supply and sockets for **all** IC's are included in the price plus a detailed 127 pg. instruction manual which now includes over 40 pgs. of software info, including a series of lessons to help get you started and a music program and graphics target game. Many schools and universities are using the Super Elf as a course of study. OEM's use it for training and R&D.

Remember, other computers only offer Super Elf features at additional cost or not at all. **Compare before you buy. Super Elf Kit $106.95, High address option $8.95, Low address option $9.95. Custom Cabinet** with drilled and labelled plexiglass front panel **$24.95**. All metal Expansion Cabinet, painted and silk screened, with room for 5 S-100 boards and power supply **$57.00. NiCad Battery Memory Saver Kit $6.95.** All kits and options also completely assembled and tested.

Questdata, a software publication for 1802 computer users is available by subscription for $12.00 per 12 issues. Single Issues $1.50. Issues 1-12 bound $16.50.

Tiny Basic Cassette **$10.00**, on ROM **$38.00**, original Elf kit board **$14.95. 1802 software;** Moews Video Graphics **$3.50.** Games and Music **$3.00,** Chip 8 Interpreter **$5.50.**

Super Expansion Board with Cassette Interface $89.95

This is truly an astounding value! This board has been designed to allow you to decide how you want it optioned. **The Super Expansion Board comes with 4K of low power RAM** fully addressable anywhere in 64K with built-in memory protect and a **cassette interface**. Provisions have been made for all other options on the same board and it fits neatly into the hardwood cabinet alongside the **Super Elf**. The board includes slots for up to 6K of **EPROM** (2708, 2758, 2716 or TI 2716) and is **fully socketed.** EPROM can be used for the monitor and Tiny Basic or other purposes.

A 1K Super ROM Monitor $19.95 is available as an on board option in 2708 EPROM which has been preprogrammed with a program loader/editor and error checking multi file cassette read/write software, (relocatable cassette file) another exclusive from Quest. It includes register save and readout, block move capability and video graphics driver with blinking cursor. Break points can be used with the register save feature to isolate program bugs quickly, then follow with single step. If you have the **Super Expansion Board** and **Super Monitor** the monitor is up and running at the push of a button.

Other on board options include **Parallel Input and Output Ports** with **full handshake**. They allow easy connection of an ASCII keyboard to the input port. **RS 232 and 20 ma Current Loop** for teletype or other device are on board and if you need more memory there are two **S-100** slots for static RAM or video boards. Also a 1K Super Monitor version 2 with video driver for full capability display with Tiny Basic and a video interface board. **Parallel I/O Ports $9.85, RS 232 $4.50, TTY 20 ma I/F $1.95, S-100 $4.50. A 50 pin connector set** with ribbon cable is available at $15.25 for easy connection between the **Super Elf** and the **Super Expansion Board.**

Power Supply Kit for the complete system (see Multi-volt Power Supply).

Quest Super Basic V5.0

A new enhanced version of **Super Basic** now available. Quest was the first company worldwide to ship a full size Basic for 1802 Systems. A complete function **Super Basic by Ron Cenker** including floating point capability with scientific notation (number range ±.17E$^{\pm 38}$), 32 bit Integer ±2 billion; multi dim arrays, string arrays; string manipulation; cassette I/O; save and load, basic, data and machine language programs; and over 75 statements, functions and operations.

New improved faster version including **renumber** and essentially **unlimited variables.** Also, an exclusive user expandable command library.

Serial and Parallel I/O Included.

Super Basic on Cassette $55.00.

PROM Eraser

assembled. 25 PROM capacity **$37.50** (with timer **$69.50**). 6 PROM capacity OSHA/UL version **$69.50** (with timer **$94.50**).

Z80 Microcomputer

16 bit I/O, 2 MHz clock, 2K RAM, ROM Breadboard space. Excellent for control. Bare Board **$28.50.** Full Kit **$99.00.** Monitor **$20.00.** Power Supply Kit **$35.00. Tiny Basic $30.00**

S-100 Computer Boards

8K Static Godbout Econo IIA Kit	149.00
16K Static Godbout Econo XIV Kit	269.00
24K Static Godbout Econo XX-24 Kit	414.00
32K Static Godbout Econo XX-32 Kit	537.00
16K Dynamic RAM Kit	289.00
32K Dynamic RAM Kit	328.00
64K Dynamic RAM Kit	399.00
Video Interface Kit	**$139.00**

80 IC Update Master Manual $39.00

Comp. IC data selector, 2700 pg. master reference guide. Over 51,000 cross references. Free update service through 1980. Domestic postage $3.50.

Modem Kit $60.00

State of the art, orig., answer. No tuning necessary. 103 compatible 300 baud. Inexpensive acoustic coupler plans included. Bd. only $17.00.

LRC 7000+Printer $389.00

40/20 column dot matrix impact, std. paper. Interface all personal computers.

64/40/32/20 version **$405.00.** Optional cables available.

LRC 7000 printer interface cable for Super Elf with software $26.00

NiCad Battery Fixer/Charger Kit

Opens shorted cells that won't hold a charge and then charges them up, all in one kit w/full parts and instructions. **$7.25**

Rockwell AIM 65 Computer

6502 based single board with full ASCII keyboard and 20 column thermal printer. 20 char. alphanumeric display, ROM monitor, fully expandable. **$375.00.** 4K version **$450.00.** 4K Assembler **$85.00,** 8K Basic Interpreter **$100.00.**

Special small power supply for AIM65 assem. in frame **$54.00.** Complete AIM65 in thin briefcase with power supply **$499.00.** Molded plastic enclosure to fit both AIM65 and power supply **$47.50.** Special Package Price: 4K AIM, 8K Basic, power supply, cabinet **$599.00**

AIM65/KIM/VIM/Super Elf 44 pin expansion board; 3 female and 1 male bus. Board plus 3 connectors **$22.95.**

60 Hz Crystal Time Base Kit $4.40

Converts digital clocks from AC line frequency to crystal time base. Outstanding accuracy.

Video Modulator Kit $9.95

Convert TV set into a high quality monitor w/o affecting usage. Comp. kit w/full instruc.

Multi-volt Computer Power Supply

8v 5 amp, ±18v .5 amp, 5v 1.5 amp, −5v .5 amp, 12v .5 amp, −12v option. ±5v, ±12v are regulated. Basic Kit **$29.95.** Kit with chassis and all hardware **$43.95.** Add $4.00 shipping. Kit of hardware **$14.00,** Woodgrain case **$10.00.** $1.50 shipping.

Gremlin Color Video Kit $69.95

32 x 16 alpha/numerics and graphics; up to 8 colors with 6847 chip; 1K RAM at E000. Plugs into Super Elf 44 pin bus. No high res. graphics. On board RF Modulator Kit **$4.95**

Elf II Adapter Kit $24.95

Plugs into Elf II providing Super Elf 44 and 50 pin plus S-100 bus expansion. (With Super Expansion). High and low address displays, state and mode LED's optional **$18.00.**

1802 16K Dynamic RAM Kit $149.00

Expandable to 32K. Hidden refresh w/clocks up to 4 MHz w/no wait states. Addl. 16K RAM **$63.00**

Super Elf 44 pin expansion board; 3 female and 1 male bus. Board plus 3 connectors **$22.95**

Tiny Basic Extended on Cassette (added commands include Stringy, Array, Cassette I/O etc.)	**$15.00**
S-100 4-Slot Expansion	**$ 9.95**
Super Monitor VI.I Source Listing	**$15.00**

Super Color S-100 Video Kit $129.95

Expandable to 256 x 192 high resolution color graphics. 6847 with all display modes computer controlled. Memory mapped. 1K RAM expandable to 6K. S-100 bus 1802, 8080, 8085, Z80 etc.

Editor Assembler (Requires minimum of 4K for E/A plus user source)	**$25.00**
1802 Tiny Basic Source listing	**$19.00**
Super Monitor V2.0/2.1 Source Listing	**$20.00**

TERMS: $5.00 min. order U.S. Funds. Calif residents add 6% tax. $10.00 min. BankAmericard and Master Charge accepted. $1.00 insurance optional. Postage: Add 5%. C.O.D. $10.00 min. order.

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1900 MHz to 2500 MHz DOWN CONVERTER
This receiver is tunable a range of 1900 to 2500 mc and is intended for amateur radio use. The local oscillator is voltage controlled (l.e) making the I-f range approximately 54 to 88 mc (Channels 2 to 7).

PC BOARD WITH DATA	$19.99
PC BOARD WITH CHIP CAPACITORS 13	$44.99
PC BOARD WITH ALL PARTS FOR ASSEMBLY	$69.99
PC BOARD WITH ALL PARTS FOR ASSEMBLY PLUS 2N6603	$89.00
PC BOARD ASSEMBLED AND TESTED	$99.99
PC BOARD WITH ALL PARTS FOR ASSEMBLY, POWER SUPPLY AND ANTENNA	$159.99
POWER SUPPLY ASSEMBLED AND TESTED	$49.99
YAGI ANTENNA 4' LONG APPROX. 20 TO 23 dB GAIN	$49.99
YAGI ANTENNA 4' WITH TYPE (N, BNC, SMA Connector)	$64.99
2 FOOT DISH WITH FEED AND MOUNT	$59.99
2300 MHz DOWN CONVERTER	
Includes converter mounted in antenna, power supply. Plus 90 DAY WARRANTY	$259.99
OPTION #1 MRF902 in front end. (7 dB noise figure)	$299.99
OPTION #2 2N6603 in front end. (5 dB noise figure)	$359.99
2300 MHz DOWN CONVERTER ONLY	
10 dB Noise Figure 23 dB gain in box with N conn. Input F conn. Output	$149.99
7 dB Noise Figure 23 dB gain in box with N conn. Input F conn. Output	$169.99
5 dB Noise Figure 23 dB gain in box with SMA conn. Input F conn. Output	$189.99
DATA IS INCLUDED WITH KITS OR MAY BE PURCHASED SEPARATELY	$15.00

Shipping and Handling Cost:
Receiver Kits and $1.50. Power Supply add $2.00. Antenna add $5.00. Option 1/2 add $3.00. For complete system add $7.50.

HOWARD/COLEMAN TVRO CIRCUIT BOARDS

DUAL CONVERSION BOARD $25.00
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 $6.00
For use with dual conversion board. Consists of 6-47 pF.

70 MHz IF BOARD $25.00
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 ½ 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 $7.00
For use with 70 MHz IF Board. Consists of 7-.01 pF.

DEMODULATOR BOARD $40.00
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 $15.00
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 $25.00
Duplicate of the single audio but also covers the 6.2 range.

DC CONTROL $15.00
This circuit controls the VTO's, AFC and the S Meter.

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95H91DC	350 MHz Prescaler Divide by 5/6	9.50
11C90DC	650 MHz Prescaler Divide by 10/11	16.50
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
11C06DC	UHF Prescaler 750 MHz D Type Flip/Flop	12.30
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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Frequency response 40 MHz to 300 MHz
Gain: 300 MHz 16 dB Min., 17.5 dB Max.
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Size: 35, 42, 47, 49, 51, 52	$2.15
Size: 53, 54, 55, 56, 57, 58, 59, 61, 63, 64, 65	1.85
Size: 66	1.90
Size: 1.25 mm, 1.45 mm	2.00
Size: 3.20 mm	3.58

CRYSTAL FILTERS: TYCO 001-19880 same as 2194F

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Ultimate 50 dB: Insertion loss 1.0 dB max. Ripple 1.0 dB max. Ct. 0 + / – 5 pf 3600 ohms. $5.95

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Models:	SFD-455D 455 kHz	$3.00
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	SFE-10.7 10.7 MHz	5.95

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614A	900 to 2100 mc. Signal Generator	500.00
616A	1.8 to 4.2 Gc Signal Generator	400.00
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695A	12.4 to 18 Gc Sweep Generator	900.00

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473	225 to 400 mc AM/FM Signal Generator	750.00

Singer:

MF5/VR-4	Universal Spectrum Analyzer with 1 kHz to 27.5 mc Plug In	1200.00

Keltek:

XR630-100	TWT Amplifier 8 to 12.4 Gc 100 watts 40 dB gain	9200.00

Polarad:

2038/2436/1102A	Calibrated Display with an SSB Analysis Module and a 10 to 40 mc Single Tone Synthesizer	1500.00

RF TRANSISTORS

TYPE	PRICE	TYPE	PRICE	TYPE	PRICE
2N1561	$15.00	2N5590	$8.15	MM1550	$10.00
2N1562	15.00	2N5591	11.85	MM1552	50.00
2N1692	15.00	2N5637	22.15	MM1553	56.50
2N1693	15.00	2N5641	6.00	MM1601	5.50
2N2632	45.00	2N5642	10.05	MM1602/2N5842	7.50
2N2857JAN	2.52	2N5643	15.82	MM1607	8.65
2N2876	12.35	2N6545	12.38	MM1661	15.00
2N2880	25.00	2N5764	27.00	MM1669	17.50
2N2927	7.00	2N5842	8.78	MM1943	3.00
2N2947	18.35	2N5849	21.29	MM2605	3.00
2N2948	15.50	2N5862	51.91	MM2608	5.00
2N2949	3.90	2N5913	3.25	MM8006	2.23
2N2950	5.00	2N5922	10.00	MMCM918	20.00
2N3287	4.30	2N5942	46.00	MMT72	1.17
2N3294	1.15	2N5944	8.92	MMT74	1.17
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
2N3309	3.90	2N6082	11.30	MRF420	20.00
2N3375	9.32	2N6083	13.23	MRF450	11.85
2N3553	1.57	2N6084	14.66	MRF450A	11.85
2N3755	7.20	2N6094	7.15	MRF454	21.83
2N3818	6.00	2N6095	11.77	MRF458	20.68
2N3866	1.09	2N6096	20.77		
2N3866JAN	2.80	2N6097	29.54		
2N3866JANTX	4.49	2N6136	20.15	MRF502	1.08
2N3924	3.34	2N6166	38.60	MRF504	6.95
2N3927	12.10			MRF509	4.90
2N3950	26.86			MRF511	8.15
2N4072	1.80	2N6439	45.77	MRF901	3.00
2N4135	2.00	2N6459/PT9795	18.00	MRF5177	21.62
2N4261	14.60	2N6603	12.00	MRF8004	1.60
2N4427	1.20	2N6604	12.00	PT4186B	3.00
2N4957	3.62	A50-12	25.00	PT4571A	1.50
2N4958	2.92	BFR90	5.00	PT4612	5.00
2N4959	2.23	BLY568C	25.00	PT4628	5.00
2N4976	19.00	BLY568CF	25.00	PT4640	5.00
2N5090	12.31	CD3495	15.00	PT8659	10.72
2N5108	4.03	HEP76/S3014	4.95	PT9784	24.30
2N5109	1.66	HEPS3002	11.30	PT9790	41.70
2N5160	3.49	HEPS3003	29.88	SD1043	5.00
2N5179	1.05	HEPS3005	9.95	SD1116	3.00
2N5184	2.00	HEPS3006	19.90	SD1118	5.00
2N5216	47.50	HEPS3007	24.95	SD1119	3.00
2N5583	4.55	HEPS3010	11.34		
2N5589	6.82	HEPS5026	2.56		
		HP35831E/		TRWMRA2023-1.5	42.50
		HXTR5104	50.00	40281	10.90
		MM1500	32.20	40282	11.90
				40290	2.48

CHIP CAPACITORS

1pf	27pf	220pf	1200pf
1.5pf	33pf	240pf	1500pf
2.2pf	39pf	270pf	1800pf
2.7pf	47pf	300pf	2200pf
3.3pf	56pf	330pf	2700pf
3.9pf	68pf	360pf	3300pf
4.7pf	82pf	390pf	3900pf
5.6pf	100pf	430pf	4700pf
6.8pf	110pf	470pf	5600pf
8.2pf	120pf	510pf	6800pf
10pf	130pf	560pf	8200pf
12pf	150pf	620pf	.010mf
15pf	160pf	680pf	.012mf
18pf	180pf	820pf	.015mf
22pf	200pf	1000pf	.018mf

We can supply any value chip capacitors you may need.

PRICES

1 to 10	1.49
11 - 50	1.29
51 - 100	.89
101 - 1,000	.69
1,001 up	.49

HAMLIN SOLID STATE RELAYS:

120vac at 40 Amps.
Input Voltage 3 to 32vdc.
240 vac at 40 Amps.
Input Voltage 3 to 32 vdc.

YOUR CHOICE $4.99

ATLAS CRYSTAL FILTERS FOR ATLAS HAM GEAR

5.52-2.7/8
5.595-2.7/8/U
5.595-.500/4/CW
5.595-2.7LSB
5.595-2.7USB
5.645-2.7/8
9.0USB/CW

YOUR CHOICE $24.95

✓ Reader Service—see page 146

MICROWAVE COMPONENTS

ARRA

2416	Variable Attenuator	$ 50.00
3614-60	Variable Attenuator D to 60dB	75.00
KU520A	Variable Attenuator 18 to 26.5 GHz	100.00
4684-20C	Variable Attenuator D to 180dB	100.00
6684-20F	Variable Attenuator D to 180dB	100.00

General Microwave

Directional Coupler 2 to 4GHz 20dB Type N		75.00

Hewlett Packard

H487B	100 ohms Neg. Thermistor Mount (NEW)	150.00
H487B	100 ohms Neg. Thermistor Mount (USED)	100.00
477B	200 ohms Neg. Thermistor Mount (USED)	100.00
X487A	100 ohms Neg. Thermistor Mount (USED)	100.00
X487B	100 ohms Neg. Thermistor Mount (USED)	125.00
J468A	100 ohms Neg. Thermistor Mount (USED)	150.00
478A	200 ohms Neg. Thermistor Mount (USED)	150.00
J382	5.85 to 8.2 GHz Variable Attenuator 0 to 50dB	250.00
X382A	8.2 to 12.4 GHz Variable Attenuator 0 to 50dB	250.00
394A	1 to 2 GHz Variable Attenuator 6 to 120dB	250.00
NK292A	Waveguide Adapter	65.00
K422A	18 to 26.5 GHz Crystal Detector	250.00
8436A	Bandpass Filter 8 to 12.4 GHz	75.00
8439A	2 GHz Notch Filter	75.00
8471A	RF Detector	50.00
H532A	7.05 to 10 GHz Frequency Meter	300.00
G532A	3.95 to 5.85 GHz Frequency Meter	300.00
J532A	5.85 to 8.2 GHz Frequency Meter	300.00
8D9A	Carriage with a 444A Slotted Line Untuned Detector Probe and 809B Coaxial Slotted Section 2.6 to 18 GHz	175.00

Merrimac

AU-25A/	801115 Variable Attenuator	100.00
AU-26A/	801162 Variable Attenuator	100.00

Microlab/FXR

X638S	Horn 8.2 - 12.4 GHz	60.00
601-818	X to N Adapter 8.2 - 12.4 GHz	35.00
Y610D	Coupler	75.00

Narda

4013C-10/	22540A Directional Coupler 2 to 4 GHz 10db Type SMA	90.00
4014-10/	22538 Directional Coupler 3.85 to 8 GHz 10dB Type SMA	90.00
4014C-6/	22876 Directional Coupler 3.85 to 8 GHz 6dB Type SMA	90.00
4015C-10/	22539 Directional Coupler 7.4 to 12 GHz 10dB Type SMA	95.00
4015C-30/	23105 Directional Coupler 7 to 12.4 GHz 30dB Type SMA	95.00
3044-20	Directional Coupler 4 to 8 GHz 20dB Type N	125.00
3040-20	Direcitonal Coupler 240 to 500 MC 20dB Type N	125.00
3043-20/	22006 Directional Coupler 1.7 to 4 GHz 20dB Type N	125.00
3003-10/	22011 Directional Coupler 2 to 4 GHz 10dB Type N	75.00
3003-30/	22012 Directional Coupler 2 to 4 GHz 30dB Type N	75.00
3043-30/	22007 Directional Coupler 1.7 to 3.5 GHz 30dB Type N	125.00
22574	Directional Coupler 2 to 4 GHz 10dB Type N	125.00
3033	Coaxial Hybrid 2 to 4 GHz 3dB Type N	125.00
3032	Coaxial Hybrid 950 to 2 GHz 3 dB Type N	125.00
784/	22380 Variable Attenuator 1 to 90dB 2 to 2.5 GHz Type SMA	550.00
22377	Waveguide to Type N Adapter	35.00
720-6	Fixed Attenuator 8.2 to 14.4 GHz 6 dB	50.00
3503	Waveguide	25.00

PRD

U101	12.4 to 18 GHz Variable Attenuator D to 60dB	300.00
X101	8.2 to 12.4 GHz Variable Attenuator D to 60dB	200.00
C101	Variable Attenuator 0 to 60dB	200.00
205A/367	Slotted Line with Type N Adapter	100.00
195B	8.2 to 12.4 GHz Variable Attenuator D to 50dB	100.00
185BS1	7.05 to 10 GHz Variable Attenuator D to 40dB	100.00
196C	8.2 to 12.4 GHz Variable Attenuator D to 45dB	100.00
170B	3.95 to 5.85 GHz Variable Attenuator D to 45dB	100.00
588A	Frequency Meter 5.3 to 6.7 GHz	100.00
140A,C,D,E	Fixed Attenuators	25.00
109J,I	Fixed Attenuators	25.00
WEINSCHEL ENG.	2692 Variable Attenuator +30 to 60dB	100.00

COMPUTER I.C. SPECIALS

MEMORY	DESCRIPTION	PRICE
2708	1K x 8 EPROM	$ 7.99
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	8.99
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
MCM68A10P	128 x 8 Static RAM 360ns	4.99
MCM68B10P	128 x 8 Static RAM 250ns	5.99
MC6820P	PIA	8.99
MC6820L	PIA	9.99
MC6821P	PIA	8.99
MC68B21P	PIA	9.99
MCM6830L7	Mikbug	14.99
MC6840P	PTM	8.99
MC6845P	CRT Controller	29.50
MC6845L	CRT Controller	33.00
MC6850L	ACIA	10.99
MC6852P	SSDA	5.99
MC6852L	SSDA	11.99
MC6854P	ADLC	22.00
MC6860CJCS	0-600 BPS Modem	29.00
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
6530	Support For 6500 series	15.99
2650	Microprocessor	10.99
TMS1000NL	Four Bit Microprocessor	9.99
TMS4024NC	9 x 64 Digital Storage Buffer (FIFO)	9.99
TMS6011NC	UART	9.99
MC14411	Bit Rate Generator	11.99
AY5-4007D	Four Digit Counter/Oisplay Drivers	8.99
AY5-9200	Repertory Dialler	9.99
AY5-9100	Push Button Telephone Diallers	7.99
AY5-2376	Keyboard Encoder	19.99
AY3-8500	TV Game Chip	5.99
TR1402A	UART	9.99
PR1472B	UART	9.99
PT1482B	UART	9.99
8257	DMA Controller	9.99
8251	Communication Interface	9.99
8228	System Controller & Bus Driver	5.00
8212	8 Bit Input/Output Port	5.00
MC14410CP	2 of 8 Tone Encoder	9.99
MC14412	Low Speed Modem	14.99
MC14408	Binary to Phone Pulse Converter	12.99
MC14409	Binary to Phone Pulse Converter	12.99
MC1488L	RS232 Driver	1.00
MC1489L	RS232 Receiver	1.00
MC1405L	A/D Converter Subsystem	9.00
MC1406L	6 Bit D/A Converter	7.50
MC1408/6/7/8	8 Bit O/A Converter	4.50
MC1330P	Low Level Video Oetector	1.50
MC1349/50	Video IF Amplifier	1.17
MC1733L	LM733 OP Amplifier	2.40
LM565	Phase Lock Loop	2.50

↙ Reader Service—see page 146

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 terrestial 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 (6M or 2M)	$199.95	$299.95
XV4/LPA4-30/Cabt (for UHF)	$229.95	$349.95

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

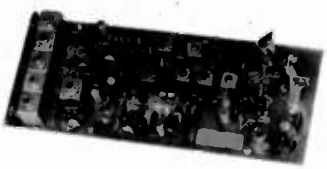
MODEL	RF RANGE	OUTPUT RANGE
CA28	28-32 MHz	144-148 MHz
CA50	50-52	28-30
CA50-2	50-54	144-148
CA144	144-146	28-30
CA145	145-147–or– 144-144.4	28-30 27-27.4 (CB)
CA146	146-148	28-30
CA220	220-222	28-30
CA220-2	220-224	144-148
CA110	Any 2MHz of Aircraft Band	26-28 or 28-30
CA432-2	432-434	28-30
CA432-5	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

- Fully shielded designs
- Double tuned circuits for spurious suppression
- Easy to align with built-in test aids



T50-50	6-chan, 6M, 2W Kit	$44.95
T50-150	6-chan, 2M, 2W Kit	$44.95
T50-220	6-chan, 220 MHz, 2W Kit	$44.95
T450	1-chan, 450 MHz, ¾W Kit	$44.95

See our Complete Line of VHF & UHF Linear PA's

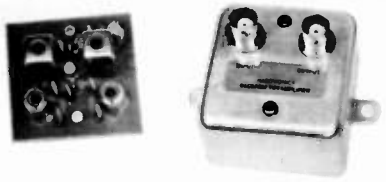
- Use as linear or class C PA
- For use with SSB Xmtg Converters, FM Exciters, etc.

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 18-300 MHz.

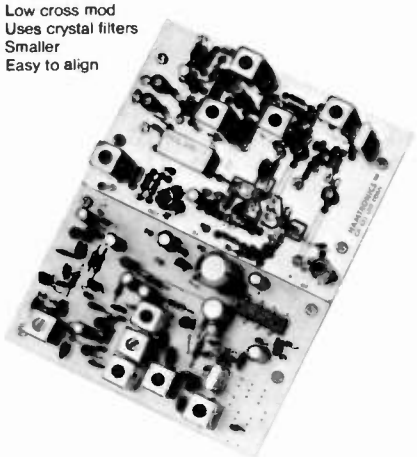
MODEL P432 UHF PREAMP, available in versions to cover bands 300-650 MHz.

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 sattelite 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 ±9 kHz, -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! ↙33

- Write or phone 716-392-9430
(Electronic answering service evenings & weekends)
- Use Credit Card, UPS COD, Check, Money Order
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Call or Write to get FREE CATALOG With Complete Details
(Send 4 IRC's for overseas mailing)

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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/0	22.50
Z80	SIO/1	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
80 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
5.595 - 2.7 USB
5.595 - 2.7/8/L
5.595 - 2.7 LSB
9.0 - USB/CW
YOUR CHOICE $12.99 each

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 ½ 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 ½ in. $4.99 each

NO ORDERS UNDER $10

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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
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Downconverter Kit - PCB and parts
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Power Supply assembled
$59.99
Complete Kit with Yagi antenna
$109.99

REPLACEMENT PARTS

MRF901	$ 3.99
MBD101	1.29
.001 Chip Caps	1.00
Power supply PCB	4.99
Downconverter PCB	19.99

Bogner down converter, industrial version. 1 year guarantee $225.00

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Gold plated contacts
Dual 43/86 pin .156 spacing
Solder tail for PCB $3.00 each

CONTINUOUS TONE BUZZERS
12 VDC $2.00 each

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✔ Reader Service—see page 146

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39¢ each or 10/$3.00

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69¢ each or
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2.5 Amps 25¢ each or
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420 MFD @ 400 VDC OR
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$6.99 each

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Model A30340
230 VAC @ .78 Amps
Will also work on 115 VAC
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470 pf @ 15 KV	$3.99 each
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3 switch with end plates
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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Red	8/$1.00
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Amber	6/$1.00

MEDIUM LED's

Red	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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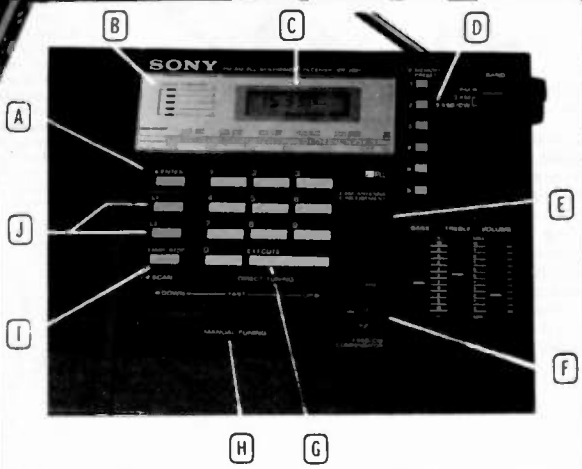
INTRODUCING SONY'S NEW DIGITAL DIRECT ACCESS RECEIVER!

only **$299.95** plus $5.00 shipping



A Enter Button
B Signal Strength Indicator
C Liquid Crystal Display
D Memory Preset Buttons
E Antenna Adjustment Dial
F SSB/CW Compensator
G Execute Bar
H Manual Tuning Buttons
I Scan Button
J High/Low Limit Buttons

Revolutionary Direct 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. PLL_1 circuit has 100 KHz step while PLL_2 handles 1 KHz step, both of which are controlled by separate quartz crystal oscillators for precise, no-drift tuning. **DUAL CONVERSION SUPERHETERODYNE** circuitry assures superior AM reception and high image rejection characteristics. The 10.7 MHz IF of the FM band is utilized as the 2nd IF of the AM band. A new type of crystal filter made especially for this purpose realizes clearer reception than commonly used ceramic filters. **ALL FET FRONT END** for high sensitivity and interference rejection. Intermodulation, cross modulation, and spurious interference are effectively rejected. **FET RF AMP** contributes to superior image rejection, high sensitivity, and good signal to noise ratio. Both strong and weak stations are received with minimal distortion.

EXTENDED SPECTRUM CONTINUOUS TUNING

OPERATIONAL FEATURES

INSTANT FINGERTIP TUNING with the calculator-type key board enables the operator to have instant access to any frequency in the LW, MW, SW, and FM bands. And the LCD digital frequency display confirms the exact, drift-free signal being received. **AUTOMATIC SCANNING** of the above bands. Continuous scanning of any desired portion of the band is achieved by setting the "L_1" and "L_2" keys to define the range to be scanned. The scanner can stop automatically on strong signals, or it can be done manually. **MANUAL SEARCH** is similar to the manual scan mode and is useful for quick signal searching. The "UP" and "DOWN" keys let the tuner search for you. The "FAST" key increases the search rate for faster signal detection. **MEMORY PRESETS.** Six memory keys hold desired stations for instant one-key tuning in any mode (AM, SSB/CW, and FM), and also, the "L_1" and "L_2" keys can give you two more memory slots when not used for scanning. **OTHER FEATURES:** Local, normal, DX sensitivity selector for AM; SSB/CW compensator; 90 min. sleep timer; AM Ant. Adjust.

SPECIFICATIONS

CIRCUIT SYSTEM: Fm Superheterodyne; AM Dual conversion superheterodyne. **SIGNAL CIRCUITRY:** 4 IC's, 11 FET's, 23 Transistors, 16 Diodes. **AUXILIARY CIRCUITRY:** 5 IC's, 1 LSI, 5 LED's, 25 Transistors, 9 Diodes. **FREQUENCY RANGE:** FM 76-108 MHz; AM 150-29,999 KHz. **INTERMEDIATE FREQUENCY:** FM 10.7 MHz.; AM 1st 66.35 MHz., 2nd 10.7 MHz. **ANTENNAS:** FM telescopic, ext. ant. terminal; AM telescopic, built-in ferrite bar, ext. ant. terminal. **POWER:** 4.5 VDC/120 VAC **DIMENSIONS:** 12¼ (W) X 2¼ (H) X 6¾ (D). **WEIGHT:** 3 lb. 15 oz. (1.8 kg)

SPECTRONICS, INC.
1009 GARFIELD ST. OAK PARK, IL. 60304

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BULLET ELECTRONICS

P.O. Box 401244-E Garland, TX. 75040 (214) 278-3553

The Greatest Breakthrough In Electronic Music Ever!

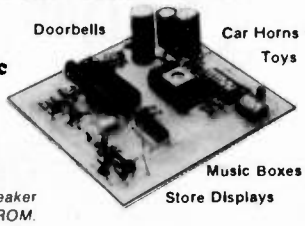
New! **The Super Music Maker**

REVISION 2

$24.95

(Basic Kit)

Does not include speaker switches or 2708 ROM.



Now you can play hundreds of songs using the Bullet Super Music Maker. The unit features a **single factory programmed microprocessor IC** that comes with 20 pre-programmed short tunes. By adding the additional PROMS (2708's) the system can be expanded to play up to **1000 notes per PROM.** Just think . . . . a compact electronic instrument that will play dozens, hundreds or even thousands of selections of music. The kit comes with **all electronic components (less the PROM),** and a drilled, plated and screened PC Board which measures 4" x 4¾". The 7 **watt amplifier** section is on the same PC board and drives an 8 ohm speaker (not included), from a whisper to ear splitting volume. Since the unit works on **12 VDC** or **12 VAC***, vehicle or portable operation is possible. **What do you get for $24.95? Everything but a speaker, transformer, case, switches, and PROM.** Additional 2708 albums containing popular tunes are available for **$15.00** each or you can program your own PROMS using information provided with the kit instructions. Lists of available PROM albums are available on request. *(Note: Unit plays electronic music one note at a time, it is not possible to play chords or a melody with harmony simultaneously.)*

★ Envelope control gives decay to notes.
★ "Next tune" feature allows sequential playing of all songs.
★ On board inverter allows single voltage (+12) operation.

OPTIONAL ACCESSORIES

DIP Switches	One 8 pos., One 5 pos. (Can be **directly soldered** to PC Bd. to access tunes)	**2.00/Set**
Rotary Switches	Two 5 position (For **remote wiring** to PC Bd. to access tunes)	**2.00/Set**
Attractive Black Plastic Case		**6.50**
Wallplug Transformer	(For operation on 117VAC house voltage)	**3.00**

Super Value Power Transformer

Well made, open frame transformer with mounting ears. Build a +5 and ±12 supply with inexpensive parts. **Free schematics of several designs. Primary 117VAC. SEC #1** 15VAC @ .5A **SEC #2** 15 VAC @ .5A **SEC #3** 8VAC @ 2.5A. **$2.95**

ORDER: BET-0005

7 Watt Audio Amp Kit $5.95

SMALL, SINGLE, HYBRID IC AND COMPONENTS FIT ON A 2" x 3" PC BOARD (INCLUDED). RUNS ON 12 VDC. GREAT FOR ANY PROJECT THAT NEEDS AN INEXPENSIVE AMP. LESS THAN 3% THD @ 5 WATTS. COMPATIBLE WITH SE-01 SOUND KIT.

Overvoltage Protection Kit $6.95

Protect your expensive equipment from overvoltage conditions. Every computer should have one! **Works with any fused DC power source** from 10 to 20 volts up to 25 amps.

AY3-8910 PROGRAMMABLE SOUND GENERATOR

The AY3-8910 is a 40 pin LSI chip with three oscillators, three amplitude controls, programmable noise generator, three mixers, an envelope generator, and three D/A converters that are controlled by 8 BIT WORDS. No external pots or caps required. This chip hooked to an 8 bit microprocessor chip or Buss (8080, Z80, 6800 etc.) can be software controlled to produce almost any sound. It will play three note chords, make bangs, whistles, sirens, gunshots, explosions, bleets, whines, or grunts. In addition, it has provisions to control its own memory chips with two IO ports. The chip requires +5V @ 75ma and a standard TTL clock oscillator. A truly incredible circuit.

12.95 W/Basic Spec Sheet (4 pages)
60 page manual with S-100 interface instructions and several programming examples, **$3.00 extra**

ZULU II CLOCK KIT X-RATED!

WITH CALENDAR AND NOX™ CIRCUIT

X-TRA VALUE: All the components and high quality plated G-10 PC Boards are provided.
X-CELLENCE IN DESIGN: Easy Assembly! Large open layout.
X-CELLENCE IN IDEAS: 5 years of designed products for the amateur radio market.
X-CELLENCE IN INSTRUCTIONS: Clear step-by-step instructions with quality illustrations and schematic.
X-TRA FEATURES: There has never been a clock kit with so many features — at any price!

- Unit operates on either **12 VAC** or **12 VDC.**
- On board **QUARTZ XTAL TIMEBASE** or 60Hz AC line freq. can be used.
- Automatic **BATTERY BACKUP***
- Reads true **24 HOUR TIME** and **31 DAY CALENDAR.**
- **Unique NOX™ CIRCUIT activates readouts with a handclap followed by the date for 4 seconds. Or they can be turned on constantly.**
- When used mobile readouts blank whe ignition is off.
- Special **NOISE SUPPRESSION** and battery reversal circuits.
- Bright 1/2" LED's show hours, minute and seconds.

19.95

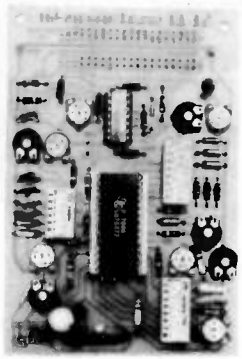
LESS CASE

ACCESSORIES

Custom High Impact Molded Case with Ruby Lens. Available in Blue or Tan.
$6.50

117 VAC to 12 VAC Transformer.
$1.35

*9V Battery Not Included



Sound Effects Kit 18.50

The **SE-01 Sound Effects Kit** is a complete kit; all you need to build a programmable sound effects machine except a battery and speaker. Our kit is designed to really ring out the **TI 76477** Sound Chip. Only the SE-01 provides you with additional circuitry that includes a **PULSE GENERATOR, MUX OSCILLATOR and COMPARITOR** to make more complex sounds a snap. We help you in building the kit with a clear, easy-to-follow construction manual and we show you how to easily program the unit. Other dealers will sell you the chip or a "kit" of parts but you are on your own to do the most difficult part...make neat sounds! Within a short time after you build the SE-01 you can easily create **Gunshots, Explosions, Space Sounds, Steam Trains** and much more. We think the Bullet SE-01 is the best deal on the market but don't ask us. — ask the **15,000** happy SE-01 owners!

Complete Kit With Quality Plated PC Board **$18.50**
(Less battery & speaker)

AUTO/VAN CLOCK KIT 16.95

- 12 Hr. Format
- 6 Digit ½" LED Readouts
- Quartz XTAL Timebase
- Alarm & Snooze Options
- Noise Filtering
- Easy Assembly • 12 VDC
- 4 5/8" x 3" x 1 1/2"
- All Parts!

ULTRASONIC RELAY KIT

Invisible Beam Works Like A Photo Electric Eye. **COMPLETE KIT**. All Parts & PC Board. Use Up To 25 Ft. Apart.
$21.50

Optional entry delay and Alarm Timeout Circuit will source or sink up to 200 MA DC.
$3.95

PARTS

LM3046	(CA3046) Xistor Array	.75
RCA 40430	400V 6A TRIAC TO-66	.75
LM567	Tone Decoder	.99
CD4046	PLL CMOS	.99
LM3302	Quad Comparator	.89
2SC 1849	High Freq. NPN TO-92	6/1.00
MPS A 20	NPN General Purpose	8/1.00
TL490	Bar/Graph Driver w/specs	2.50
7812	12V 1A Regulator	.99
7805	5V 1A Regulator	.99
78M05	5V ½A Reg. TO-5 (Hse #)	.60
LM3911	Temp. Transducer w/specs	1.10
555	Timer IC	.49
2N6028	P.U.T. w/specs	.50
IL-1	Opto Isolator w/specs	.60
LM377	Dual LM380 w/specs	1.09
TIP-30	PNP Power TO-220	3/1.00
SCR	Sensitive Gate 200V 4A	7/1.00
SCR	Sensitive Gate 600V 4A RCA	3/1.00
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Perfect for power transistors, or 309 and 340K series voltage regulators.

3/1.10

Thermoloy H6014 Black Anodized

THE PERFECT TRANSFORMER

117VAC primary. 12VAC secondary @ 200ma Great for all your CMOS, or low power TTL projects. PC board mount. ***ORDER:***
99¢ ea. **3/$2.50** ***XFMR 03***
Size: 1.5" W x 1.25" D x 1.25" H

Special Purchase

2N3055

115W NPN POWER TRANSISTOR TO-3

Most popular transistor for power supplies, audio amps, switching, etc.

Limit 20 per customer **50¢ Each**

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↙12

ramsey the first name in Counters !

9 DIGITS 600 MHz $129.95 WIRED

PRICES

CT-90 wired, 1 year warranty	$129.95
CT-90 Kit, 90 day parts warranty	109.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC Adapter/Charger	12.95
OV-1, Micro-power Oven time base	49.95
External time base input	14.95

The CT-90 is the most versatile, feature packed counter available for less than $300.00! Advanced design features include: three selectable gate times, nine digits, gate indicator and a unique display hold function which holds the displayed count after the input signal is removed! Also, a 10mHz TCXO time base is used which enables easy zero beat calibration checks against WWV. Optionally; an internal nicad battery pack, external time base input and Micro-power high stability crystal oven time base are available. The CT-90, performance you can count on!

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 10 MV to 150 MHz Less than 50 MV to 500 MHz
Resolution:	0.1 Hz (10 MHz range) 1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	9 digits 0.4" LED
Time base:	Standard-10.000 mHz, 1.0 ppm 20-40°C. Optional Micro-power oven-0.1 ppm 20-40°C
Power:	8-15 VAC @ 250 ma

7 DIGITS 525 MHz $99.95 WIRED

SPECIFICATIONS:

Range:	20 Hz to 525 MHz
Sensitivity:	Less than 50 MV to 150 MHz Less than 150 MV to 500 MHz
Resolution:	1.0 Hz (5 MHz range) 10.0 Hz (50 MHz range) 100.0 Hz (500 MHz range)
Display:	7 digits 0.4" LED
Time base:	1.0 ppm TCXO 20-40°C
Power:	12 VAC @ 250 ma

The CT-70 breaks the price barrier on lab quality frequency counters. Deluxe features such as: three frequency ranges - each with pre-amplification, dual selectable gate times, and gate activity indication make measurements a snap. The wide frequency range enables you to accurately measure signals from audio thru UHF with 1.0 ppm accuracy - that's .0001%! The CT-70 is the answer to all your measurement needs, in the field, lab or ham shack.

PRICES:

CT-70 wired, 1 year warranty	$99.95
CT-70 Kit, 90 day parts warranty	84.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC adapter/charger	12.95

7 DIGITS 500 MHz $79.95 WIRED

PRICES:

MINI-100 wired, 1 year warranty	$79.95
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 $159.95 WIRED

NEW READ RECEIVER FREQUENCY

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 25 mv to 150 MHz Less than 150 mv to 600 MHz
Resolution:	1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	8 digits 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	110 VAC or 12 VDC

The CT-50 is a versatile lab bench counter that will measure up to 600 MHz with 8 digit precision. And, one of its best features is the Receive Frequency Adapter, which turns the CT-50 into a digital readout for any receiver. The adapter is easily programmed for any receiver and a simple connection to the receiver's VFO is all that is required for use. Adding the receiver adapter in no way limits the operation of the CT-50, the adapter can be conveniently switched on or off. The CT-50, a counter that can work double-duty!

PRICES:

CT-50 wired, 1 year warranty	$159.95
CT-50 Kit, 90 day parts warranty	119.95
RA-1, receiver adapter kit	14.95
RA-1 wired and pre-programmed (send copy of receiver schematic)	29.95

DIGITAL MULTIMETER $99.95 WIRED

PRICES:

DM-700 wired, 1 year warranty	$99.95
DM-700 Kit, 90 day parts warranty	79.95
AC-1, AC adaptor	3.95
BP-3, Nicad pack +AC adapter/charger	19.95
MP-1, Probe kit	2.95

The DM-700 offers professional quality performance at a hobbyist price. Features include; 26 different ranges and 5 functions, all arranged in a convenient, easy to use format. Measurements are displayed on a large 3½ digit, ½ inch LED readout with automatic decimal placement, automatic polarity, overrange indication and overload protection up to 1250 volts on all ranges, making it virtually goof-proof! The DM-700 looks great, a handsome, jet black, rugged ABS case with convenient retractable tilt bail makes it an ideal addition to any shop.

SPECIFICATIONS:

DC/AC volts:	100 uV to 1 KV, 5 ranges
DC/AC current	0.1 uA 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

ramsey electronics, inc. VISA master charge
2575 Baird Rd. Penfield, NY 14526 ✓62

PHONE ORDERS
CALL 716-586-3950

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.

Save on Scanners!

NEW Product!

Communications Electronics,™ the world's largest distributor of radio scanners, welcomes the addition of the Fanon SCMA-6 accessory to our product line. This useful accessory mounts in your car and makes your Fanon Slimline scanner work like a high priced mobile receiver.

A new product made by Electra, the *Freedom Phone*® is now available from **CE**. This is the ultimate *cordless* extention phone that can make and take your calls.

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. Most items are **in stock** for **quick shipment**, so **order today** from **CE!**

Bearcat®‡ 300

The Ultimate Synthesized Scanner!

List price $519.95/**CE** price **$329.00**

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 new *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.

Bearcat® 250

List price $419.95/**CE** price **$269.00**

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. Overseas customers should order the *Bearcat* **250FB** at $349.00 each. This model is like a *Bearcat* 250, but designed for International operation with 220 V AC/12 V DC power supply and 66-88 MHz low band coverage instead of 32-50 MHz.

Bearcat® 220

List price $419.95/**CE** price **$269.00**

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. Overseas customers should order the *Bearcat* **220FB** at $349.00 each. This model is like a *Bearcat* 220, but designed for International operation with 220 V AC/12 V DC power supply and 66-88 MHz low band coverage instead of 32-50 MHz.

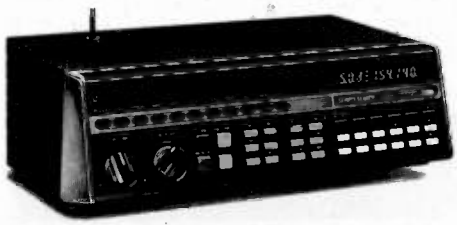
NEW! Bearcat® 210XL

List price $319.95/**CE** price **$209.00**

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! 50-Channel Bearcat 300

NEW! Bearcat 160

NEW! Bearcat® 160

List price $279.95/**CE** price **$189.00**

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. The *Bearcat* 160 features 16-channel monitoring of the most popular public service bands. And to locate more of what you're listening for, Electra introduces another operating convenience: Manual Search. Used with Automatic Search it simplifies seeking and finding unknown but active frequencies. 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 Auxillary. All this performance in sleek, contemporary styling. And at a price so low, it astounds even us!

Bearcat® 5

List price $129.95/**CE** price **$94.00**

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 $179.95/**CE price $114.00**

Frequency range: 33-47, 152-164, 450-508 MHz.

The incredible, new *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 2¾ x 6¼ x 1". Includes rubber ducky antenna. Order crystals for each channel. Made in Japan.

NEW! Fanon Slimline 6-HLU

List price $169.95/**CE price $109.00**

Low cost 6-channel, 3-band scanner!

The new *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 2¾ x6¼ x 1." Includes rubber ducky antenna. Order crystal certificates for each channel. Made in Japan.

NEW! 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 SCANNER ACCESSORIES

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
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 ¾ inch hole mount. Order **#A64** is a ⅜ 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.

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).

Regency®‡ M400

List price $379.95/**CE** price **$259.00**

30 Channel • Synthesized • Service Search Digital clock • Digital timer • M100 styling Search/Store • Priority Channel • AC/DC

Frequency range: 30-50, 144-174, 440-512 MHz.

The new *Regency* M400 is a compact programmable FM monitor receiver for use at home or on the road.

OTHER REGENCY® SCANNERS

NEW! R1040	$169.00
Touch K100	$199.00
Touch M100	$199.00

NEW! Telephone Products

Electra's cordless *Freedom Phone* does everything an ordinary phone does and more. Because it is cordless, you can take it anywhere, inside or outside—on the patio, by the pool, in the garage, in the workshop...even next door at the neighbor's.

Model **FF-500** has pushbutton dialing. Rechargeable ni-cad batteries included. Battery low light. Secure feature. Telescopic antenna. Your cost is $179.00. Model **FF-1500** has the same features as the FF-500 but also includes a charger/cradle that allows the phone's handset to be recharged away from the base station. Your cost for this cordless phone is $199.00. The model **FF-3000** has all the standard features (except charger/cradle) plus interchangeable telescopic and rubber ducky antenna. Redial feature. Belt clip. Carrying case. Greater range. Your cost is $229.00.

World Scanner Association™

The WORLD SCANNER ASSOCIATION is sponsored as a public service by **Communications Electronics.™** When you join, you'll receive a one-year membership and our quarterly newsletter with scanner news and features. You'll also get a wallet I.D. card, an Official WSA Membership Certificate, and more. FREE classified ads for members so you can contact other scanner owners when you want to sell or buy a scanner. FREE membership in the WSA Buyer's Co-op. Your Co-op membership will allow you to get special discounts on scanners and scanner related products. Since the WSA Buyer's Co-op gives you group purchasing power, you can easily pay for your membership dues the first time you make a Co-op purchase. To join, send $12.00 ($20.00 outside U.S.A.) for your membership materials.

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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 30 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 five weeks bank clearance.

Mail orders to: **Communications Electronics,™** Box 1002, Ann Arbor, Michigan 48106 U.S.A. Add $6.00 per scanner or phone product for U.P.S. *ground* shipping, or $12.00 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. 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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‡*Regency* is a federally registered trademark of Regency Electronics Inc.

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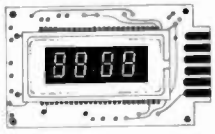
We're first with the best.℠

National Semiconductor Clock Modules



12VDC AUTOMOTIVE/ INSTRUMENT CLOCK

APPLICATIONS:
- In-dash autoclocks
- 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, 8204Q, 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 $79.50

Jumbo 6-Digit Clock Kit

- Four .630" ht. and two .300" ht. common anode displays
- Uses MM5314 clock chip
- Switches for hours, minutes and hold functions
- Hours easily viewable to 30 feet
- Simulated walnut case
- 115VAC operation
- 12 or 24 hour operation
- Includes all components, case and wall transformer
- Size: 6¾" x 3-1/8" x 1¾"

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: 6¾" x 3-1/8" x 1¾"

JE701 ..... $19.95

Regulated Power Supply

Uses LM309K. Heat sink provided. PC board construction. Provides a solid 1 amp @ 5 volts. Can supply up to ±5V, ±9V and ±12V with JE205 Adapter. Includes components, hardware and instructions. Size: 3½" x 5" x 2"H

JE200 ..... $14.95

ADAPTER BOARD —Adapts to JE200— ±5V, ±9V and ±12V

DC/DC converter with +5V input. Toriodal hi-speed switching XFMR. Short circuit protection. PC board construction. Piggy-back to JE 200 board. Size: 3½" x 2" x 9/16"H

JE205 ..... $12.95

MICROPROCESSOR COMPONENTS

8080A/8080A SUPPORT DEVICES

INS8080A	CPU	6.50
DP8212	8-Bit Input/Output	3.25
DP8214	Priority Interrupt Control	5.95
DP8216	Bi-Directional Bus Driver	3.49
DP8224	Clock Generator/Driver	3.95
DP8226	Bus Driver	3.49
DP8228	System Controller/Bus Driver	4.95
DP8238	System Controller	5.95
INS8243	I/O Expander for 48 Series	9.95
INS8250	Asynchronous Comm. Element	16.95
DP8251	Prog. Comm. I/O (USART)	7.95
DP8253	Prog. Interval Timer	14.95
DP8255	Prog. Peripheral I/O (PPI)	9.95
DP8257	Prog. DMA Control	19.95
DP8259	Prog. Interrupt Control	19.95
DP8275	Prog. CRT Controller	49.95
DP8279	Prog. Keyboard/Display Interface	19.95
DP8300	Octal Bus Receiver	6.95
DP8303	System Timing Element	6.95
DP8304	8-Bit Bi-Directional Receiver	3.95
DP8307	8-Bit Bi-Directional Receiver	3.95
DP8308	8-Bit Bi-Directional Receiver	3.95

6800/6800 SUPPORT DEVICES

MC6800	MPU	14.95
MC6802CP	MPU with Clock and RAM	19.95
MC6810API	128x8 Static RAM	6.95
MC6821	Peripheral Inter. Adapt (MC6820)	7.49
MC6828	Priority Interrupt Controller	30.95
MC6830-L8	1024x8 Bit ROM (MC68A23-8)	14.95
MC6850	Asynchronous Comm. Adapter	6.95
MC6852	Synchronous Serial Data Adapter	6.95
MC6860	0-600bps Digital MODEM	10.95
MC6862	2400bps Modulator	12.95
MC6880A	Quad 3-State Bus Trans. (MC8T26)	2.25

MICROPROCESSOR CHIPS

Z80 (780C)	CPU (MK3880N) (2MHz)	13.95
Z80A (780-1)	CPU (MK3880N-4) (4MHz)	15.95
CDP1802	CPU	19.95
2650	MPU	39.95
IDA4290	ADC CPU—8-Bit Slice (Com. Temp. Grade)	18.95
MC6809	MPU w/Clock (64K Bytes Memory)	11.95
INS8035N-6	MPU—8-Bit (6MHz)	16.95
INS8039N-6	CPU—Sgl. Chip 8-Bit (128 bytes RAM)	19.95
INS8040N-6	CPU (256 Bytes RAM)	24.95
INS8070N	CPU—64 Bytes RAM	24.95
INS8073N	CPU w/Basic Micro Interpreter	29.95
P8035	CPU	19.95
INS8900	CPU—16-Bit	29.95
TMS9900JL	MPU—16-Bit	49.95

SHIFT REGISTERS

MM500H	Dual 25-Bit Dynamic	.50
MM501H	Dual 50-Bit Dynamic	.50
MM506H	Dual 100-Bit Static	.95
MM510H	Dual 64-Bit Accumulator	.50
MM1402	256-Bit Dynamic	3.95
MM5013	1024-Bit Dynamic/Accumulator	1.95
MM5016H	500/512-Bit Dynamic	.89
MM5034N	Octal 80-Bit	9.95
MM5035N	Octal 80-Bit	9.95
2504V(1404A)	1024-Bit Dynamic	3.95
2518N	Hex 32-Bit Static	6.95
2522V	Dual 132-Bit Static	3.95
2524V	512-Bit Dynamic	.99
2525V	1024-Bit Dynamic	2.95
2527V	Dual 256-Bit Static	2.95
2528V	Dual 250-Bit Static	4.00
2529V	Dual 240-Bit Static	4.00
2532N	Quad 80-Bit Static	2.95
3341PC	Fifo (Dual 80)	6.95

DATA ACQUISITION

AF100-1CN	Universal Active Filter 2.5%	5.95
AF121-1CJ	Touch Tone Low Pass Filter	19.95
AF122-1CJ	Touch Tone Low Pass Filter	19.95
LM308AH	Super Gain Op Amp	1.00
LM134Z	Constant Current Source	1.30
LM135Z	Temperature Transducer	1.40
LF356N	JFET Input Op Amp	1.10
LF398N	Sample & Hold Amplifiers	3.95
LM399H	Temp. Comp. Prec. Ref. (5ppm/C°)	6.95
ADC0804LCN	8-Bit A/D Converter (1 LSB)	4.95
DAC0806LCN	8-Bit D/A Converter (0.19% Lin.)	2.25

DATA ACQUISITION (CONTINUED)

ADC0809CCN	8-Bit A/D Converter (8-Ch. Multi.)	5.25
ADC0817CCN	8-Bit A/D Converter (16-Ch. Multi.)	10.95
DAC1000LCN	10-Bit D/A Conv. Micro. Comp. (0.05%)	13.95
DAC1008LCN	10-Bit D/A Conv. Micro. Comp. (0.20%)	8.95
DAC1020LCN	10-Bit D/A Converter (0.05% Lin.)	6.49
DAC1021LCN	10-Bit D/A Converter (0.20% Lin.)	5.95
DAC1222LCN	12-Bit D/A Converter (0.20% Lin.)	9.95
CD4051N	8-Channel Multiplexer	1.19
AY-5-1013	20K BAUD UART	6.95

RAM'S

2101	256x1 Static	1.49
1103	1024x1 Dynamic	.99
2111 (8101)	256x4 Static	3.95
2102	1024x1 Static	1.75
2102L	1024x1 Static	1.95
2111 (8111)	256x4 Static	3.95
2112	256x4 Static MOS	4.95
2114	1024x4 Static 450ns	5.95
2114L	1024x4 Static 450ns Low Power	6.95
2114-3	1024x4 Static 300ns	7.49
2114L-3	1024x4 Static 300ns Low Power	7.95
2117	16,384x1 Dynamic 350ns (house marked)	4.95
4116 (UPD416)	16K Dynamic 250ns	9.95
MM2147J	4096x1 Fast 70ns	19.95
5101	256x4 Static	7.95
MM5261	1024x1 Dynamic Fully Decoded	.99
MM5262	2Kx1 Dynamic	.25
MM5280/2107	4096x1 Dynamic	4.95
MM5290J-2(4116)	16K Dynamic 150ns (UPD416)	6.95
MM5298J-3A	8K Dyn. 200ns (lower ½ of MM5290J)	4.95
7489	16x4 Static	1.75
UPD434/MK4027	4K Dynamic 16-pin	8.88
TMS4044-45NL	4K Static	14.95
TMS4045	1024x4 Static	14.95

PROMS/EPROMS

1702A	2K UV Erasable PROM	5.95
2708	8K EPROM	9.95
TMS2716	16K EPROM (5V, +5V, +12V)	19.95
2716Intel(2516)TI	16K EPROM (Single +5V)	17.95
2732Intel(2532)TI	32K EPROM	49.95
2758	8K EPROM (450ns) (Single +5V)	7.95
5203	2048 PROM	14.95
82S23(74S188)	32x8 PROM (Open Collector)	4.85
82S115	4096 Bipolar PROM	19.95
82S123(74S288)	32x8 Tri-State Bipolar PROM	4.95
82S185	8K PROM	29.95

ROM'S

2513(2140)	Character Generator (Upper Case)	9.95
2513(3021)	Character Generator (Lower Case)	9.95
2516N	Character Generator	10.95
MM5230*	2048 (8x1 Read Only Memory	1.95

NMOS READ ONLY MEMORIES

MCM6670P	128x9x7 ASCII Shifted w/Greek	13.50
MCM6749P	128x9x7 Math Symbol & Pictorial	13.50
MCM6750P	128x9x7 Alpha, Control Char. Gen.	13.50

MICROPROCESSOR MANUALS

M-Z80	User Manual	7.50
M-8CDP1802	User Manual	7.50
M-2650	User Manual	5.00

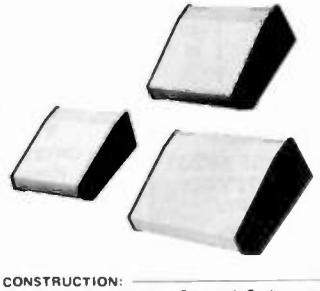
SPECIAL FUNCTION

DS0025CN	Dual MOS Clock Driver (5MZ)	3.50
DS0026CN	Dual MOS Clock Driver (5MZ)	3.95
INS1771N-1	Floppy Disc Controller	29.95
INS2661N	Communication Chip	19.95
MM5387N	Microprocessor Real Time Clock	14.95
MM5314N	Microprocessor Compatible Clock	11.95
COP402N	Microcontroller with 64-Digit RAM and Direct LED Drive	9.95
COP402MN	Microcontroller with 64-Digit RAM & Direct LED Drive w/N Buss Int.	7.49
COP470N	32-Seg VAC Fluor. Driver (20-pin pkg.)	3.25

TELEPHONE/KEYBOARD CHIPS

AY-5-9100	Push Button Telephone Dialer	14.95
AY-5-9200	Repertory Dialer	19.95
AY-5-9500	CMOS Clock Generator	4.95
AY-5-23A	Keyboard Encoder (66 keys)	11.95
HD0165-5	Keyboard Encoder (56 keys)	7.95
74C922	Keyboard Encoder (16 keys)	5.49
74C923	Keyboard Encoder (20 keys)	5.75
MM5369N	Push Button Pulse Dialer	7.88
MM57109N	98/64-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:
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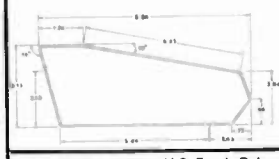

Enclosure Model No.	Panel Width	PRICE
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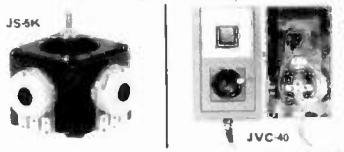

JS-5K

JVC-40

JS-5K	5K Linear Taper Pots	$5.25
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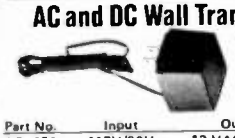

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JE610/DTE-AK (as pictured above) ... $124.95
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DTE-AK (case only — 3¾"Hx11"Wx8¾"D) $ 49.95

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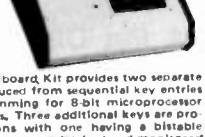

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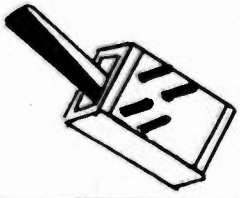

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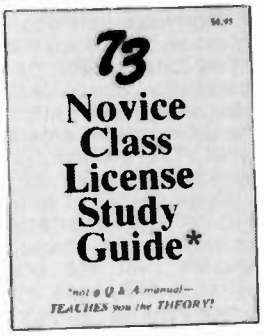

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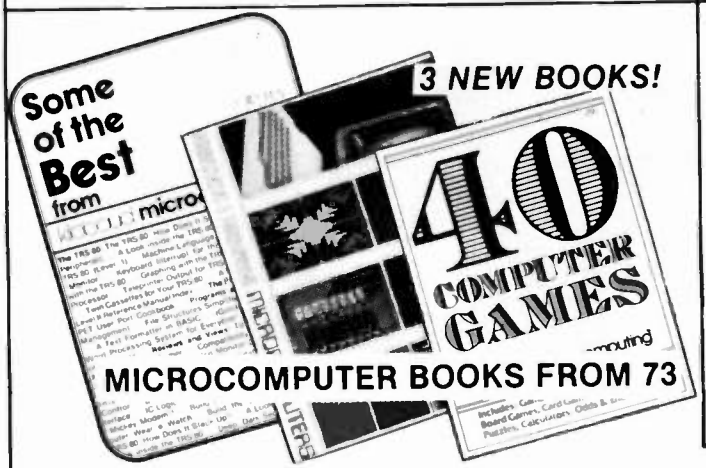

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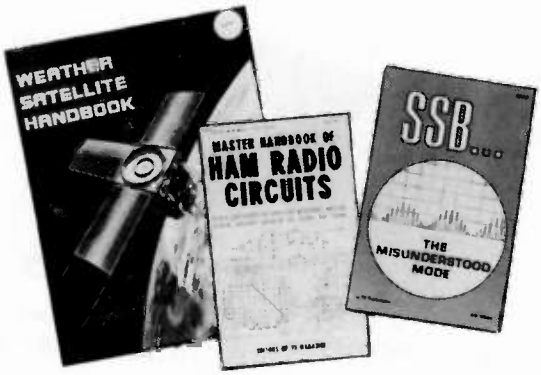

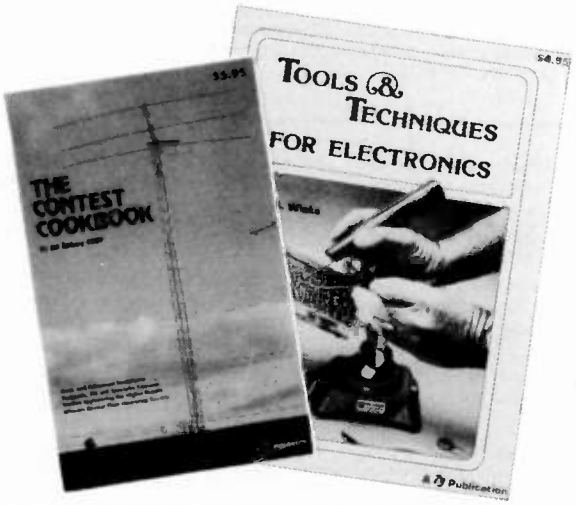

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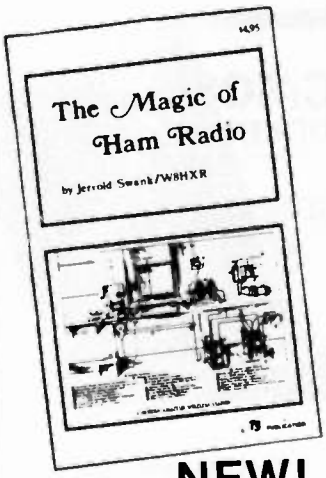

NEW!

● **THE MAGIC OF HAM RADIO** – BK7312 – by Jerrold Swank, W8HXR begins with a brief history of amateur radio and of Jerry's involvement in it. Part 2 details many of ham radio's heroic moments. Hamdom's close ties with the continent of Antarctica are the subject of Part 3. In Parf 4 the strange and humorous sides of ham life get their due. And what of the future? Part 5 peers into the crystal ball. $4.95.*

● **A GUIDE TO HAM RADIO** – BK7321 – by Larry Kahaner WB2NEL. What's Amateur Radio all about? You can learn the basics of this fascinating hobby with this excellent beginner's guide. It answers the most frequently asked questions in an easy-going manner, and it shows the best way to go about getting an FCC license. A Guide to Ham Radio is an ideal introduction to a hobby enjoyed by people around the world. $4.95.*

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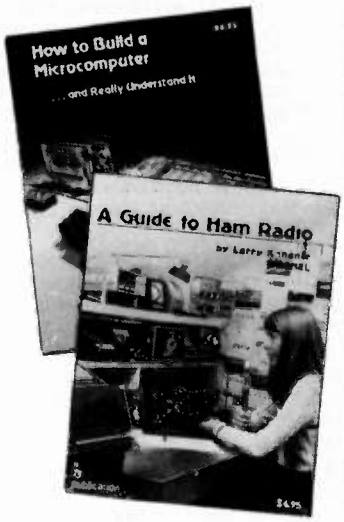

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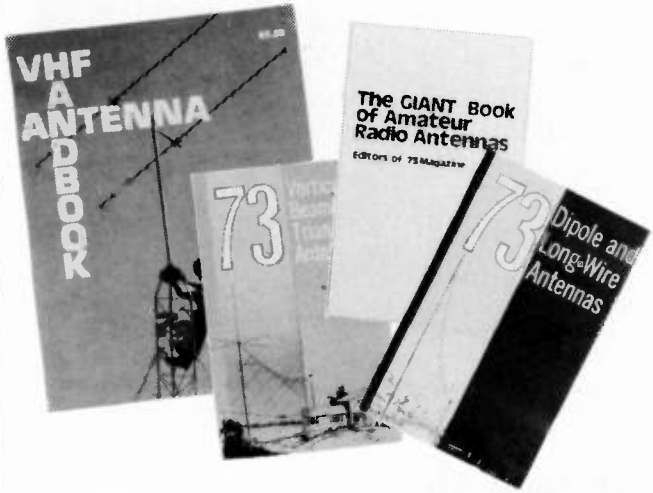

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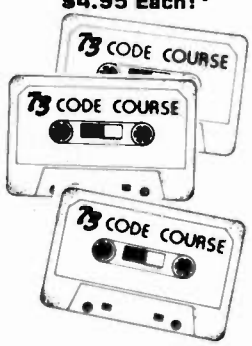

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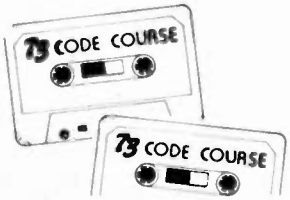

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I. What is your age?
1. Under 18
2. 18–22
3. 23–30
4. 31–40
5. 41–60
6. Over 60

II. Are you living on a fixed, or retirement, income?
A. Yes
B. No

III. How long have you been a ham?
1. Less than one year
2. 1–5 years
3. 6–10 years
4. 11–25 years
5. Over 25 years

IV. What class license do you hold?
A. Novice
B. Technician
C. General
D. Advanced
E. Amateur Extra
F. Not licensed

V. Are you an ARRL member?
1. Yes
2. No

VI. If yes to question 5, please indicate membership.
A. Regular
B. Life

VII. How much time do you spend hamming?
1. Less than 10 hours per week
2. More than 10 hours per week

VIII. Is Amateur Radio your only hobby?
A. Yes
B. No

IX. Please list your other major interests.
1. Computers
2. Flying
3. Photography
4. Outdoor sports

X. Do you belong to an Amateur Radio Club?
A. Yes
B. No

XI. If yes to above, does your club have a Novice or newcomers class?
1. Yes
2. No

XII. Do you plan to build any equipment during the next year?
A. Yes
B. No

XIII. Did you build any equipment during the past year?
1. Yes
2. No

XIV. Do you own a microcomputer?
A. Yes
B. No

XV. Do you plan to purchase a microcomputer during the next year?
1. Yes
2. No

XVI. If you are not a subscriber please circle 500.

1	6	11	16	21	126	131	136	141	146	251	256	261	266	271	376	381	386	391	396
2	7	12	17	22	127	132	137	142	147	252	257	262	267	272	377	382	387	392	397
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4	9	14	19	24	129	134	139	144	149	254	259	264	269	274	379	384	389	394	399
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26	31	36	41	46	151	156	161	166	171	276	281	286	291	296	401	406	411	416	421
27	32	37	42	47	152	157	162	167	172	277	282	287	292	297	402	407	412	417	422
28	33	38	43	48	153	158	163	168	173	278	283	288	293	298	403	408	413	418	423
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30	35	40	45	50	155	160	165	170	175	280	285	290	295	300	405	410	415	420	425
51	56	61	66	71	176	181	186	191	196	301	306	311	316	321	426	431	436	441	446
52	57	62	67	72	177	182	187	192	197	302	307	312	317	322	427	432	437	442	447
53	58	63	68	73	178	183	188	193	198	303	308	313	318	323	428	433	438	443	448
54	59	64	69	74	179	184	189	194	199	304	309	314	319	324	429	434	439	444	449
55	60	65	70	75	180	185	190	195	200	305	310	315	320	325	430	435	440	445	450
76	81	86	91	96	201	206	211	216	221	326	331	336	341	346	451	456	461	466	471
77	82	87	92	97	202	207	212	217	222	327	332	337	342	347	452	457	462	467	472
78	83	88	93	98	203	208	213	218	223	328	333	338	343	348	453	458	463	468	473
79	84	89	94	99	204	209	214	219	224	329	334	339	344	349	454	459	464	469	474
80	85	90	95	100	205	210	215	220	225	330	335	340	345	350	455	460	465	470	475
101	106	111	116	121	226	231	236	241	246	351	356	361	366	371	476	481	486	491	496
102	107	112	117	122	227	232	237	242	247	352	357	362	367	372	477	482	487	492	497
103	108	113	118	123	228	233	238	243	248	353	358	363	368	373	478	483	488	493	498
104	109	114	119	124	229	234	239	244	249	354	359	364	369	374	479	484	489	494	499
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