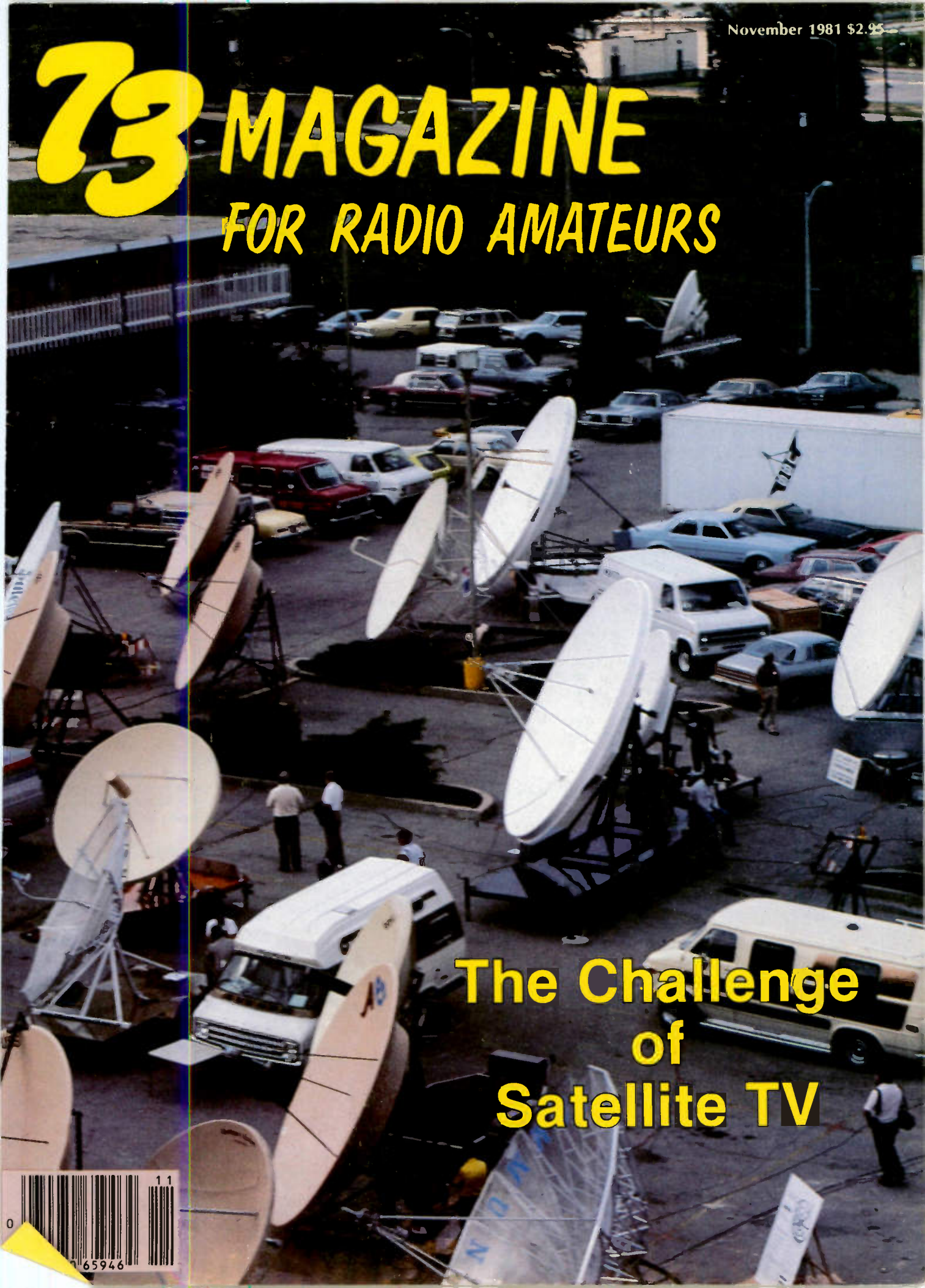
November 1981 $2.95

73 MAGAZINE

FOR RADIO AMATEURS



The Challenge of Satellite TV

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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TS-130S

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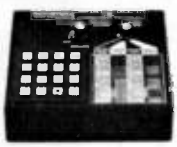

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Regular $3185
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Contributions in the form of manuscripts with drawings and/or photographs are welcome and will be considered for possible publication. We can assume no responsibility for loss or damage to any material. Please enclose a stamped, self-addressed envelope with each submission. Payment for the use of any unsolicited material will be made upon acceptance. All contributions should be directed to the *73* editorial offices. "How to Write for 73" guidelines are available upon request.

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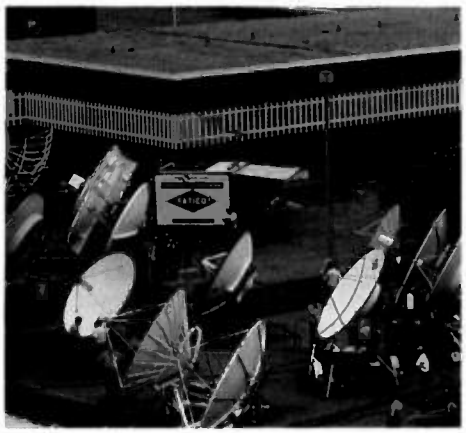
nov. 81

73 MAGAZINE



Cover: More than 50 satellite antennas were on hand at an August, 1981, trade show and seminar in Omaha, Nebraska. Photo by Tim Daniel N8RK.

W2NSD/1
NEVER SAY DIE

editorial by Wayne Green

DARKEST AFRICA

What would *you* say if the phone rang one day and someone offered you an all-expenses paid trip to Africa . . . for two?

It was July 4th, a Saturday, and I was sitting there writing an editorial. Weekends are the only time when there are no interruptions and I can concentrate on writing, so I was annoyed when one of the phones rang. I got all over the aggravation when I found I was talking with South Africa . . . that there was going to be a microcomputer exposition in Johannesburg in a month and they wanted me to come down at their expense to address the group.

With a new magazine being launched in September, I was hesitant. We have a lot riding on the success of *Desktop Computing* and I didn't want to take any chances.

When they threw in short visits to Swaziland and Lesotho, I was hooked. With 99 countries visited so far, this would put me well over one hundred. Plus I wanted to know what was going on in South Africa as far as both amateur radio and computers are concerned and there is nothing like a personal visit.

It had been 15 years since I had been to Africa, with the exception of Egypt. In 1966, I talked some other hams into going over for a hunting safari in Kenya, using as my guide a book by Herter on how to go on safari for $660. We'd visited Kenya, Uganda, and Tanzania at the time and my impression was that all of these countries were headed away from civilization, with the latter two going back to the bush the fastest.

Sherry looked over the routing to South Africa and found that the best (lowest cost) route was via Rio de Janeiro on the way over and via Nairobi in Kenya on the way back. The overnight stop in Rio would help us to get to South Africa rested, so that was a good move. I had her add a little to the Nairobi stopover so we could see the town, visit the game park, and even get down to the south coast of Kenya, below Mombasa, for a couple days of rest on the Indian Ocean. This would give me a chance to compare Kenya of today with what I'd seen 15 years ago.

The first big hassle was getting the visas for all of those countries within a few days. This had to be done in Washington, so we brought along our passports and the reams of papers, photographs, and visa fees when we went down to meet with the new chairman of the FCC, Mark Fowler. A professional visa expediter worked hard on it and got the passports back to us at Kennedy Airport in New York just minutes before our departure. That's enough to push anyone ulcer-prone over the edge.

Just to add to the comfort and relaxation of my trip, things were coming to a head at home on Hawthorne-Green Institute, a cooperative deal with a local college in New Hampshire to teach computing using our staff and laboratory, a prospective new magazine (which had me flying to California and New York in the last few days before taking off for Africa), two other prospective magazines (more traveling), and contracts with three microcomputer firms for software development (more travel).

A call from South Africa assured me that my ham licenses had been taken care of for ZS, 3D6, and 7P8, complete with rigs to use in all three countries. The first reports were that the 7P8 was impossible, that no licenses had been issued in ages, but then at the last minute they got it through. A small plane had been chartered for the 3D6-7P8 trip.

Finally, exactly one month after that phone call from South Africa, Sherry and I were on a Pan Am plane heading for Rio and Johannesburg. We had our passports and visas, a change of clothes, lots of cameras and film, and hopes for an opportunity to help both amateur radio and computing to grow.

What would I find in Africa? In 1966, I had seen the disintegration of Uganda as a result of the transfer of power to the blacks. They had forced the white farmers to leave the country, with the result that the farms, which had been the major source of income for Uganda via their exporting of coffee, sugar, and food, had virtually gone out of business. I saw hundreds of deserted farms and little left in the way of crops. I suspect that this weakened the country and made possible the takeover by Amin a short while later.

Next they threw out the Asians, who had been running almost 100% of the small businesses and stores, effectively destroying what was left of the economy of the country. Tanzania followed a similar pattern, as discussed in detail in a book *South of the Moon*, by Lyttel. Both countries were heading rapidly away from civilization . . . back to the bush.

In Kenya, the first president, Jomo Kenyatta, kept the white and Asian infra-structure relatively intact, thus preserving the country much better than the others. When Kenyatta died three years ago, he was succeeded by President Moi and I wondered what changes I would see.

When I visited Kenya 15 years ago, there was hope for some black hams. Would there be any now? Any DXer knows that there are very few active hams in all of Africa . . . and how many of you have ever worked a black amateur in Africa? I wanted to know what the possibilities are for developing black amateurs in

W2NSD/1 ON-THE-AIR SCHEDULE NOVEMBER, 1981

Date	Band/Mode
3	15-20m Phone
10	20m RTTY
17	15-20m Phone
24	20-40m Phone

We'll be on the air 7:00-10:00 pm eastern time on the dates listed above. Look for us in the first 25 kHz of the General class portion of the band. When two bands are listed, we'll spend 90 minutes on the first band and then switch to the second.

Power up.

40 W, 15 memories/offset recall, scan, priority, DTMF touch-pad

TR-7850

Kenwood's remarkable TR-7850 2-meter FM mobile transceiver provides all the features you could desire, including a powerful 40 watts RF output. Frequency selection is easier than ever, and the rig incorporates new memory developments for repeater shift, priority, and scan, and includes a built-in autopatch touch-pad (DTMF) encoder. A 25-watt output version, the TR-7800, is also available.

TR-7850 FEATURES:

- **Powerful 40 watts power output**
  Selectable high or low power operation. High 40-watt output provides reliable signal for wide area coverage.
- **15 multifunction memory channels, easily selectable with a rotary control**
  M1-M13...memorize frequency and offset (±600 kHz or simplex). M14...memorize transmit and receive frequencies independently for nonstandard offset. M0...priority channel, with simplex, ±600 kHz, or nonstandard offset operation.
- **Internal battery backup for all memories**
  All memory channels (including transmit offset) are retained when four AA NiCd batteries (not Kenwood supplied) are installed in battery holder inside TR-7850. Batteries are automatically charged while transceiver is connected to 12-VDC source.
- **Extended frequency coverage**
  143.900-148.995 MHz, in switchable 5-kHz or 10-kHz steps.
- **Priority alert**
  M0 memory is priority channel. "Beep" alerts operator when signal appears on priority channel. Operation can be switched immediately to priority channel with the push of a switch.
- **Built-in autopatch touch-pad (DTMF) encoder**
  Front-panel touch pad generates all 12 telephone-compatible dual tones in transmit mode, plus four additional DTMF signaling tones (with simultaneous push of REV switch).
- **Front-panel keyboard**
  For frequency selection, transmit offset selection, memory programming, scan control, and selection of autopatch encoder tones.
- **Autoscan**
  Entire band (5-kHz or 10-kHz steps) and memories. Automatically locks on busy channel; scan resumes automatically after several seconds, unless CLEAR or mic PTT button is pressed to cancel scan.
- **Up/down manual scan**
  Entire band (5-kHz or 10-kHz steps) and memories, with UP/DOWN microphone (standard).
- **Repeater reverse switch**
  Handy for checking signals on the input of a repeater or for determining if a repeater is "upside down."
- **Separate digital readouts**
  To display frequency (both receive and transmit) and memory channel.
- **LED bar meter**
  For monitoring received signal level and RF output.
- **LED indicators**
  To show: +600 kHz, simplex, or -600 kHz transmitter offset; BUSY channel; ON AIR.
- **TONE switch**
  To actuate subaudible tone module (not Kenwood-supplied).
- **Compact size**
  Depth is reduced substantially.
- **Mobile mounting bracket**
  With quick-release levers.

More information on the TR-7850 is available from all authorized dealers of Trio-Kenwood Communications 1111 West Walnut Street, Compton, California 90220.

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...paceseller in amateur radio

Matching accessory for fixed-station operation:
- KPS-12 fixed-station power supply for TR-7850

Other accessories not shown:
- KPS-7 fixed-station power supply for TR-7800
- SP-40 compact mobile speaker

Specifications and prices are subject to change without notice or obligation.

Africa. I felt that if amateur radio is going to get the support it needs from the 57 countries of Africa, black amateurs are a must.

The flight to Brazil is much like those to Europe, only longer. You leave in the evening and arrive early the next morning, pooped. At best, I get no more than short naps on a plane. Between the frequent meals, the movies, people walking around and talking, and the crying children, there is little peace on these long flights.

One day is not enough to really see all of Brazil, let alone Rio. We arrived early in the morning to find the city heavily hazed over and went straight to our hotel and a catch-up sleep. That afternoon we visited some friends and laid the groundwork for a return visit to talk with the government in Brasilia about setting up ham clubs in the high schools.

Brazil, as you may have read in the September *Reader's Digest*, is aiming to become a high-technology country. I pointed out to them that there is a parallel between the number of hams a country has and its electronics and communications technology. Since this is no coincidence, the best way to get the needed technicians and engineers is to get amateur radio growing in Brazil . . . in the high schools.

Early the next morning we were back on a plane, headed for Johannesburg. We got in around midnight, with some delays due to the air controllers'

Continued on page 164

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

by Bandel Linn K4PP

"Since you're arranging things for Field Day, let me suggest the use of my mountaintop ranch! Champagne and Reuben sandwiches will be provided by my staff . . ."

440 SYNTHESIZED

INTRODUCING SANTEC'S ST-7/T

SANTEC•NOLOGY breaks into the 440-band with style! The new ST-7/T synthesizes the entire band in 5 kHz steps, works both up and down repeater splits and does it all right from your hand, with versatile power options of 3 watts, 1 watt or even 50 milliwatts (all nominal), to reach out to where you want. The high power mode of 3 watts radiates on 440 like 5 watts on 2 meters ... and that's a handful!!

Tones? This one has them ... tones and subtones! The 16 button tone pad is a SANTEC Standard at no extra cost, and the ST-7/T's optional synthesized subtone encoder is controlled by the radio's front panel switch.

All the regular SANTEC accessories used with your HT-1200 fit the ST-7/T as well, meaning that you can enjoy both bands fully with a smaller cash investment. Grab the new SANTEC ST-7/T and join the fun on 440 MHz. See your SANTEC Dealer for delivery details*.

146 STILL THE LEADER

HT-1200

SANTEC'S popular HT-1200 is the incomparable 2 meter leader. This little rig is handing over quality, power and features that you'd expect from something nearer the size of a bread box. SANTEC packs a 2 meter ham shack into the palm of your hand!

You can carry scan, search, 10 memories and fully synthesized key pad control around with you and still get out with a big 3.5 watts (nominal). Compare them apples to anything you want, and settle for nothing less.

*Sale of the ST-7/T is subject to FCC Certification.

SANTEC

✓24

The SANTEC HT-1200 is approved under FCC Part 15 and exceeds FCC regulations limiting spurious emissions.

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79.7 1650
77.0 1600
74.4 1500
71.8 1000
67.0 800
OFF
118.6 2100
123.0 2150
127.3 2200
131.8 2250
136.5 2300
141.3 2350
146.2 2400
151.4 1209
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173.8 1138
179.8 2175
186.2 1477
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203.5 2805
Communications Specialists TE-64

Food for thought.

Our new Universal Tone Encoder lends it's versatility to all tastes. The menu includes all CTCSS, as well as Burst Tones, Touch Tones, and Test Tones. No counter or test equipment required to set frequency-just dial it in. While traveling, use it on your Amateur transceiver to access tone operated systems, or in your service van to check out your customers repeaters; also, as a piece of test equipment to modulate your Service Monitor or signal generator. It can even operate off an internal nine volt battery, and is available for one day delivery, backed by our one year warranty.

- All tones in Group A and Group B are included.
- Output level flat to within 1.5db over entire range selected.
- Separate level adjust pots and output connections for each tone Group.
- Immune to RF
- Powered by 6-30vdc, unregulated at 8 ma.
- Low impedance, low distortion, adjustable sinewave output, 5v peak-to-peak.
- Instant start-up.
- Off position for no tone output.
- Reverse polarity protection built-in.

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: $79.95

master charge VISA

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✓15

Wilson Microwave Systems

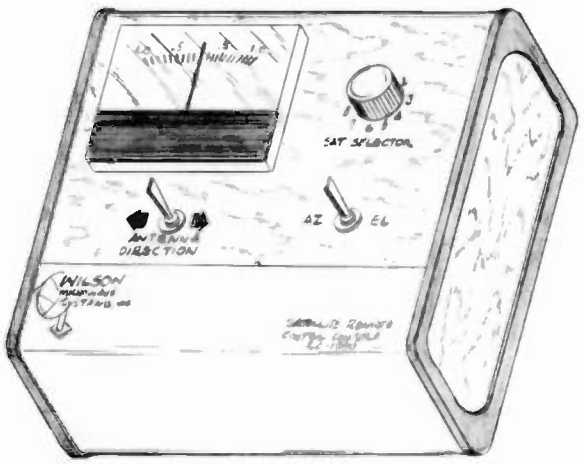
Wilson Microwave Systems uses the latest state of the art method of manufacturing the parabolic designed antenna. Resistance to distortion and instability is increased with the addition of a full screen mesh sealed within the ¼" thick fiberglass.

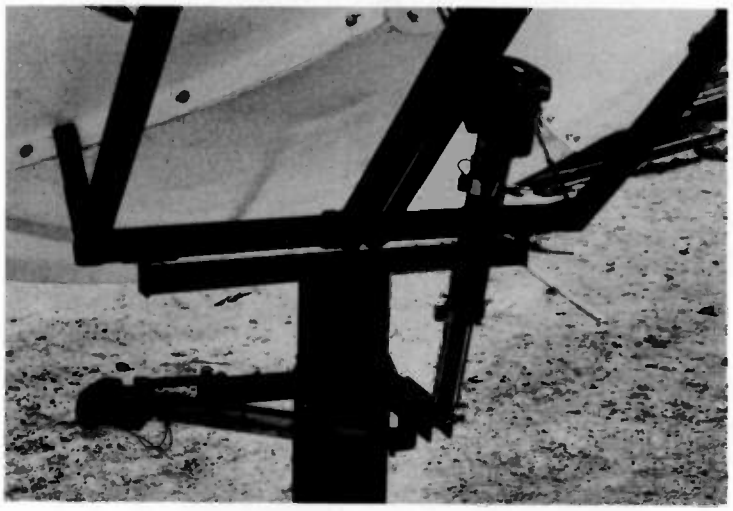
Wilsons unique "Vari-Mount" provides the easiest installation and mounting method available today. The 4pc construction of the dish provides easier handling, less installation time, and greatly reduced shipping costs.

With the exclusive 4 point Williams' mount, you are assured a quicker installation and that the antenna will be more securely fastened to the Vari-Mount. The antenna struts aid in stabilizing the fiberglass for operational reception in winds of up to 50 - 60 MPH.

A ball bearing race allows easy turning of the antenna in changing to the different satellites. A scale is included on the base to assist in their location.

For those areas that require a larger dish than the 3.35 meter, Wilson offers an addition that will increase the size to 4.0 meter. It is easily bolted to the outer edge and maintains the strength, while increasing the performance.





The optional remote control feature allows you to control movement of the azimuth and elevation positions of the antenna from the comfort of your easy chair — without having to go outside. This feature may be added later.

Wilson can now supply you with a complete system for turnkey operation that includes everything that is required for installation. The package includes the fiberglass 11' antenna featured above, receiver, 120° LNA, modulator, and all cables required. Many options are available.

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The Satellite TV Challenge

—73 Magazine's answer

Tim Daniel N8RK
73 Magazine Staff

International Crystal was one of the first firms to enter the home satellite TV market. They have expanded their line to include accessories that help make a good signal become better.

Welcome to the satellite TV challenge. This issue of *73 Magazine* marks the start of a regular section devoted to the rapidly advancing TVRO (Television Receive Only) field. We at *73* are quite excited about this promising, virtually untapped, technology.

Why Satellite TV?

Hams are innovators. They make complex and expensive technology understandable and affordable. As a magazine, *73* has been in the forefront of amateur radio's innovations, first pushing solid-state gear, SSB, FM and repeaters, and, more recently, popularizing microcomputers. Along the way, *73* has shown that the spirit of ham radio is not confined to the spectrum and privileges allotted to us by the FCC. Similarly, satellite TV is more than just watching "free" movies. Don't take our word on it: read WA1DCP and W2IKQ's article, "Space Spinoffs," in this issue. There you will see that much of the pioneer work behind the home satellite TV industry has

R. L. Drake is a name that hams recognize. Their stylish TVRO receiver drew a crowd at SPTS Omaha. (See New Products section in this issue.) Drake is marketing the receiver in conjunction with another well-known amateur radio firm, Hoosier Electronics.

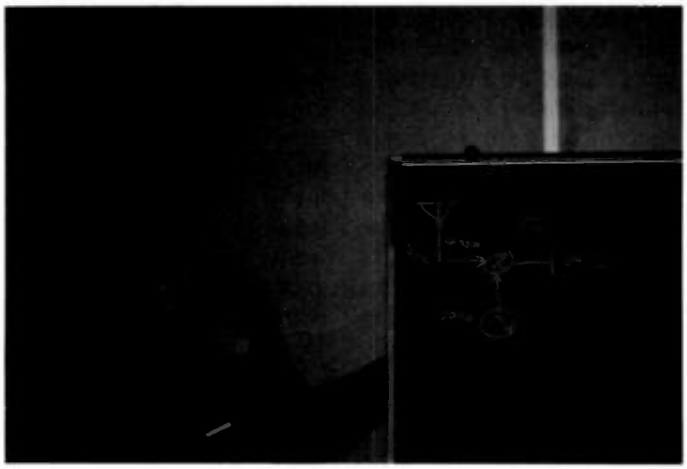
been done by hams. What does the future hold? That depends on you!

Natural Highs

Remember the thrill that accompanies the completion of a piece of homebrew gear or a kit? Or, how about the excitement each time you work a new country? These kinds of natural highs are part of the satellite TV world, too. Sure, you can spend a fistful of bucks to have someone install and debug a TVRO system. But, for a real adrenaline rush, put together your own system. When everything is finally in place and those first pictures appear after traveling 22,000+ miles, you will be *very* excited. Even then, your work is not finished. There are new satellites to find, picture quality to improve on, etc. The challenge and sweet feeling of success are waiting for you.

Getting Started

The satellite TV field is not what engineers call "steady state." You can't rely on things staying the same, nor can you expect to learn everything overnight. Getting started means a willingness to learn. There are new buzzwords to master and a new industry to become familiar with. For

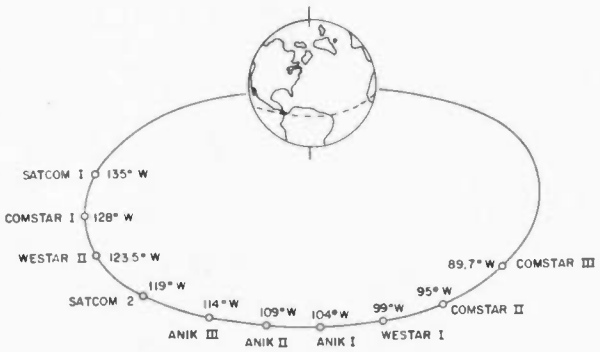


Hamfest attendees will probably recognize this smiling face. John Ramsey is the man behind the Ramsey Electronics booth. Sat-Tec, a subsidiary of Ramsey Electronics, is manufacturer of satellite receivers. John took time out at the SPTS satellite TV seminar in Omaha to share some of the secrets of designing and building low cost TVRO gear.

SATELLITE TV BASICS

Stephen Gibson
PO Box 38386
Hollywood CA 90038

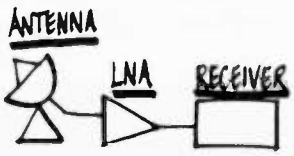
Nearly all of the TV satellites are in geostationary orbit around the Earth's equator. This belt is known as the Clarke belt, after famed science fiction author Arthur C. Clarke suggested the idea of orbiting relay stations back in the forties. The satellites are sometimes called "birds" and are located about 22,300 miles above the surface of the planet. Because they turn with the same speed as the Earth, they appear to be standing still. An antenna pointed at a Clarke orbit satellite does not have to be moved.



Geosynchronous satellites are located in the Clarke belt. This diagram includes only those birds that carry regular video programming.

The uplink is in the 5.9-to-6.4-GHz band. The mode is wideband FM video. Each satellite has either 12 or 24 transponders depending on design. Channel bandwidth is 40 MHz, but neglecting guard bands, practical bandwidth is 30 MHz. The sound is generally sent on a 6.2- or 6.8-MHz FM subcarrier. Downlink is in the 3.7-to-4.2-GHz band. Ma Bell here on Earth shares these frequencies and nearly dominates the band in metropolitan areas. Bell carriers are offset ±10 MHz from satellite carriers, so traps in the I-f can sometimes knock Ma Bell out of the picture.

The 24-channel birds use a method of frequency reuse to get the 12 extra channels. The trick is simply to send 12 channels vertically polarized and the other 12 horizontally polarized. Polarization is relative to the North Pole or the antenna skew angle on the bird and not your location.



Three-piece Earth station.

You need only three items to receive satellite TV:

1) A large dish-type antenna with a gain of 38 dB or more at 4 GHz. It depends on your geographical location and can be calculated (see "How Big a Dish?"). Surface accuracy of the dish must be within 1/8 inch to achieve any efficiency. A TV antenna rotator can be used to change antenna feed polarization. The types of antenna mounts are varied, but generally fall into two categories: polar mounts which have one turning axis and are similar to those used by astronomers, and azimuth/elevation mounts having two turning axes similar to those used by OSCAR chasers. Adjustable mounts are desirable now that several satellites have programming.

2) A preamplifier, known in the jargon as an LNA (low noise amplifier), boosts the very weak signal. It is a broadband design covering 3.7 to 4.2 GHz with 30 to 50 dB gain and a 1-to-2-dB noise figure. The GaAsFET transistors used in LNAs achieve these noise figures with ease at this frequency, but require care in handling. Careful choice of LNA noise figure and dish antenna gain are very important to receiving noise-free pictures. To avoid signal loss, the LNA is generally located at the dish antenna feedpoint which, for a parabolic dish, would be at the dish focus or focal point. A feedhorn of circular or rectangular design couples the LNA to the dish.

3) The LNA output is fed down low-loss coax to an FM receiver similar to that used by Ma Bell in the same frequency band. Sensitivity must be something around −50 to −60 dBm with a 10-to-15-dB noise figure. A received carrier-to-noise ratio of at least 10 dB will yield good pictures once the FM threshold of the receiver is exceeded. Noise or snow on the TV screen is referred to as sparklies. I-f bandwidth usually is somewhere between 20 and 30 MHz. Dual conversion is used, but single conversion designs are gaining in popularity. Subcarrier detectors recover the FM sound. The sound and video outputs of the receiver can feed a TV monitor, your VTR, or a modulator to get the signal into VHF or UHF for your TV receiver.

an introduction in a nutshell, read Stephen Gibson's "Satellite TV Basics," included here. From there you might want to tackle "How Big a Dish?", also included in this issue. All of this is just a fraction of the information we hope to bring to you via the pages of *73*. Whether you want to dive right in or just ease into the satellite TV challenge, we'll be here to show you the way.

What Good Is It?

Satellite TV can be more than just a technical toy. A TVRO system is a great way to educate and entertain your family. There are hundreds of hours of top-quality, commercial-free television available each week. For a glimpse at what satellite TV offers, see the "Satellite Channel Guide" in this issue. While there are important legal issues to consider, don't be put off by someone that says a home satellite receiver is illegal. That just isn't so. In a future issue we will have an in-depth look at the legal issues surrounding satellite TV.

Opportunity Knocks

Don't be surprised if you see a lot of familiar-looking names associated with the satellite TV industry. A recent satellite TV seminar and trade show in Omaha, Nebraska, was almost like a hamfest, with companies like R.L. Drake, KLM, and Wilson exhibiting the latest in home satellite gear. Individual hams and manufacturers are finding a lucrative market in satellite TV. Like any other growing field, it takes initiative to make it, but the opportunities are there. (For an intense three-day exposure to the commercial and technical aspects of home satellite TV, consider attending the next Satellite Private Terminal Seminar, sponsored by STTI, Box G, Arcadia OK.)

73 Magazine's coverage of the satellite TV challenge is not possible without your help. A key ingredient to our efforts is advertising. Please tell manufacturers "I saw your ad in *73*." Another reader responsibility involves filling out and returning the Reader Service card that accompanies each issue.

If you are working on something new, please take the time to share your knowledge with all of us. Input in the form of articles, product reviews, and ordinary letters is welcome. You can be sure that we will carefully consider your comments, but it may not be possible to answer all correspondence directly. ■

UPCOMING ARTICLES

"Bob Cooper: Profile of a Pioneer"
"Satellite Channel Guide, Part II"
Stephen Gibson on receivers
Product reviews and construction articles
"Satellite TV Glossary"

KLM, a big name in ham radio antennas, has joined the satellite game with several complete systems. Their automated tracking system allows you to turn your dish from bird to bird from the comfort of your living room.

While the experts debate the relative merits of spherical antennas like the one shown here, hobbyists are finding new and simpler ways to build this inexpensive "8-ball" design.

Reader Service for facing page ↙74→

Now the stars are within your reach

Movie Stars
Concert Stars
Sports Stars

Your favorite stars are coming off the satellites right now in one of the greatest selections of family and adult entertainment ever offered. And now there's a new satellite receiver system that puts it all within your reach — at a price that's within reach.

The new Heathkit Earth Station

It includes a *3-meter Satellite Antenna* with a single-axis adjustable mount that lets you direct your antenna to receive signals from the entire satellite arc. It's a heavy-duty, commercial-quality antenna, made by Scientific-Atlanta and designed for long, reliable performance.

Special Low-Noise Amplifier and Down-Converter converts signals to 500 MHz band for transmission on ordinary TV cable.

The Receiver features electronically-synthesized tuning for stable, drift-free reception, and 24 channel selections for a broad variety of programming. It even includes a special Zenith Space Command Remote Control so you can change programs without leaving your easy chair.

Special Earth Foundation Kit anchors your antenna firmly to withstand winds of up to 100 mph.

Unique Site Survey Kit

You can trust Heath to do it right. The first step in establishing your station is the purchase of a special Site Survey Kit that includes everything you need to determine a clear line-of-sight to the satellites. So you know your location is correct before you buy the Station.

Easy-to-follow, step-by-step assembly

Like all Heathkit products, the Satellite Earth Station includes a clearly written manual that guides you every step of the way through assembly and installation. And over-the-phone assistance is always available.

For complete details and prices on the Heathkit Earth Station and 400 other electronic kits for home, work or play, send today for the latest free Heathkit Catalog or visit your nearby Heathkit Electronic Center.

Send for free catalog

Write to Heath Co., Dept. 011-834, Benton Harbor, MI 49022

Visit your Heathkit Store

Heathkit products are displayed, sold and serviced at 56 Heathkit Electronic Centers in the U.S. See your telephone white pages for locations.

Heathkit Electronic Centers are units of Veritechnology Electronics Corporation

Viewing of some satellite TV channels may require the customer to obtain permission from, or make payments to, the programming company. The customer is responsible for compliance with all local, state and federal governmental laws and regulations, including but not limited to construction, placement and use. For use only in Continental U.S.

Heathkit

Space Spinoffs for Amateur Radio

— the makings of a communications revolution

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Revolutionary changes in amateur radio may be on the way. With the cost of backyard TVRO (television receive only) systems plummeting and the telecommunications industry gearing up for rooftop data and video business communications, new forms of space-age amateur radio communications are becoming feasible. Here are some of the mind-boggling possibilities:

- National or global two-way amateur satellite communications, 24 hours a day.
- Dramatically improved moonbounce communications, using low-cost TVRO dish antennas at microwave frequencies.
- And national packet-switched microwave-linked repeater networks for voice, electronic mail, and information-bank access.

Right now, there's over 1100 MHz of amateur spectrum to work with, virtually unused (see Fig. 1). And that

73 Magazine publisher Wayne Green W2NSD discusses the ham radio, satellite TV tie-in with Portus Barlow WA1DCP, president of Downlink.

1215-1300 MHz*
2300-2450 MHz
3300-3500 MHz*
5650-5925 MHz*
10-10.5 GHz*
24-24.25 GHz*
*Satellite operation permitted on part or all of band.

Fig. 1. Practical microwave amateur bands.

doesn't include the 31 GHz allocated above 24 GHz. Best of all, there is great promise for low-cost equipment becoming available for the bands between 1 and 24 GHz.

What equipment, you ask? Well, consider the mountain of gear available for 3.7-to-4.2-GHz satellite TV reception. Many hams have this equipment sitting in their backyards already, aimed at one of the eleven domestic (US and Canada) satellites. Hams already have played a key role in the TVRO technology that has exploded since Bob Cooper W5KHT "went public" in *TV Guide*. Here are some of the key developments:

- Bob Coleman K4AWB's plans for converting surplus microwave equipment.
- Oliver Swan's revolutionary low-cost "window screen" spherical antenna, capable of capturing signals from several satellites.
- Taylor Howard W6HD's low-cost, do-it-yourself TVRO-receiver design.
- Bob Luly KA6KBU's 22-pound, 12-foot, portable umbrella antenna.
- Steve Gibson's microcomputer-controlled antenna.
- Clyde Washburn's 24-channel, tunable TVRO receiver.

The result of all this innovation: under-$4000, consumer-TVRO systems. For an idea of what the future might hold, see the box.

"The next logical step is to start working on low-cost uplinking," says Stanford University Professor Taylor Howard. Let's take a look at how this might proceed. Right now, 1296 MHz seems to be the frontier, with just a handful of pioneers using the band for EME (moonbounce). Steve Mieth W6YFK, for example, is achieving EME echo with an 18-foot TVRO-style parabolic antenna, 80 to 100 Watts into the feed, and a preamp with a 1-dB noise figure. This sure beats those monster two-meter arrays and 1-kW rigs! Steve also has had some success on 2300 MHz with a similar setup. The 2300 band is interesting because of the dozens of companies manufacturing MDS receivers, as well as the surplus gear that is becoming available. Dxers with an eye on the 2400-MHz band may get a chance to try their hand at receiving signals from the UoSAT satellite, scheduled for launch this fall.

"The mystery is out of microwaves."

Another interesting band is 3.4 to 3.5 GHz which falls right below the 3.7-to-4.2-TVRO band. We could easily adapt low-cost TVRO low-noise amplifiers and antennas for this band, to say nothing of all that surplus Ma Bell and military gear available. Combine those possibilities with the 5.65-to-5.925-GHz band, which falls just below the 6-GHz uplink band. Power GaAs FETs and other transmitting devices are becoming available, so we theoretically have the basis of a full-blown amateur satellite communications system.

Consider this, again theoretically: Two Watts into the standard 12-foot-TVRO antenna is sufficient to communicate via a geostationary satellite with a 4-kHz-wide signal. For a full 36-MHz-wide video signal you'd need about five kilowatts.

That suggests some interesting possibilities. Why not lease a preemptable 4-kHz subcarrier on a commercial satellite? Think of it as a repeater with *very* good range! Say, the entire US, Canada, and Mexico! To keep things under control, an encryption circuit could be built right into the transponder receiver. This would allow the common carrier (RCA, Western Union, etc.) to shut out amateurs when the circuit was needed for another customer.

And what about the world of GHz and above? Hams are there experimenting, too, thanks to the commercial availability of Gunnplexers. The coming race for direct-broadcast satellite services will spin off some great equipment! Hams are already at 24 GHz during contests.

Taylor Howard W6HD offers some interesting thoughts about the specific developments that are in store for amateur radio. He sees antenna feed design, lower cost detectors, and microwave-frequency filtering on PC boards as key areas. On the uplink side, W6HD believes we need to develop low-cost solid-state amplifiers, high-stability multiplier chains, and inexpensive synthesizers. "The mystery is out of microwaves," Howard says, "and hams are the ones who will pioneer low-cost uplinking."■

Satellite TV net hams interested in satellite TV have been gathering on 20 meters, 14.310 MHz, starting at 1900 UTC on Sundays.

References

Robert Cooper, "The Satellite TV Primer," *73 Magazine*, November, 1979.

New Howard Manual, Coop's Operations Manual, Gibson Satellite Navigator, Washburn Receiver Manual, Nelson Antenna Manual, and *Coop's Satellite Digest* (monthly), all from STT, Box G, Arcadia OK 73007.

The Home Satellite TV Book, E. Terrence Easton, Playboy Press, February, 1982.

Satellite Channel Chart. Bimonthly guide to programming on all domestic satellites, including sports events. $15/year from WESTSAT Communications, Box 434, Pleasanton CA 94566.

SATGuide. Monthly guide to SATCOM I programming. $36/year from Commtek Publishing Co., Box 1700, Halley ID 83333.

What's Next?

Here's a sneak preview of what's coming in home satellite TV. Watch for:

- A $350 electronically-switched polarization device, eliminating need for mechanical rotation of the feed horn.
- An easy-to-build, complete TVRO pre-packaged kit for under $2,000.
- Microprocessor-controlled dish antennas and receivers for satellite selection and tracking, and transponder scanning and selection, all tied in with programmable VTRs.

How Big A Dish?

—Satellite Central, part I

Photos by Tim Daniel

Stephen Gibson enjoys both computers and Earth stations.

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Hollywood CA 90038

Beginning this month, I will cover the principles of satellite TV with an eye on details on how you can design and build or buy your own Earth station. In the months that follow, I will continue with the basics of each element of your TVRO (television receive only) terminal. I hope that this series, Satellite Central, will become a conduit for ideas and developments that will make construction and operation of your Earth station much easier.

I also hope to include satellite technical info and some program information of interest to add to the fun. There is more than just TV up on the satellites and we will cover every aspect in some detail so you can pursue your own brand of DX from the sky. This is an exciting new way for you to liven up your communications hobby because everyone around you can appreciate your efforts.

How Big A Dish? (Not All Locations Are Created Equal)

It seems appropriate to start off our discussion with antennas. Because the received-signal levels are very weak, we need rather high antenna gains. How much gain is needed? Good question. It works out that "where you are" is everything. Most of the birds with TV on them do not employ global-coverage antenna patterns. In fact, they are quite selective. Signal levels vary several dB over the continental United States.

Satellite designers predict the coverage patterns as "footprints" on a map. Fig. 1 is a footprint map for expected signal intensities from SATCOM 1, a very popular cable-TV bird. Despite the accuracy with which we can steer a *Voyager* probe into orbit around Saturn, we can predict only within a couple of dB or so what the signal level footprints will actually be. You may think that's very good (and it is), but it can make a big difference in your antenna (pocketbookwise) as we shall soon see.

Footprint Tracking Made Easy

The numbers on the map are signal levels in dBW (decibels above 1 Watt). They look pretty substantial. But the satellites are about 22,300 miles away, so there must be some loss. It works out to about −196 dB at 4 GHz. Using the center of the footprint, for example, where the power level is +36 dBW, the signal arriving here on Earth is really −160 dBW (+36−196 = −160 dBW), and that's weak! In fact, it's so weak that we don't have a receiver sensitive enough to get it! A typical TVRO receiver needs something like −80 dBW to work.

So we need gain and lots of it. Only one problem. The awful truth is that a yagi (even at Radio Shack specs) or a whole array of yagis don't have enough gain even if you could get them all to operate in phase. The antenna array needed to meet the receiver requirements would be gigantic and probably cost more than next year's national debt!

So why not add a preamp? Fine, but yagi antennas and the like also pick up terrestrial noise and a preamp won't make the noise go away; it'll just make it louder. Dish-design antennas are perhaps a better choice because they offer more gain per area/cost and they have narrow beamwidths which means they don't see as much noise. Table 1 is a list of practical antenna sizes and their gains.

6 feet	35.0 dB
8 feet	37.5 dB
10 feet	39.5 dB
12 feet	41.0 dB
15 feet	42.9 dB
20 feet	44.5 dB

Table 1. Typical dish antenna gains at 4 GHz based on diameter. These values can vary based on the efficiency of your feed arrangement and dish accuracy.

Note that a 20-foot dish has only about 44.5 dB gain, but we need 80 dB gain. Looks bad, doesn't it? So we're back to adding a preamp.

New problem. The preamp must have an excellent noise figure. In fact, the preamp has a special NASA-type designation called LNA, which is simply "low noise amplifier." It appears that we must somehow have enough antenna gain to overcome the incoming terrestrial noise and the noise generated by the LNA.

Noise is the Culprit

If we could find a place in the universe where there was no molecular activity we'd have a very quiet place. It would also be very cold. Radio astronomers use a scale known as the Kelvin scale to measure noise temperature in the sky. Zero degrees on the Kelvin scale is roughly some 273 degrees *below* zero degrees on the Centigrade scale. If we think of zero degrees Kelvin as zero activity and noise, then we have an absolute scale to measure noise in our system.

Typical sources of noise that can bother our TVRO

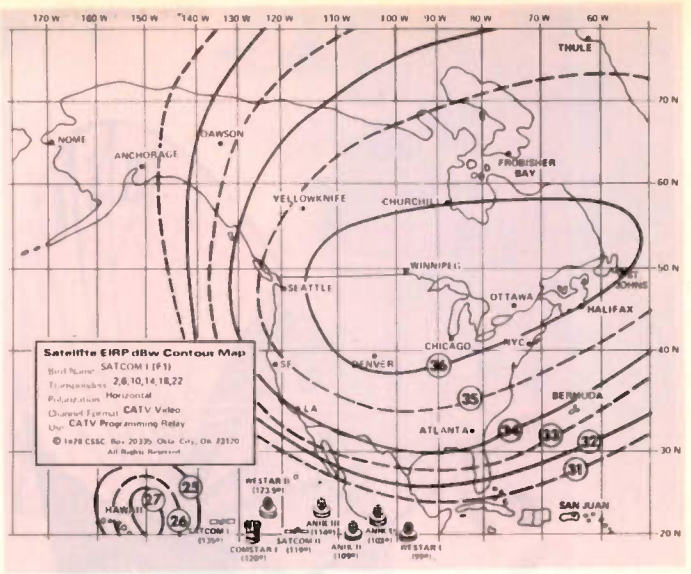

Fig. 1. Use this footprint map of antenna coverage patterns from SATCOM 1 to calculate the received signal level at your location. SATCOM and COMSTAR satellites have three other footprint patterns including this one for all 24 transponders. WESTAR and ANIK birds use a single pattern for all 12 transponders. WESTAR III, not shown, is at 90.0°.

Getting from here to there with a dish antenna requires some ingenuity. This is one company's answer to the problem.

An antenna shootout was featured at SPTS Omaha. It proved that all antennas are not created equal. Tests by two impartial engineers gave both manufacturers and buyers a chance to see which antennas were up to snuff.

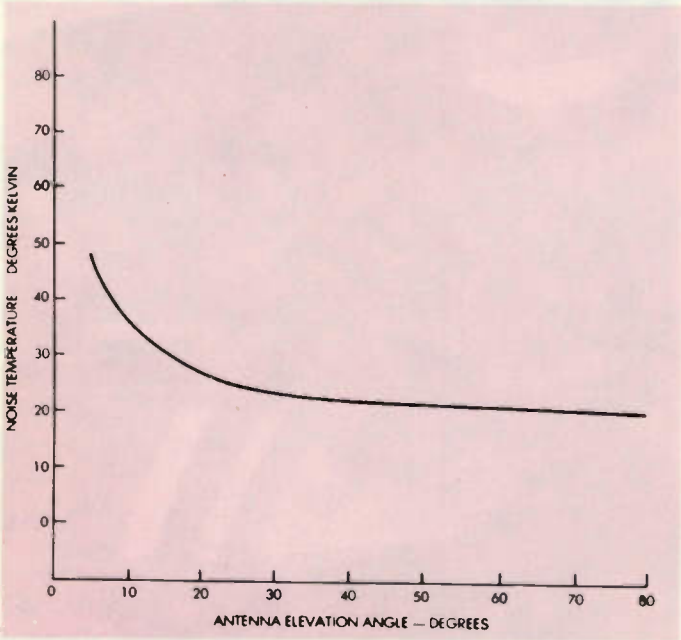

Fig. 2. Even large dishes intercept terrestrial noise, but the noise level drops as you tilt the dish back from the horizon towards the open sky. Typical dish angles for Clarke orbit birds may be from 20 to 60 degrees depending on your location.

are rain, the sun, other microwave services, and the Earth itself. In fact, the noise temperature of the Earth is about 290 degrees Kelvin.

Perhaps you've guessed that we need an antenna with enough directionality to ignore terrestrial noise. System designers express this as a ratio of carrier-to-noise, or C/N. As a rule, most receivers need a C/N ratio of about 10 dB. That is, the received carrier must be 10 dB hotter than the noise to get clear pictures. So all we really need to know is the satellite signal level at our location and the noise level. If we add 10 dB to the difference we should have the required antenna gain.

Simple Dish Math

We use this formula to calculate noise level: Noise Power = KTB, where K = Boltzman's constant, 1.38×10^{-23}, T = system noise temperature, and B = system bandwidth.

How do we use it to get a right answer? (All too often, you see a formula and plug in some sample numbers and voila . . . wrong answer!) Here are the exact steps to take. First, we see that the typical bandwidth of satellite TV signals is 30 MHz. A quick look at the above formula may cause you think if you could reduce the bandwidth a little, you could also reduce the noise. The question is, how much can we cut before the picture looks rotten? I'll cover that in another installment.

A noise figure of	equals a noise temperature of
290° K	3.0 dB
225° K	2.5 dB
170° K	2.0 dB
120° K	1.5 dB
100° K	1.3 dB
75° K	1.0 dB

Table 2. LNA noise temperature to noise figure conversion.

Next, we must know the system noise temperature. This is a mixture of antenna noise, LNA noise, and receiver noise. Inasmuch as we must surpass the noise threshold of the receiver by at least 10 dB, we can ignore receiver noise temperature and just deal with the antenna noise and LNA noise. Fig. 2 is a graph of typical antenna noise temperatures based on elevation angle. Notice that the noise appears to drop as we tilt the antenna back from the Earth towards the open sky.

Table 2 is a list of typical LNA noise temperatures you are likely to find. As of this writing, 100 degrees is considered a very good LNA for the money. That may change. If we now add the LNA noise temperature to the noise intercepted by the antenna we have a fair idea of the system noise temperature. For example, an antenna tilted back to 45 degrees elevation might intercept 20 degrees Kelvin noise. Suppose we chose a 100 degree LNA. Adding, we get an overall noise temperature of 120°. Then all we do is use the formula, Noise Power = KTB.

$1.38 \times 10^{-23} \times 120° \times 30 \times 10^{6} = 49 \times 10^{-15}$. Converting to a power ratio: Noise in dBW = 10 Log (Noise Power) = −133 dBW.

If you've managed to stay with the numbers so far, you can see that the signal from space (−160 dBW) is *weaker* than the noise level (−133 dBW). But if we add in some antenna gain—say 40 dB or so—we boost the signal from space up and out of the noise to −120 dBW: −160 dBW + 40 dB dish = −120 dBW signal level.

Then subtracting: −120 dBW (Noise) − (−) 133 dBW (Signal with antenna) = 13 dB C/N. The satellite signal *exceeds* the noise level by a robust 13 dB, giv-

ing us solid copy picture-wise.

Easy Formula Saves Time

To find the antenna gain you need for your particular location, you simply apply Gibson's Dish Antenna Rule: Antenna Gain = Noise Level − Signal Level + C/N.

Using our example figures: −133 dBW (Noise) − (−) 160 dBW (Signal) + 13 dB (Suggested C/N) = 40 dB dish! Based on the table of dish antenna gains, it looks as if an 11- or 12-foot dish would work... but only if we use a 100 degree LNA.

Try It For Your Location

All you really need to calculate the right dish size for your spot on the map is a footprint map and the two formulas above. If your location does not fall on a particular contour on the map, then do some interpolation and estimate. If anything, estimate lower than the map. Remember, we said the footprints were predictions and actual values have been found to vary a couple of dB.

Next, subtract the path loss of 196 dB. Then figure the noise level based on the LNA you've chosen and the 3-dB bandwidth of your receiver. Plug the numbers into Gibson's Dish Antenna Rule and hope the dish gain needed fits your pocketbook. If it looks as if you'll need to buy an acre of real estate for your giant behemoth, then try a lower LNA noise temperature or a receiver bandwidth of, say 22 MHz, and plug in the numbers to find the dish gain again. Just remember that you may need to hock the family jewels to buy a super-duper LNA.

Perhaps you see that the antenna and LNA are on a kind of teeter-totter. Bigger dishes mean you can use an LNA with a higher noise temperature; a smaller dish means you need a lower noise temperature LNA along with a higher price tag. We can resort to graphs to put the dish cost vs LNA cost ratio in perspective, but costs on LNAs are dropping like flies as are some antenna prices. Maybe you could see it better as: Gibson's Simple Path Loss Equation: Big Dish + Good LNA = Clear Pictures.

But that all seems obvious now. Instead, let's apply Clever Idea #1: Big Dish + Not So Good LNA = Good Pictures. Or we could also apply Clever Idea # 2: Not-So-Big Dish + Good LNA = Good Pictures.

You are free to experiment with the values and see the interaction. Maybe you'd like to write a computer program to translate your ideas via the formulas into a complete line-equation program. As a TVRO entrepreneur, this would be a nice bell and whistle for potential customers.

Satellite Central needs your input of comments and ideas, with full credit to be given, of course. The time is right for you to join in the fun of receiving TV from space. If you have a question regarding the topics we cover here, feel free to drop me a line (letters only, no calls please). Sorry, I can answer mail only if it is accompanied by an SASE. ■

Satellite Channel Guide

— part I

RCA SATCOM 1 (135°W)
Polarization: ODD—Vertical; EVEN—Horizontal

TR—1 **Nickelodeon**—premium children's programming (6.8)
ARTS (Alpha Repertory Television Service)—performing and cultural arts programming (6.8)
TR—2 **PTL** (People That Love)—religious (6.8)
TR—3 **WGN-TV,** Chicago—Midwest's leading independent station (6.8)
TR—5 **The Movie Channel**—24 hr/day first-run movies (6.8)
TR—6 **WTBS,** Altanta—Ted Turner's Superstation
TR—7 **ESPN** (Entertainment & Sports Network)—24 hr/day sports (6.8)
TR—8 **CBN** (Christian Broadcasting Network)—religious (6.8)
TR—9 **C-SPAN**—live coverage from the House of Representatives (6.8)
USA Network—professional sporting events, Calliope, and the English Channel (6.8)
BET (Black Entertainment Network) (6.8)
TR—10 **Showtime** (West)—first-run movies, entertainment specials (6.8)
TR—11 **MTV** (Music Television)—Pop/Rock Video (5.8 & 6.62 stereo)
TR—12 **Showtime** (East)—first-run movies, entertainment specials (6.8)
TR—14 **CNN** (Cable News Network)—24 hr/day news (6.8)
TR—15 **Occasional Transmissions**—sporting events, news & network feeds (6.2/6.8)
TR—16 **Showtime** (Spare)—occasional network remote and sports events feeds (6.8)
AETN (American Educational Television Network) (6.8)
CMN (Christian Media Network)—religious (6.8)
NJT (National Jewish Television)—religious (6.8)
TR—17 **WOR-TV,** New York—the Big Apple's top independent station (6.8)
TR—18 **Reuter's Monitor Service**—commodity/stock market information (digital video)
Galavision—the best in Spanish-oriented programming (6.8)
TR—19 **The Shopping Channel**—Shop-at-Home TV service (6.8)
Spotlight—first-run movies (6.8)
TR—20 **Home Box Office Cinemax** (East)—time-structured HBO (6.8)
TR—21 **HTN** (Home Theatre Network)—quality P and PG movies (6.8)
The Weather Channel (est. Spring 1982)
TR—22 **HBO** (Home Box Office) (West)—first-run movies, sports & entertainment specials (6.8)
MSN (Modern Satellite Network)—general entertainment (6.8)
Beta—programming for women (est. 1-4-82)
TR—23 **HBO Cinemax** (West)—time-structured HBO (6.8)
TR—24 **HBO** (East)—first-run movies, sports & entertainment specials (6.8)

Audio Services on SATCOM 1

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Satellite TV Receivers

— is there a better way?

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Eastwood Village #1201 South
Rte. 11, Box 499
Birmingham AL 35210

My original review of the Universal Communications 2300-MHz downconverter kits, which appeared in the April, 1981, *73 Magazine*, revealed the widespread interest in receiving MDS and commercial TV satellite transmissions. Indeed, my mailbox bulged with letters for several weeks after the article was published.

A large number of inquiries received concerned my briefly-mentioned thoughts of later converting a Universal Communications unit (or some semblance thereof) for reception of the 3.7-to-4.2-GHz satellite TV band, and (hopefully) assembling a complete but inexpensive TVRO system.

This article on TVRO is written to share my work and knowledge, plus the work of Steve Franklin of Universal Communications, with others desiring infor-

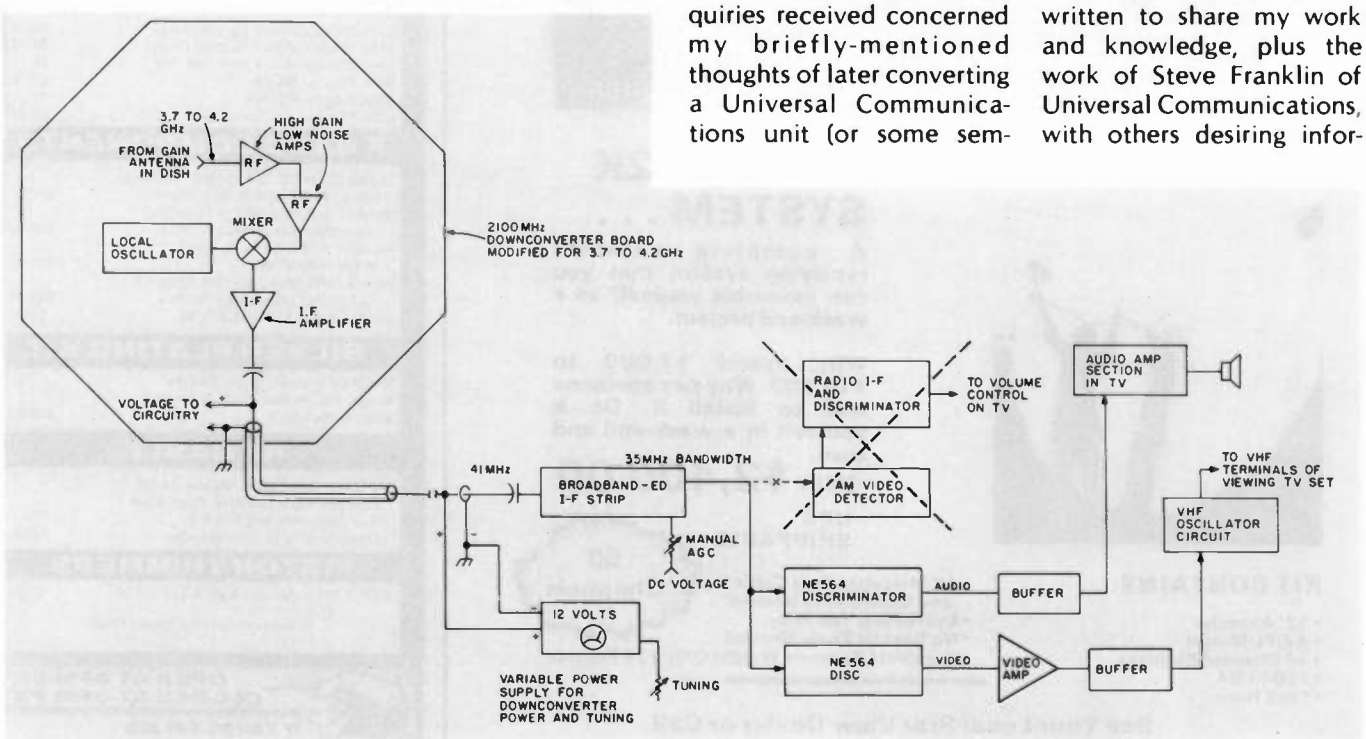

Fig. 1. The originally-planned TVRO described in the text. The 2100-MHz downconverter board is modified by cutting tuned lines to approximately half length, adding two high-gain, low-noise transistors, low-noise diodes, generating 41 MHz i-f, etc. Highly-modified televison is used mainly for its i-f strip, power supply, and audio amplifier section.

mation on TVRO designs. Perhaps I'll answer some questions that you've been pondering, or possibly I'll whet your thoughts on simpler and less-expensive ways of constructing TVROs. An excess of knowledge and concepts in this area of rising popularity is one thing we aren't experiencing at this time!

The Originally-Planned Concept

Most of the presently-popular commercial TVRO systems employ a basically similar design: A high-gain, low-noise amplifier (LNA) is placed at the focal point of a 10- to 16-foot parabolic dish which is aimed at a specific satellite. The acquired signals then are fed to an indoor converter unit via hardline cable. That unit converts incoming frequencies between 3.7 and 4.2 GHz to the popular TVRO i-f frequency of 70 MHz, amplifies the signal, and detects the FM video and 6.2- or 6.8-MHz audio (depending on the particular satellite being received). The resultant baseband signals then are used to modulate a TV oscillator circuit which radiates into the TV set's VHF antenna terminals. Selecting various transponders of a satellite is accomplished by varying the indoor tuner's selected input frequency and downconverting that channel to the 70-MHz i-f range.

While the previously described concept is an optimum turnkey system, it seems that an enterprising amateur could shave frills and lower system cost with a different approach to TVROs. The hardline cable connecting the LNA to the tuner, for example, exhibits a typical loss of 15 dB—part of the gain provided by the LNA. It thus seems that if a low-noise figure could be obtained, a home-brew rf amplifier/tuner unit could be mounted at the dish and used to downconvert with techniques similar to those used in inexpensive 2400-MHz MDS converters. The resultant 35-MHz bandwidth i-f signal might then be processed by a highly-modified black and white TV (nothing dictates the use of a 70-MHz i-f).

Deborah Franklin tries on a 10' parabolic dish fitted with an Avantek LNA and 3.7-to-4.2-GHz downconverter described in the text.

Such TVs usually can be obtained from repair shops or friends (sets with bad picture tubes or flybacks are good candidates for this operation). The downconverter's output cable would sidestep the TV tuner and connect directly to the i-f input. The i-f stages would then be heavily swamped and stagger-tuned to increase bandwidth from near 5 MHz to near 35 MHz (additional i-f stages also might be required here). The AM video detector then would be replaced with a broadband FM counterpart, such as an NE564 discriminator chip, while another NE564 tuned to either 6.2 or 6.8 MHz would be used for audio demodulation.

A small TV oscillator circuit then could be home-brewed or obtained from a surplus outlet and used to feed the satellite TV signal to the antenna terminals of an unbutchered (and usually color!) TV set for viewing. The complete receiver is shown in Fig. 1.

The Universal Communications 2.1-GHz MDS receiver might be a candidate for a low-cost downconverter. The rf amplifier would have to be replaced with a low-noise, high-gain counterpart while the mixer and oscillator circuits would need to be trimmed to the new frequency range.

The greatest drawback to

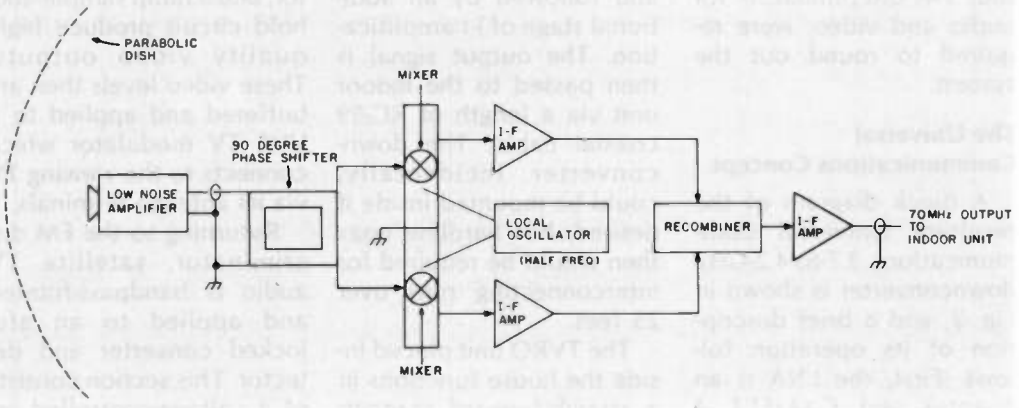

Fig. 2. The Universal Communications 3.7-to-4.2-GHz downconverter. The unit incorporates dual mixers operating 90 degrees out of phase and dual i-f amplification.

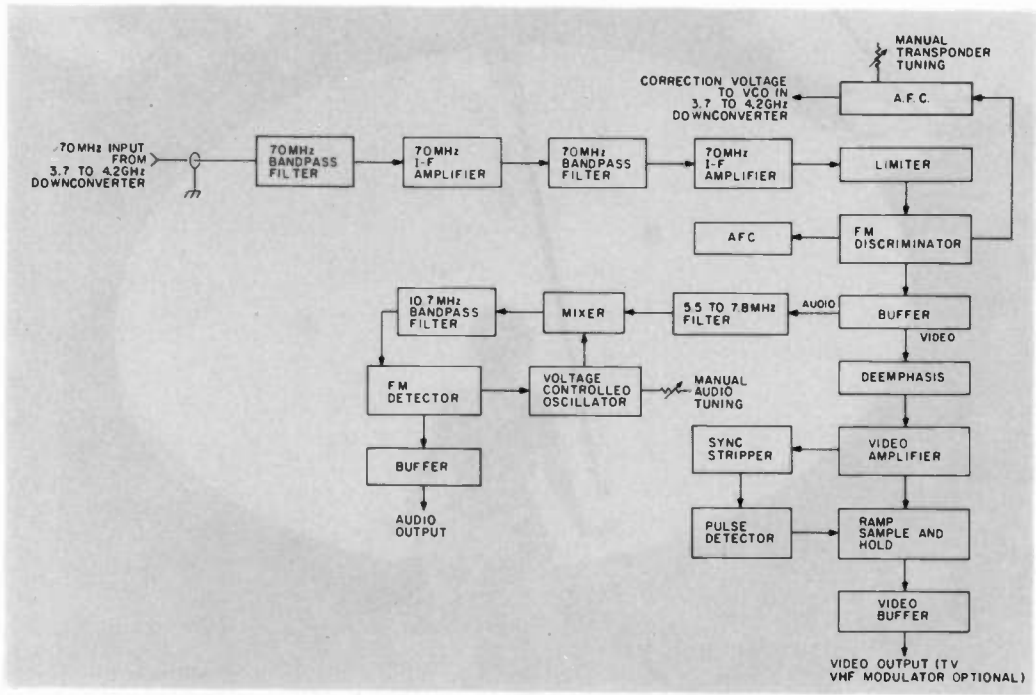

Fig. 3. Block diagram of the indoor tuning unit. Circuitry is straightforward, with video sampling similar to SSTV techniques being employed.

this scheme, shown in Fig. 1, may lie in the cumbersome modification of the downconverter and TV set. The price is right but the patience and expertise required are probably beyond the average hobbyist. Steve Franklin has shown that pictures can be received with such a system, but they are plagued by noise and image problems. The receiver that grew out of this approach uses a conventional low-noise amplifier and a doubly-balanced mixer, eliminating many of the problems that plague simple receivers.

Finally, an i-f section consisting of a few ICs, etc., plus FM discriminators for audio and video, were required to round out the system.

The Universal Communications Concept

A block diagram of the resultant Universal Communications 3.7-to-4.2-GHz downconverter is shown in Fig. 2, and a brief description of its operation follows. First, the LNA is an Avantek unit, GaAsFET, 4 stages, with 50-dB overall gain and a 120° Kelvin noise figure. The LNA cost (in July, 1981) is $650. Signals from the LNA are applied to the downconverter's 90° phase shifter, producing the two out-of-phase signals for application to their respective mixers (these mixers are similar to those used on 2.1-GHz downconverter boards).

The mixers are fed from a common local oscillator operating at half the desired frequency (this board-mounted oscillator is substantially less expensive than standard TVRO types). Outputs from the two mixers are then amplified to overcome phase-shift losses, applied to a recombiner, and followed by an additional stage of i-f amplification. The output signal is then passed to the indoor unit via a length of RG-59 coaxial cable. The downconverter, incidentally, could be mounted inside if desired, but hardline coax then would be required for interconnecting runs over 25 feet.

The TVRO unit placed inside the house functions in a straightforward manner: Its block diagram is shown in Fig. 3, and a description of its operations follows. The incoming 70-MHz i-f signal first undergoes a series of bandpass filters and i-f amplifiers before being applied to a limiter stage and an FM discriminator. The detected signal then is directed to a buffer stage which splits it and feeds two points. Following along the video path first, the signal undergoes de-emphasis and then is applied to a video amplifier which includes positive or negative video polarity output.

Next, a video sampling arrangement similar to more sophisticated SSTV techniques is employed: A sync stripper, pulse detector, and a ramp sample-and-hold circuit produce high-quality video outputs. These video levels then are buffered and applied to a VHF TV modulator which connects to the viewing TV via its antenna terminals.

Returning to the FM discriminator, satellite TV audio is bandpass-filtered and applied to an afc-locked converter and detector. This section consists of a voltage-controlled oscillator (vco), mixer, 10.7-MHz bandpass filter, FM detector, and an afc circuit. Simply described, this "closed-loop" system's afc monitors the FM detector's output and directs a proportional correction voltage to the converter's vco as required. An additional voltage input is employed for manual tuning of the audio. The output audio signal then is handled in a conventional manner.

As this article is being written, Universal Communications (PO Box 339, Arlington TX 76010) is gearing up to produce TVROs based on the previously-described concept. This arrangement definitely has broken the price barrier (*projected* cost, less dish and LNA, is $800!) while maintaining the quality of equivalent systems selling for over $1500. Its design is the most logical approach to satellite TV receivers I've seen, and I heartily recommend considering its concept. The question of system kits is presently unresolved, due primarily to problems encountered with home constructors "botching up" the simple MDS downconverters also manufactured by Universal Communications.

Summary

Satellite TV reception is a rising trend which promises increased popularity during the near future, and now is an opportune time to join that activity. The equipment capable of receiving weak microwave signals from these satellites is necessarily expensive: That restricts general-public reception and provides a measure of "cloaking" to the satellite signals. While home-brew TVROs can't sidestep the high costs of LNAs, GaAsFETs, etc., the contemplation of such setups gives one a relatively good understanding of the circuitry involved and a better overview of what he's getting for his money. ■

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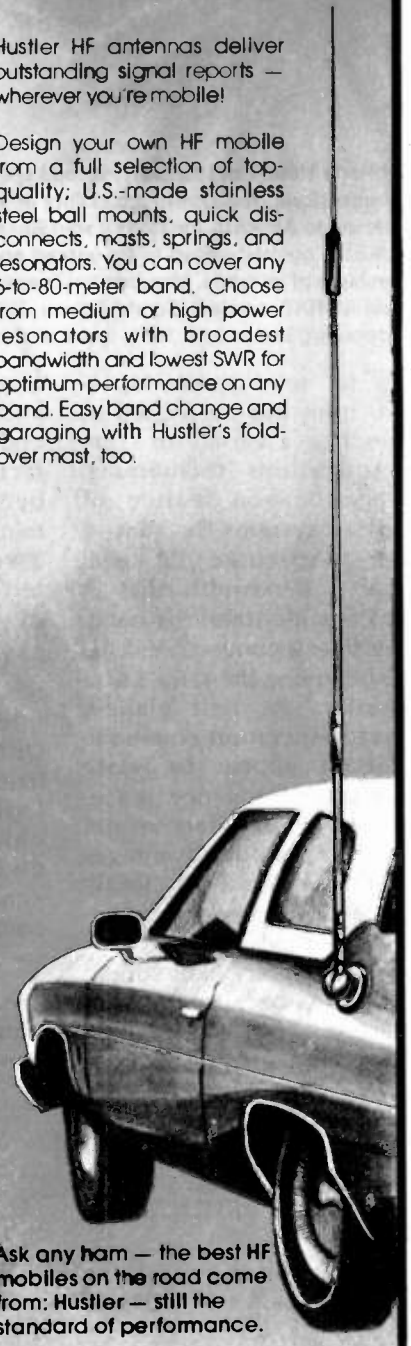

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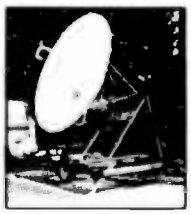

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Spread Spectrum

—a report from AMRAD

Editor's Note: Until recently, spread spectrum has been a term known only to a few people involved in developing top-secret military communications. Today, the possibility of using spread spectrum for other radio services is being investigated by a group of radio amateurs known as AMRAD, Amateur Radio Research and Development Corporation. After receiving a Special Temporary Authority from the FCC, AMRAD pushed ahead to try spread spectrum on the amateur bands. AMRAD members are interested in experimental communications systems of all types. Membership is available to any interested person for $12 a year. This includes a subscription to the club newsletter. To join AMRAD, contact Gerald Adkins, Treasurer, 1206 Livingston St. North, Arlington VA 22205. ● The following article is based on material appearing in the July, 1981, issue of the AMRAD newsletter.

The term *spread spectrum* has been used to describe a variety of communications techniques. The common feature of these systems is that a spread-spectrum (SS) signal has a bandwidth that is much wider than the bandwidth of a conventional signal carrying the same information. At first glance, spread-spectrum communications appear to waste valuable frequency space. In reality, SS offers several very important advantages over conventional amplitude- or frequency-modulation methods.

The military likes spread spectrum because it is very secure. You can't eavesdrop on a spread-spectrum conversation if you don't know the sequence used to code the signal. Another tactical advantage offered by SS is its immunity to jamming. Unless the enemy has a very wideband transmitter, he won't do much harm to your signal.

A similar sort of immunity exists for unintentional interference (QRM and QRN). The SS signal is also likely to resist selective fading that affects one channel. In the past, diversity-receiving techniques have been used to combat fading; now, spread spectrum offers hope.

Although a spread-spectrum signal takes up a large bandwidth, the spectral density is much lower than a narrowband signal. The same information is there; it's just spread over more spectrum. This opens up the possibility of a large number of SS signals sharing a band. Or perhaps spread spectrum can peacefully coexist with narrowband signals.

There are several types of spread-spectrum communications being used today. The AMRAD experiments are focusing on the frequency-hopping and direct-sequence techniques. This report will focus on the frequency-hopping project in particular: the use of commercial SS units on the 80-, 40-, and 20-meter bands. We won't go into much detail on the inner workings of frequency hopping; for more information, Rinaldo's article in the November, 1980, issue of *QST* and the FCC report, "Potential Use of Spread Spectrum in Non-Government Applications," are recommended. The FCC report is available from the National Technical Information Service, Springfield VA 22161. The accession number is PB81-165-284. The cost is $17 paper, $3.50 microfiche.

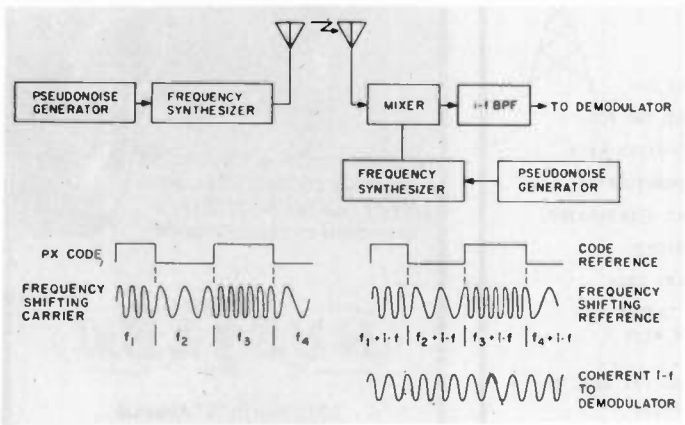

Fig. 1. Basic frequency-hopping system with waveforms. (from "Potential Use of Spread Spectrum Techniques in Non-government Applications.")

Frequency hopping is just what the name implies: The transmitter's carrier frequency jumps from channel to channel. The receiver follows along, in the same pattern. To keep the information secure, a frequency-hopped signal spends very little time on one frequency before moving in what appears to be a random manner. Fig. 1 shows a simple frequency-hopping system.

Experiment #1

We had a series of very successful frequency-hopping experiments carried out by Paul Rinaldo W4RI, Dick Kessler K2SZE (in Rochester, New York), and Olaf Rask WA3ZXW (in Annapolis, Maryland). Experiment #1 of the AMRAD Special Temporary Authority (STA) called for tests with a commercial/military frequency hopper in the 80-, 40-, and 20-meter bands. These rigs are capable of a frequency range of 2 to 15 MHz and hopping speeds adjustable from about 1 hop/second (1 chip, for you units buffs) to about 20 hops/second. The hopping sequence was assumed to be nonlinear because this rig was meant for military purposes. Normal linear sequences of short duration

are not useful for military applications.

Using these rigs is somewhat different from a standard single-sideband transceiver, but enough of the operations are the same that an amateur would feel right at home with this mode. I was able to sit in on a session that Paul had one evening and will describe what I heard.

First, both stations made contact using SSB (this was on 75 meters) on a service frequency. The next major item was making sure that the hopping-sequence generators on both rigs were set the same way. The rig has a set of thumbwheels on the front panel which are used to control the hopping sequence. Both stations set the wheels the same way. If the wheels had been set differently, the hopping sequences would be different, and the two stations couldn't talk to each other.

Now that the hopping sequences were set the same way, one station would transmit a special FSK signal which the other station would receive. This FSK signal serves to alert the other station to start hopping as soon as the FSK signal stops. The FSK signal was generated by using the Send Sync switch on the rig. To set up the second station to use this FSK sync signal, there was a FAM (frequency-agile mode) switch position to enable the second station to lock onto the FSK signal.

When the FSK signal stopped, both rigs were in the hopping mode. The speed at which the hopping took place was 5 hops/s, which is slow, as hopping goes, but has many interesting features. The mode of transmission was SSB, and Dick's signal came in very well. I was surprised that the rig's synthesizer was right on each hop, which meant that the SSB signal was very clear. No "duck talk" was present, such as comes from being a little off with an SSB signal.

One of the main advantages of spread spectrum was the so-called antijam or interference-avoidance feature which happens because the background QRM is being changed every hop. We were hopping at 5 hops/s with this rig, and I was able to observe this effect. Dick's voice was more readable than when in the (non-hop) conventional SSB mode. We made a few experiments by moving the hopping sequence up a little to see what it would do against solid, congested SSB.

In the first part of the experiment, we were in the 80-75-meter band, which resulted in the hopping sequence varying mostly in the CW portion, but it would visit phone stations now and then. What did this sound like? Well, all the sounds that hams are used to were present, but every one-fifth of a second the sound would change! What you would hear was a snatch of RTTY, a small burst of CW, a few sounds from some SSB stations, and some snap of QRN, each lasting only a fifth of a second.

It was easy to hear Dick's voice with this ever-changing background noise because Dick's signal was strong. There was some fading now and then, and this let us see what a weaker signal would sound like. When K2SZE's signal became weak, it was still readable even when it started to fade into the strange background sounds. My old CW training came back to me, and I mentally started to try to shut out the background, just as you do when receiving a weak CW station in heavy QRM. But this time the background sounds were changing!

I would say that there was about 30% SSB sounds in the mix with the remainder being CW and RTTY. There was an advantage over normal SSB with this mix. Then we moved the hopping sequence into the 75-meter phone band. Both stations had to reset the service frequency higher and then go through the sync process again, which is not hard. This time, we had a mix of 80% SSB and 20% CW and RTTY. With this mix, Dick's signal was hard to hear. Because there was such a high percentage of SSB in the background, it was difficult to pick out Dick's signal from the rest. We tried to lock onto Dick's voice and ignore the rest. But this was difficult. Things were much better with more CW and RTTY in the mix and downright hard with a high percentage of SSB.

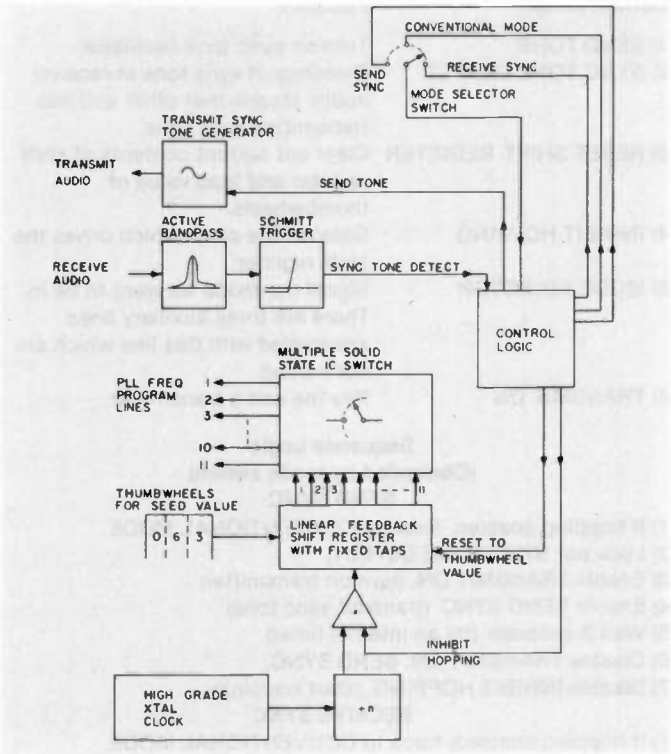

Fig. 2. Frequency-hopper controller board basic functions.

What conclusion can be drawn from this? With slow hopping (5 hops/s), SSB frequency-hopping does well against CW-like signals and poorly against voice-type signals. The fact that we were hopping at 5 hops/s didn't allow us to take advantage of a property that fast hopping has. If we were hopping faster (say 25 times a second), very short snatches of the background noise would be received. As the frequency is changing so fast, the sound of each of these snatches would just meld together and form a kind of buzz. The SSB voice signal would still sound like an SSB voice signal, but the background would sound very constant. With the right filters to treat the background buzz, the voice signal should be readable. This would happen even with a strong mix of SSB signals in the background because the amount of signal from each frequency would be very small. This is what we would like to try a little later with Experiment #2, which will allow us to build our own frequency-hopper rig out of old CB sets.

As part of the experiment, Paul turned on his Icom IC-701 so that we could hear with the other rig transmitting in the frequency-hopping mode.

Control Lines:	Function
1) SEND TONE	Turn on sync tone oscillator.
2) SYNC TONE DETECT	Presence of sync tone in receiver audio. Means that other unit has transmitted sync tone.
3) RESET SHIFT REGISTER	Clear out current contents of shift register and load value of thumbwheels.
4) INHIBIT HOPPING	Gate off the clock which drives the shift register.
5) MODE SELECTOR	Signal the mode we want to be in. There are three auxiliary lines associated with this line which are not named.
6) TRANSMIT ON	Key the unit's transmitter.

Sequence Logic
(Controlled by mode switch)
SEND SYNC

1) If hopping enabled, force to CONVENTIONAL MODE.
2) Lock out SYNC TONE DETECT.
3) Enable TRANSMIT ON. (turn on transmitter)
4) Enable SEND SYNC. (transmit sync tone)
5) Wait 3 seconds. (by an internal timer)
6) Disable TRANSMIT ON, SEND SYNC.
7) Disable INHIBIT HOPPING. (start hopping)

RECEIVE SYNC

1) If hopping enabled, force to CONVENTIONAL MODE.
2) Enable SYNC TONE DETECT.
3) Wait for SYNC TONE DETECT to go high. (sync tone received)
4) Wait for SYNC TONE DETECT to fall. (sync tone falls)
5) Disable INHIBIT HOPPING. (start hopping)
6) Lock out SYNC TONE DETECT.

CONVENTIONAL MODE

1) Enable INHIBIT HOPPING. (stop hopping)
2) Trigger RESET SHIFTREGISTER. (load thumbwheel values)
3) Lock out SYNC TONE DETECT. (in case we are resetting)
4) Disable SEND SYNC, TRANSMIT ON. (in case we are resetting)

Note: Conventional mode also is a recovery position which is used by the other two modes and by the operator to recover from a foul up such as no sync tone being received for a very long time when one is expected.

Table 1. Functional frequency-hopper control board logic sequence.

Paul picked out a place on 80 meters where it was quiet and let the receiver stay there. We didn't hear K2SZE's signal on this receiver, partially because it wasn't connected to an antenna. When we went to the transmit mode, every once in a while you would hear a snatch of sound like "aup" or "thu," but it would be gone as quickly as it came. This was the result of the rig's hopping in a random way.

Experiment #2—Proposed

A few of the AMRAD Spread-Spectrum Special Interest Group have been interested in doing something with old CB transceivers. Allan Kaplan W1AEL in Richardson, Texas, has a bunch of good ideas. His group was in active search of a number of Hy-Gain surplus CB boards to use as the basis of a 10-meter frequency hopper.

I was able to get hold of two SSB CB transceivers which were modified for 200 channels and had seen extensive use in another "service." These rigs have almost identical internals and use the standard μPD858C synthesizer chip. This chip has a number of components for a synthesizer built right onto the chip. External to the chip is an active bandpass filter, a main vco chip (which produces the output frequency), and a number of mixers and oscillators used to mix the vco output for use in the CB transmitter and receiver.

In order to frequency hop, there are three things that need to be done: 1) Change the mixer crystals so that the rig operates in the 10-meter band (this is in progress now); 2) Modify the feedback filter so that the synthesizer will lock up faster; 3) Hook the BCD frequency programming lines to a controller board.

The controller board (Fig. 2 and Table 1) will have a linear feedback shift register which has parallel output and will gate an IC which has 8 SPST switches implemented in solid state. This IC will do the actual switching of the synthesizer programming lines for isolation's sake.

A second stage of the board will be used to sense/send a tone which will be used the same way that the special FSK signal is used by the commercial rig mentioned above. When the signal appears, the clocking associated with the shift register will go into a make-ready-to-hop state. Then, when the signal ends, hopping will start and continue until the Stop Hopping switch is pressed. Lastly, a timing source is needed, and this will be supplied by a high-stability crystal oscillator which will be on board as well.

K2SZE points out that timing is critical with fast frequency hopping. For now, we don't plan to hop very fast. Only when we have gained more experience with slow hopping will we try the faster stuff.

One problem being researched is that of how to get the loop filters of the synthesizer to react faster. The loop filter sits between the output of the phase comparator/charge pump and the vco. Its job is to filter the correction voltage to the vco to eliminate high-frequency components. So, the output of the phase comparator/charge pump goes through a low-pass filter before being applied to the vco.

This loop filter in the two CB rigs consists of an active filter which is part of the μPD858C and a second filter which is a bandpass filter implemented as an active discrete transistor amplifier. The feedback network for the active filter within the μPD858C is via a resistor-capacitor combination attached to some of the 858's pins.

Both CB rigs are slated to be modified in the same way so that there will be two rigs which do the same thing right off. Differences in the synthesizer design or the controller board will probably produce a different hopping sequence. So, if you plan to do this *always* get at least two rigs of the same kind. Fig. 2 and Table 1 give more details.

For the Record

Since we started this project, we've learned a lot about the spread-spectrum mode which was heretofore unknown in the amateur community.

The FCC has certainly been forward looking with regard to spread spectrum as well as other advanced amateur technology.

At one point we talked about the idea of kits being made available for the builder. It turns out that we have a lot more ground to cover with the experimental aspects of spread spectrum before we can get to a prototype. The whole idea of the STA is to experiment. So, if you're not sure how to proceed and want to talk it over with someone, I suggest that you find someone close to you and work together. The converted-CB approach seems the simplest way to start. ■

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The right transmitter features. ***Frequency coverage*** from 80 through 10 meters, including the new 30 meter band, in nine 500 kHz segments (four segments for 10 meters), with approximately 40 kHz VFO overrun on each band edge. ***Convertible power:*** 100 or 10 watts input with 100% duty cycle for up to 20 minutes on all bands. ***3-function meter*** shows forward peak power on transmit, SWR, and received signal strength. ***PTT*** on ssb, ***full break-in*** on cw. PIN diode antenna switch. ***Built-in cw sidetone*** with variable pitch and volume. ***ALC control*** on "high" power only where needed, with LED indicator. ***Automatic*** normal sideband selection plus reverse. ***Normal 12-14V dc*** operation plus ac operation with optional power supply.

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A Visit with SVØAY

—the road to paradise

"The difference between the permanent residents here and the tourists is that the islanders wear clothes!"

So says Joe Nearns SVØAY at his QTH on the western coastal road, only a short distance from a beach on the Greek island of Rhodes in the eastern Mediterranean. The island is so far east that the mountains of Turkey can be seen to the north only twenty miles away.

The principal business on Rhodes is tourism, and vacationers arrive daily from all over Europe to enjoy the delightful beaches and warm water, and to get a maximum tan in the hot sun. It is especially interesting to explore this island, with its over 3000 years of mainstream history.

The island of Rhodes was centrally located for the ancient Greek trading routes to the Middle East. The Apostle Paul is said to have taught there, and during the time of the Crusades, the island was governed by the knights for over two hundred years. Much remains of the fortifications of that era, including a wall around the ancient city which is still largely intact.

At the village of Lindos, on the eastern shore, the remains of a Greek acropolis can be explored, including the changes made during the middle ages. The "Colossus of Rhodes," one of the seven wonders of the ancient world, actually was the lighthouse marking the entrance to Rhodes harbor. The harbor is still very much in use today, guarding a mixture of picturesque Greek fishing boats, private yachts, commercial shipping, and pleasure-cruise vessels. In fact, one of the ways to visit Rhodes is to take a Greek Island cruise out of Athens.

Joe has a location almost ideal for ham radio, a good, unique callsign, almost no local competition (there are only two other hams on Rhodes), and a nice flat roof on his house for antenna tuning! It did, however, take him eight or nine months to get his call, after applying for it. He maintains daily schedules on 40 meters with a number of hams in the Greek islands as well as weekly schedules

The western beach area of Rhodes. Joe's QTH is just around the arm of the bay in the upper right, along the coast road.

Joe Nearns SVØAY at the rig in his shack at home in Rhodes.

A view of the harbor showing commercial and pleasure boats and some of the ancient fortifications.

George N1BEP sitting on the wall of the ancient acropolis at Lindos, southeast Rhodes. The small bay below the cliff is a tiny port for fishing and pleasure boats. The climbing scenes from the movie "The Guns of Navarone," starring Anthony Quinn, were filmed on the cliffs below the acropolis.

with Argentina and the Philippines.

Although Joe has lived in several other countries and has had LU and EL2EA calls, he still retains his US call, W5NTS. Joe doesn't go after DX on a regular basis —no contests or DXCC— and sometimes he says that he has to fight off the pileups that occur when conditions are good.

QRM is very bad on 40 meters from the broadcast stations, and during dry periods QRN is bad from the corona discharge on the local power lines, apparently due to salt deposits on the insulators—one liability of living near the beach.

The language is difficult to learn since it is hard to read the Greek alphabet. There is no English-speaking community on Rhodes. Therefore, Joe's two older children (boys) attend boarding school in Athens, and the younger girls study by correspondence course.

In their spare time, the whole family goes camping around in the many beautiful spots on Rhodes, especially after the tourists have left. ■

✓See List of Advertisers on page 130


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Human engineering provides such features as illuminated annunciators for transmit, CW Narrow, RIT, tuning speed, and dial lock. Readout of mode in use and VFO along with frequency eliminates unnecessary eye movement. One large multi-function meter shows signal strength, relative power out, SWR, collector voltage, or collector current.

ICOM's dual VFO system is included as standard with the IC-720A and provides easily split frequency operation.

Other features standard with the IC-720A are variable power output, RF speech processor, receiver attenuator, noise blanker, and selectable AGC. All of this in a broadbanded transceiver requiring no tuning of transmitter or receiver.

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ICOM's control features and engineering quality make the IC-720A the ultimate in a HF transceiver.

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Paul Grupp KA1LR
73 Magazine Staff

Reviewing Daiwa's New Meters

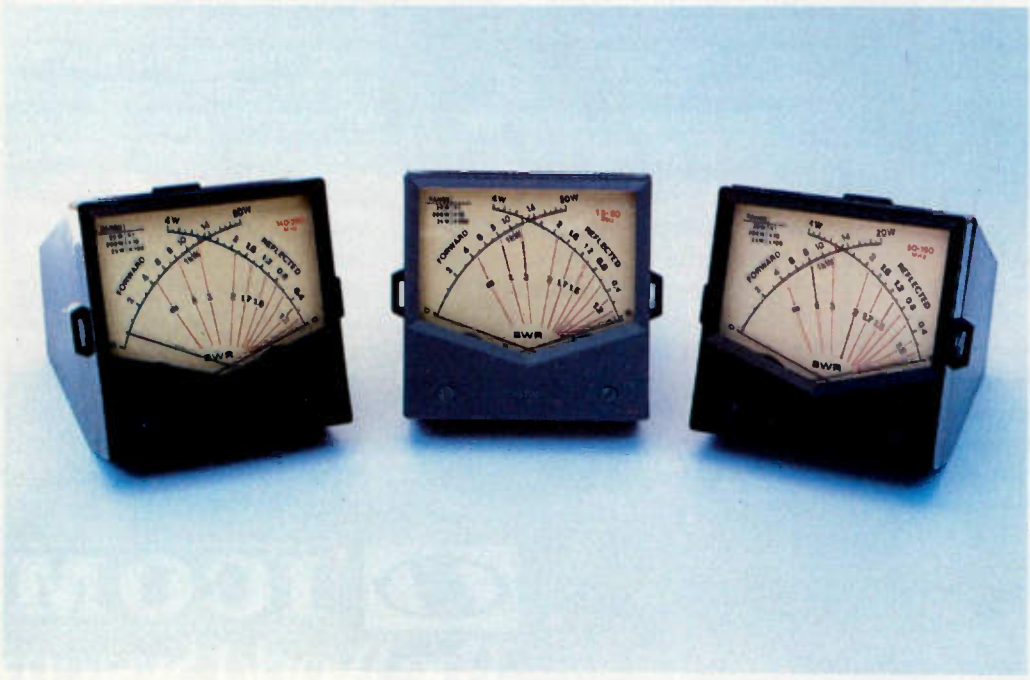
— fiddle-free swr measurement

Much as I hate to admit it, I am always in search of the ultimate swr meter. I am well aware that the subject of swr is a controversial one. In fact, swr is high on my list of discussion topics to avoid at all costs, right up there with the relative merits of quads vs. yagis, the number of angels that can dance on the head of a pin, and the ARRL. Particularly if the conversion is taking place on 80-meter phone!

After sober consideration and a mild sedative, most hams will agree that there are merits to having an swr meter in the antenna line at all times. I can't be the only one who has neglected to flip the antenna switch when changing bands or forgotten to tweak up an antenna tuner when moving from the phone portion of the band to CW. In these and similar situations, a well-designed swr meter in a prominent location can save the day, as well as a set of transmitter finals.

For this type of continuous monitoring, the last thing you need is the latest laboratory-standard instrument, complete with felt-lined wooden case and a calibration guarantee signed by the Almighty. Spend the money on intoxicating women and loose beverages instead. What you want is a simple meter that displays swr without requiring you to flip any switches or tweak any knobs. With very few exceptions, wattmeters are all pretty much alike. They differ primarily in the level of accuracy they provide, and almost all require you to flip switches and tweak knobs. Some of the most intriguing flipless, tweakless wattmeters can be found in the Daiwa line of radio accessories.

At first glance, these meters look somewhat imposing, with a pair of meter needles and a series of red lines marked on the front panel. First impressions aren't always right! Anybody can learn to read a cross-needle meter in less than a minute, and once you've learned how, you'll be hooked forever. The scale on the left side of the meter face reads forward power, and the scale on the right side reads reflected. These are the scales you would pay attention to if you are interested in measuring absolute values. Want to know swr? The point where the two needles cross displays standing wave ratio. No switches to flip or knobs to tweak! These meters may not replace the venerable Bird for test-bench applications requiring extremely high resolution and accuracy, but they are exactly what most hams need to monitor station performance on a day-to-day basis.



Swr meters from Daiwa.

Continued on page 180

Reader Service for facing page ↙81→

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Ham Shack Design for Beginners

— Novices, take note!

One set of questions usually asked by new hams concerns the practical aspects of setting up a new station. These questions are often difficult to answer since they can affect the new ham's entire family, assuming the station is to be located at home.

Question: I just got my call in the mail and now want to set up my station. What is the minimum I need for the operating position?
Answer: I have seen ham shacks ranging from a separate building containing a TV set, stereo, bathroom, and refrigerator to one built into a single desk drawer. However, at a minimum you need an ac line outlet, a ground wire, and a way to run your antenna feedline.

Q. Let's take these one at a time. What about the ac line?
A. It would be nice if you had a single 120-volt line direct from your house fuse box with 20-Amp service and a second 240-volt line for a linear amplifier. However, most of us end up plugging in a distribution box containing four or eight outlets, a fuse or breaker, a switch, and a pilot light. If you want to use a commercial box, there are several available, but they are only fused on one side; you really want fuses on both sides. See Fig. 1.

Q. Why fuse both sides? I thought that most 120-volt ac lines have a neutral or common which is grounded.
A. It is a matter of safety. If you get a lightning strike that enters your home wiring, it is nice to have both sides of the line fused so that there is a chance the fuses or breakers will blow and protect your equipment.

Q. I take it that when I want to operate the station I simply have to flip one switch and I now have power to all the equipment?
A. Yes, but you will also want to have one or two ac sockets which bypass the switch so that power is always available to your clock, desk lamp, or any other equipment which you might want to use independent of your rig. You also might consider using a key switch if you have any small children around so that they cannot turn on your station.

Q. How much power should I plan on?
A. As a rough approximation, complete a table for your station such as the one shown in Fig. 2.

Q. Well, just how many outlets do I want in total?
A. No ham in history has ever had enough outlets or current available. It is getting a little better now since many hams are also wiring

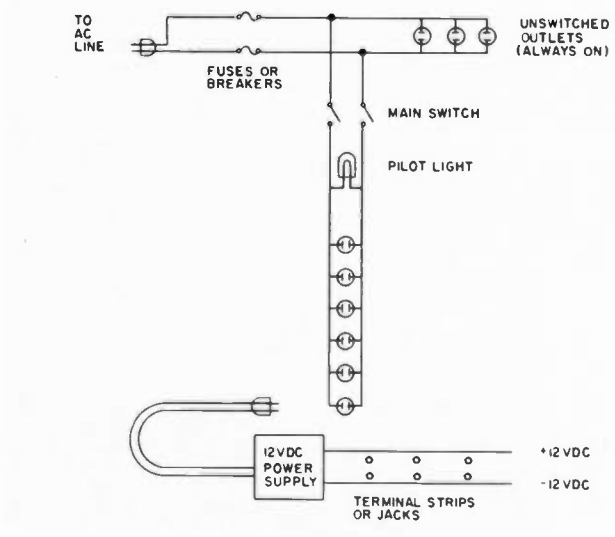

Fig. 1.

	Example (Watts)	Your Station
Rig	400	
Keyer	20	
Clock	10	
Outboard Active CW Filter	10	
Antenna Rotor	75	
Desk Lamp	100	
Total	615 Watts	

Example: 615/120 = 5.125 Amps 5.125/0.8 = 6.4 Amps total
Your Station: _____/120 = _____Amps
_____/0.8 = _____Amps total
Take the total power and divide by 120 to get the current, and then divide by 0.8 to account for any power factor. The number you get is the Ampere load you will have to supply from the ac line.

Fig. 2.

their shacks with both 12 and 5 volts dc.

Q. Why would I want to do that?
A. Typically, you will end up with a main rig and then a half dozen solid-state accessories. If you build them independently, there also will be a half dozen small dc supplies, each of which must be plugged into the ac line. If you plan ahead a little and set up a 12-volt power supply at a few Amps, you can power all of these units from the one supply. Most of the circuits around these days use 12 volts dc, with the exception of those using 5-volt digital logic. You can add a separate 5-volt dc supply or include a dropping resistor and voltage regulator in each of the 5-volt units.

Q. Will I be safer if I connect the ground bus to the ac power system?

A. Unless you are an experienced electrician, the only grounds you should use with the ac line are those built into the three-wire cords common on some equipment. Keep *your* ground bus separate.

Q. Since the ground bus is not connected to the ac line, what do I need it for?

A. You need a good ground primarily for safety. I use a 1" × 1/2" aluminum bar, running the length of my operating table. Every 6" I have drilled and tapped it to connect braid from the bus to each of the pieces of equipment. When I put a piece of equipment down on the operating table, I connect it to the ground bus before I plug it in, and when I want to remove it, I unplug before I disconnect the ground. If anything goes wrong, at least I don't end up with the 120-volt line voltage on the front panel of the equipment. See Fig. 3.

Q. Where is the ground bus connected to? Can I use a hot-water pipe rather than a cold-water pipe? How about the radiators? How about the this or the that?

A. Yes, yes, yes. If in doubt, connect it to all of them. No one has an ideal ground and you cannot hurt anything by connecting it to more than one ground. Just stay away from the ac wiring. The most important thing is to use wide braid or heavy aluminum wire, securely clamped. You should also remember that these mechanical (non-soldered) connections corrode and should be cleaned and tightened periodically.

Q. Is this ground bus the same ground that is shown in the pictures of antennas?

A. If you are using a coax-fed antenna, such as a dipole or beam, the shield of the coax will be connected through your rig or matchbox to the ground bus. But the bus plays little if any part in the antenna performance. However, if you are using a matchbox to feed a long wire with no radials, the ground bus provides the other end of the antenna circuit and is doubly important. See Fig. 4.

Q. What about antennas in setting up my shack?

A. Your shack must be located in such a way that you can run your antenna feedlines to the operating position. For this reason it is always nice to be close to an outside wall. Remember that no ham in history has ever had enough antennas, either. Plan ahead, and if you expect to run three lengths of coax into the shack, *plan* for at least six or eight and make whatever opening you drill through the wall big enough for the additional feedlines. It is much easier to stuff the extra space with loose fiberglass insulation than to go back and drill some more. Fig. 5 shows one possibility.

Q. I keep seeing pictures of ham shacks where the antenna coax, ac line, ground bus, and all of the wiring is hidden behind custom-made panels. Some of these shacks would put the best commercial installation to shame. Is this what I should plan on?
A. There is no question that designing and building a neat, custom-made installation provides some hams with just as much fun and challenge as working for DXCC. However, most hams "rack it and stack it" in the most convenient way. Whatever you do, remember that you will be making changes in your equipment, adding boxes and replacing boxes, so that you want the flexibility to change without major woodworking. If you do decide to "build it in," remember to leave room to get behind the units to work on the wiring.

Q. What about furniture?
A. My shack consisted of a folding cardtable for many years. I am now using an old desk with a spare door screwed on top to provide

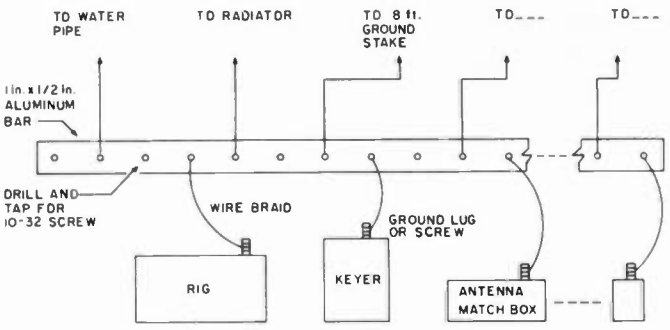

Fig. 3.

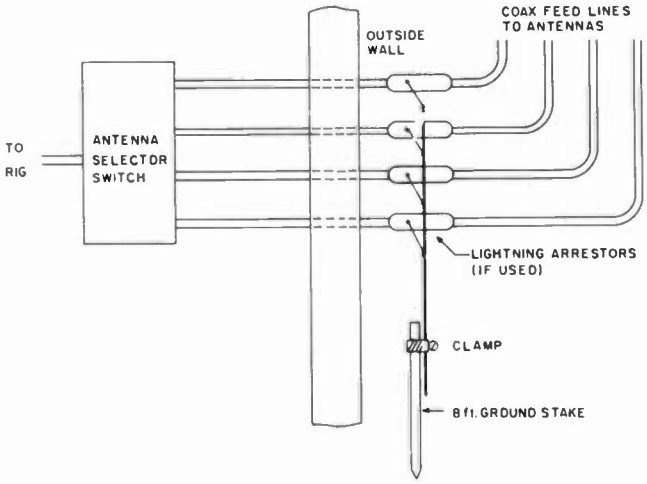

Fig. 4.

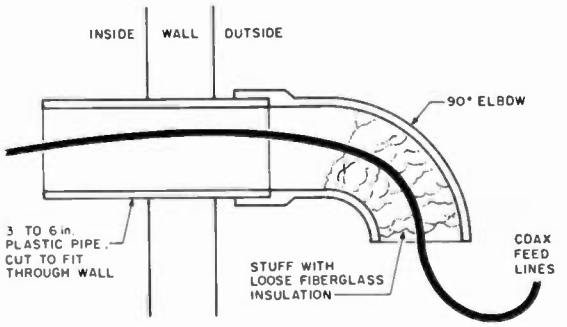

Fig. 5.

more area (Fig. 6). Old desks are nice since they give you drawers for storing logs, callbooks, headphones, and several cubic feet of clutter which otherwise would lay around. You also can get more top area by mounting a shelf above the desktop with sections of 2" × 4" wood and L-brackets. Measure the height of the largest unit you expect to have on the bottom and then mount the shelf at least 4" above this height to give heat a chance to escape.

Q. How about the little things, such as a chair, lights, and such?

A. Spend six or eight hours in a contest and you will find these are not such little things. Some phone operators literally use large armchairs as they claim "armchair copy." CW operators usually opt for a stiff-backed chair with a soft cushion. The cushion is optional until contest time. The key thing is to be comfortable for the periods you are operating. For this reason, you also will want to modify your rig to fit your needs.

Q. (with horror) Modify my brand new rig? Won't that reduce its value when I want to sell it?

A. These modifications won't. First, look at the knobs. On CW I tend to ride both the volume control and the tuning control. I found it much more comfortable to replace the 2"-diameter knob on my Heath SB-102 with a larger, 3" knob, and the fluted volume control with an identical size non-fluted knob. You also can change the height of the knobs by either drilling holes in the desktop for the rubber feet (lower the rig) or by placing the rubber feet on small wooden blocks to raise the knobs. You also can tilt the rig (Fig. 7).

Q. Why tilt it?

A. Some people are more comfortable with the rig tilted backwards to put the frequency dial more fully in their line of sight. Others like to tilt it down. Since the total investment is a few pieces of wood, it pays to experiment. Also check that the room lights or your desk lamp don't reflect in or wash out the numbers on the new rigs with the digital dials.

Q. I already can see that I will run out of space quickly. Where else can I put things?

A. If you home-brew some of the station accessories, such as audio filters and keyers, you can mount them inside a 1"-high chassis and slip them under the rig. A second approach is to suspend them from the bottom of the shelf. Separate power supplies can be placed under the operating position on the floor, and you can always hide things such as antenna rotor controls in a drawer.

Q. You said that the shack location and arrangement could affect the entire family. How is that?

A. Late-night operations with a loudspeaker or most of the old RTTY units pose an obvious problem. If you set up in a remote corner of the basement, consider including an intercom so that you can be called for dinner. An extension telephone is almost a necessity, but be forewarned, it will ring just as it is your turn to call the A9 station on the DX net.

Q. Anything else?

A. There have been several million ham-years of experimentation with the arrangement of stations. The best bet is to visit a number of stations and see how they are arranged. Don't be over whelmed by the amount of equipment you see. What you are looking for is how do you sit and how do you reach things. Then experiment before you plug in a single wire. The only thing for certain is that you will change the arrangement before very long and end up with just the right arrangement to suit *you*. ■

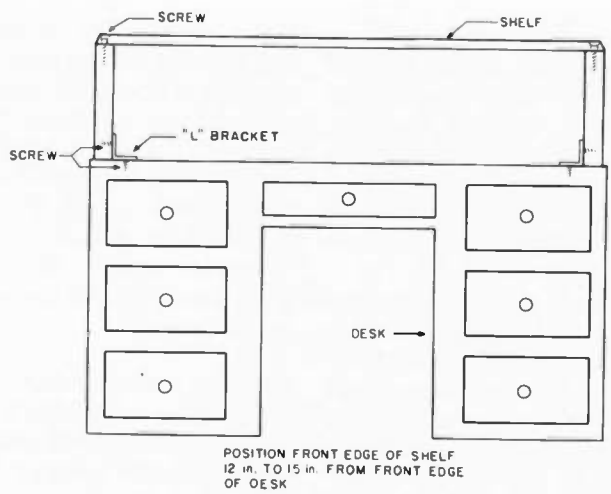

Fig. 6.

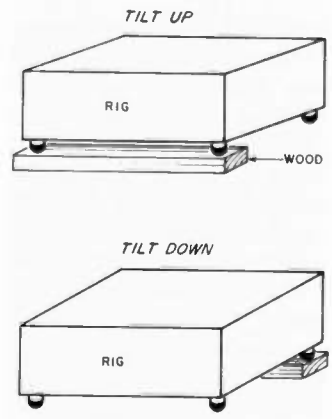

Fig. 7.

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

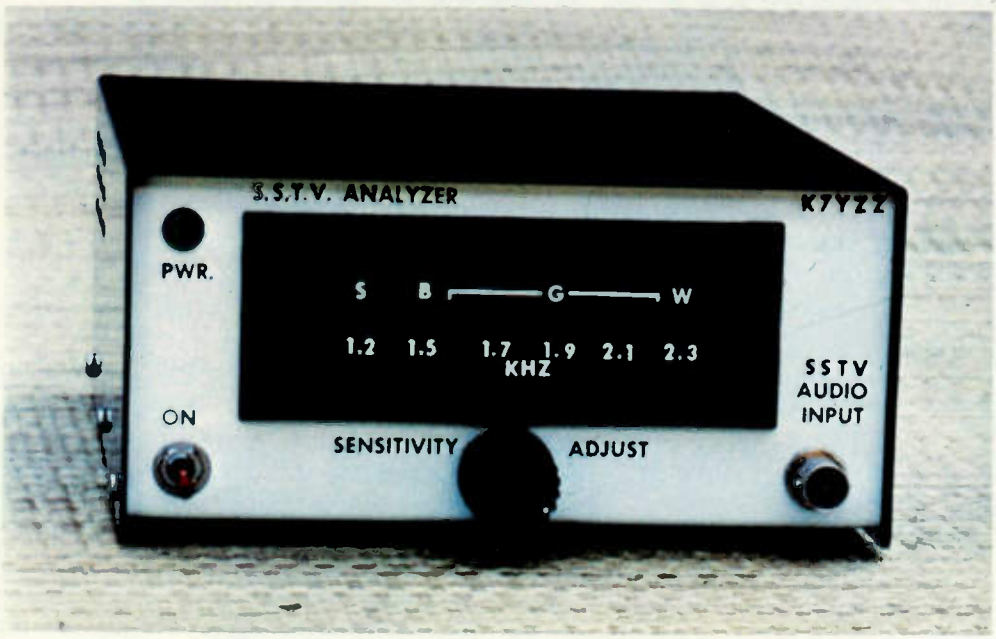
SSTV Signal Analyzer

— simple and inexpensive, even

For those of us who are experimenting with slow-scan TV, it becomes very apparent that one item required in the ham shack is a device that will indicate to the SSTV operator that the received or transmitted SSTV signal is properly adjusted for optimum gray scale. Audio frequency spectrum analyzers designed for displaying the SSTV audio signal on a small CRT have been described in previous articles.[1,2] These analyzers required the construction of high-voltage supplies to power the CRT and associated deflection circuits. Components of this type are becoming more and more difficult for the builder to locate.

A spectrum analyzer utilizing solid-state design was described recently that covered the audio range of 30 Hz to 16 kHz and was far too sophisticated for SSTV application.[3] Another pair of devices that appeared on the market were investigated for application in an SSTV signal-analyzer function. They were the LM331 frequency-to-voltage converter[4,5] and the LM3914 dot/bar display driver.[6] Several different circuit configurations were built in an attempt to use them as an SSTV audio signal analyzer. The initial results were very disappointing. The circuits were subject to input level sensitivity problems which adversely affected the display readings. The spectrum coverage also was determined to be unsuitable for SSTV application. However, from the results of the literature searched and with problems identified from the breadboard circuit experiments corrected, the configuration of a workable low-cost SSTV audio signal analyzer was developed.

The unit described in this article is of simple design and may be assembled from readily available components. It will provide the ham radio operator with information on the status of audio frequencies necessary for the proper transmission and reception of SSTV pictures.



The completed SSTV audio signal analyzer.

Circuit Description

The SSTV signal analyzer consists of five major items, an input signal amplitude limiter, an adjustable-gain operational amplifier, selective bandpass active filters, LED signal indicators, and a power supply (Figs. 1 and 2).

The incoming SSTV audio signal derived from the station's receiver or SSTV

picture-generating equipment is limited in amplitude by the limiter and is fed to an adjustable gain operational amplifier whose output is connected to six different audio bandpass active filters. The selection of component values for each audio frequency filter was made by a computer program for active filter design run on my microcomputer (Table 1). The SSTV audio frequencies selected were 1200 Hz (sync), 1500 Hz (black), 1700 Hz (gray), 1900 Hz (gray), 2100 Hz (gray), and 2300 Hz (white).

The audio signal appearing in the output of each active filter is fed to a transistor driving an LED indicator. When the appropriate SSTV audio frequency appears within the bandpass of the active filters, the resulting output causes the selected LED to illuminate.

Construction

The analyzer circuit was assembled on a perfboard pre-trimmed to fit the inside of a 6" × 2¾" × 7½" cabinet. The perfboard is 4½" × 4½" (Radio Shack 276-1394) and is mounted on two ½"-high threaded metal standoffs. The IC sockets and component parts are point-to-point hand-wired on the back side of the board. This circuit has not been converted to a PC board. The bridge rectifier diodes and filter capacitors are assembled on a separate 2¼" × 2" perfboard which is mounted in the cabinet on ½"-high threaded metal standoffs.

The three-terminal voltage regulators are mounted on the back of the chassis which provides a ready-made heat sink. The total maximum current drain when all LEDs are illuminated is 82 mA, which is so low that the voltage regulators have a very small heat rise. The negative voltage regulator requires the use of insulating mounting hardware (RS 276-1371) for proper operation.

A piece of perfboard (4½" × ¾") was used to mount the six LED frequency display indicators. A strip of black plastic electrical tape was attached to the surface of the display board on the side facing the front of the cabinet to improve display contrast. A bezel with a high-contrast filter for LED displays (RS 270-301) was mounted on the front panel. Decals were applied to the optical filter to identify the SSTV audio frequencies being detected and displayed. The six LEDs were cemented in place on the display board using model airplane cement. The display board was mounted behind the bezel using the bezel's mounting studs and small 1/8" fiber spacers.

Test and Adjustment

The power supply is the first part of the unit to be tested. Power is applied to the transformer and the regulator outputs are checked for the proper plus and minus 15 volts. The power supply is then connected to the circuit board and pin 4 of each LM324 is tested for plus 15 volts and pin 11 for minus 15 volts.

An audio signal generator[7,8] is connected to the input and the frequency of

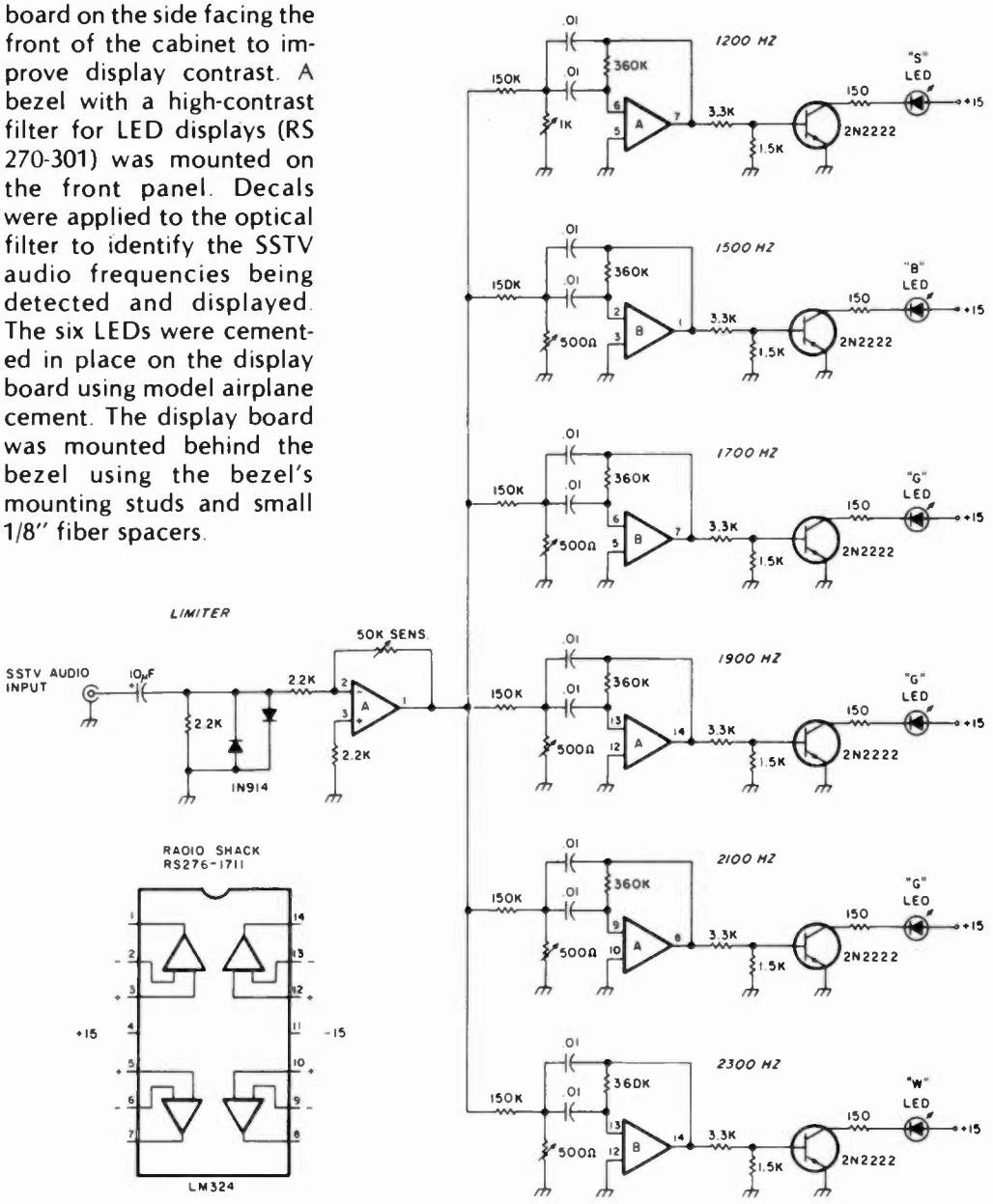
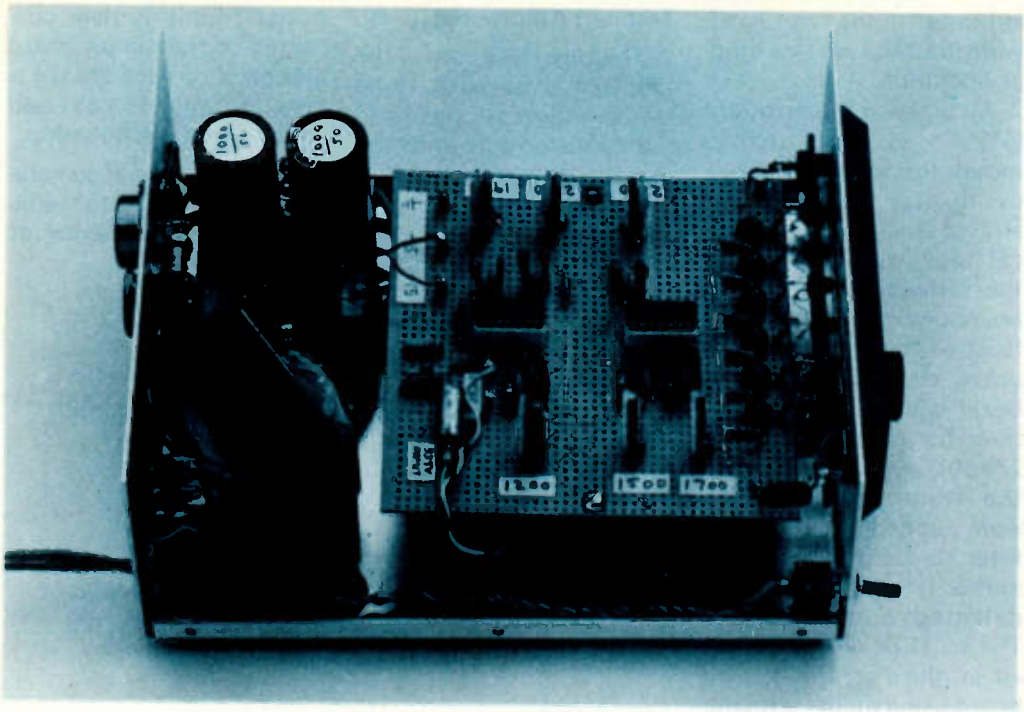


Fig. 1. SSTV audio signal analyzer.

Desired Frequency (Hz)	Computed Frequency (Hz)	−3dB Bandwidth (Hz)	Gain	R1	R2	R3	C1 = C2 (uF)
1200	1200	88.4	1.2	150k	490	360k	.01
1500	1508	88.4	1.2	150k	310	360k	.01
1700	1713	88.4	1.2	150k	240	360k	.01
1900	1900	88.4	1.2	150k	195	360k	.01
2100	2098	88.4	1.2	150k	160	360k	.01
2300	2327	88.4	1.2	150k	130	360k	.01

Table 1. Computer-derived data for SSTV audio signal analyzer bandpass active filters.



Internal layout showing components mounted on perfboard on metal standoffs.

1200 Hz is selected. The trimmer control on the 1200-Hz audio filter is adjusted for maximum brightness from the 1200-Hz LED frequency indicator on the display. The signal generator is now switched to 1500 Hz and the appropriate audio filter trimmer control is adjusted for maximum brightness from the 1500-Hz LED on the display. The same procedure is to be repeated for the remaining four frequencies. (See Fig. 3.)

An audio signal generator is again reset to 1200 Hz and the sensitivity setting is reduced until the 1200-Hz display LED just illuminates. The trimmer control on the 1200-Hz active filter is again adjusted for maximum brightness on the 1200-Hz LED indicator at this reduced input sensitivity. This procedure is then repeated for the remaining five frequencies. The last test is to manually step the audio signal generator through the six frequencies and observe that each LED turns on individually as the signal generator is switched from 1200 Hz to 2300 Hz. The SSTV audio signal analyzer is now ready for use.

Operation

Connect the SSTV audio signal analyzer to the audio output from a receiver that is tuned to an SSTV signal, the output from an active SSTV camera system, or an SSTV tape. Advance the sensitivity control until the LEDs are flickering from the presence of the SSTV audio signal. When the receiver is properly tuned to an SSTV signal, the 1200-Hz sync frequency indicator will flicker at a steady rate of 15 Hz.

The 1500-Hz to 2300-Hz frequency indicators will be illuminated depending upon the picture video content. Fig. 4 shows how the analyzer display will present different SSTV signals. If the sensitivity control is set too high, all LEDs will be driven on.

Conclusions

This little unit should be of considerable help in enabling the SSTV experimenter to send pictures of improved quality and to act as an aid in receiving pictures.

I would like to hear from those who build this unit as to how it performed for them. Questions regarding the unit are welcome but please enclose an SASE. ■

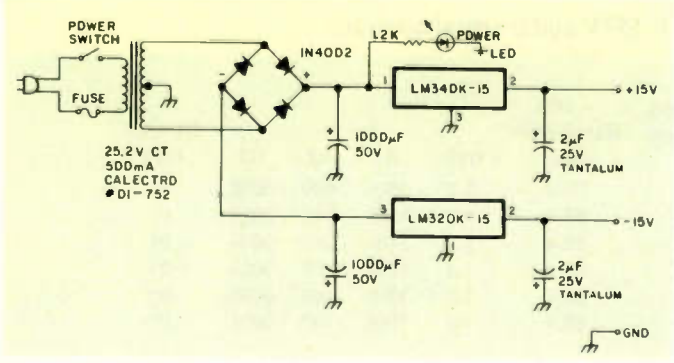


Fig. 2. Power supply.

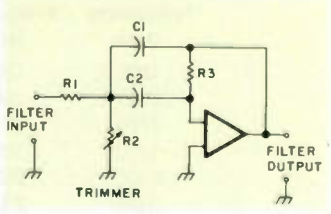


Fig. 3. Typical filter alignment.

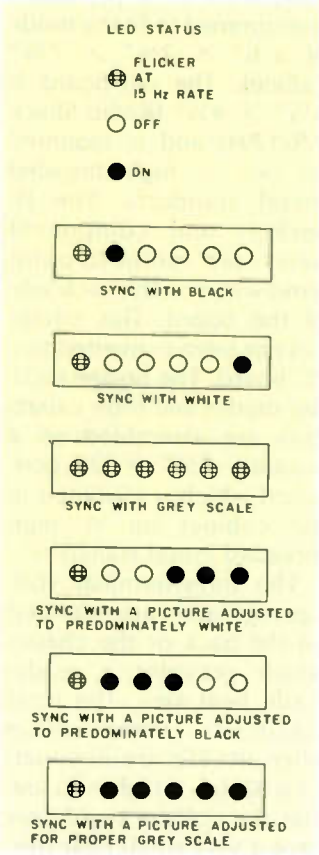


Fig. 4. SSTV audio signal analyzer displays.

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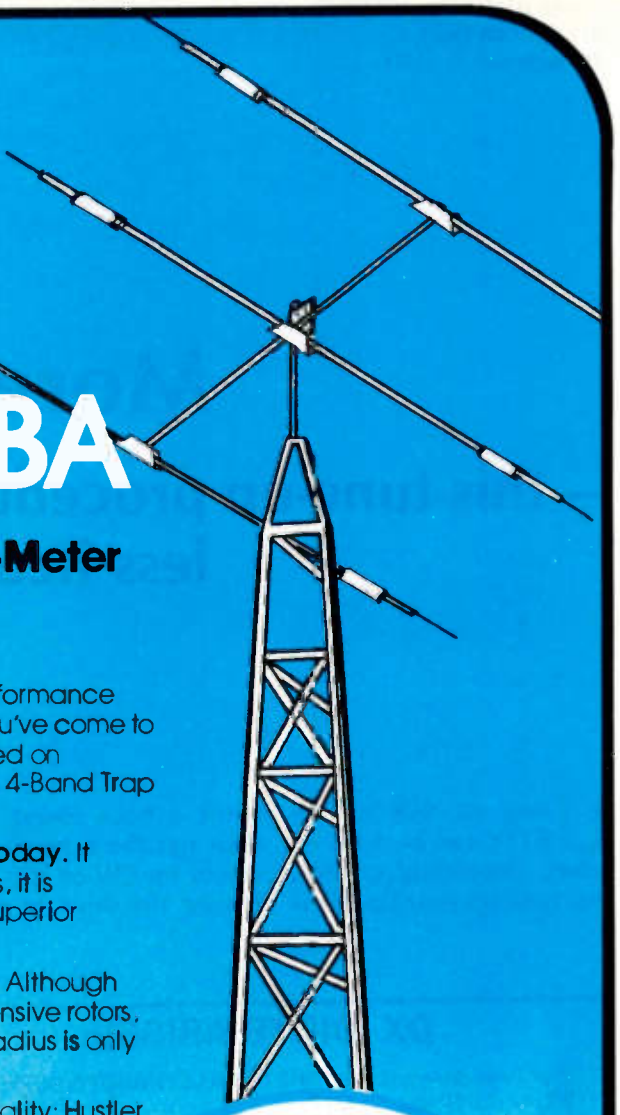

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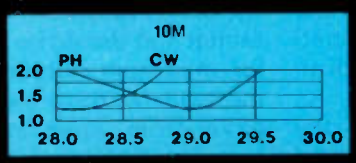

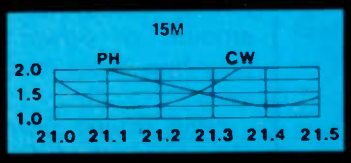

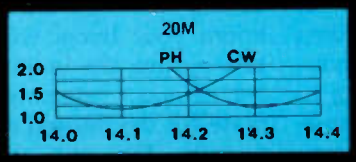

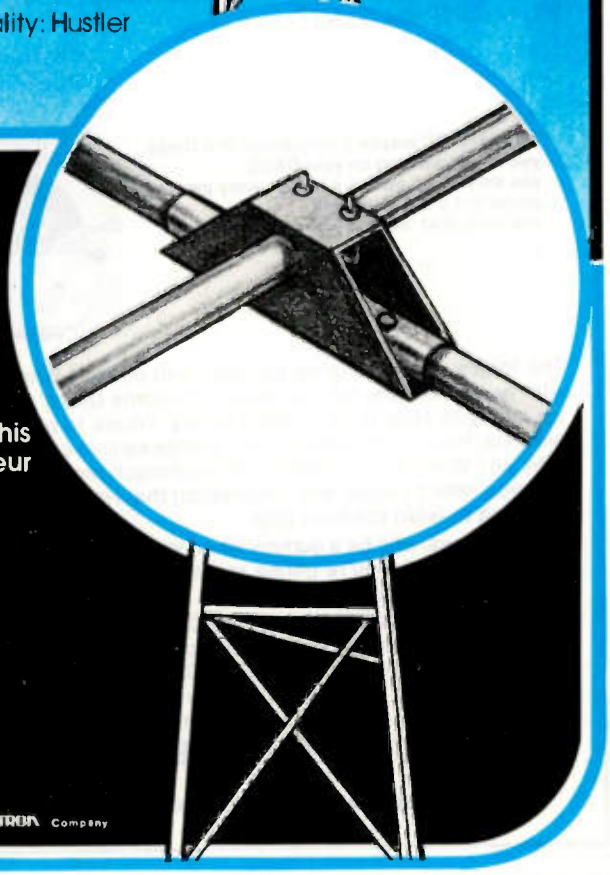

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More for Less

— this tune-up procedure gives more RTTY output, less heat to dissipate

Using an SSB rig for RTTY can be hard on tubes, depending on how you tune up your rig. Many hams, I have found, tune their rigs the same as they would for CW or SSB, then reduce the drive to about half power or half the plate current. This is a poor method to use as you are operating on a very low part of the efficiency curve (power input versus power output) of your final tubes. Try the above method into a dummy load, reducing your drive after tuning for CW to half the plate current and note the power on a power meter. Now, figure your input power (Ep × Ip) and subtract the output power from the input power. The result is the amount of power (heat) your final tubes must dissipate.

Now retune, using the same amount of drive you used when tuning up for CW, but instead of loading for maximum output power, reduce your loading to about ten mils over one-half the plate current you were loaded to for CW, retuning the plate for a dip as you reload. Now, for RTTY operation, adjust the drive to the point where your plate current (half the CW current) just begins to drop. This value should be one-half the current you normally load to for CW. Your plate input power should be the same now as before, but check the output power meter reading and you will find about twice the power output as before. And, again, subtract the output power from the input power, and you will find your tubes now have less than half the power (heat) to dissipate as before. Adding a muffin fan to draw the warm air out of the final compartment will be an even greater tube saver.

If you're using a linear, it should be tuned after your exciter and should be tuned for maximum output with the available drive you now have from your exciter tuned for RTTY. If you wish to run less than the maximum your linear will put out, reduce the loading on the linear, retuning the plate for the desired power output. Do not reduce power by reducing the drive on the exciter as this puts your tubes in the low efficiency part of the power curve.

Don't take my word for this method—try it! Your tubes will love it. Test this method and prove to yourself it works, and save on those tubes. ■

Expand your station versatility....

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DRAKE® Theta 7000E Microprocessor-Controlled Communications Terminal

The perfect addition to any amateur radio installation! Complete, automatic send/receive of Morse code (cw) Baudot code (RTTY) and ASCII code (RTTY). Works with any video monitor.

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Model 7000 **Drake Theta 7000E Terminal $1095.00**

Model 7009 **Drake TR-930 Video Monitor $ 185.00**

7-Channel Battery Back-Up Memory, the Theta 7000E has seven keyboard-selectable, non-volatile, random access memory channels each of which can hold 64 characters. Data in these memories is alterable at any time and is retained when power is removed. Messages in these memory channels can be repeated 1 to 9 times via keyboard command. All channels may be daisy-chained for continuous read-out. Channel number in use is indicated on display.

Wide Range of Transmitting and Receiving Speeds, 5 to 50 wpm in Cw with autotrack on receive. Standard RTTY speeds of 60, 67, 75, and 100 wpm Baudot code and 110, 150, 200, and 300 Baud ASCII code.

Self Contained Demodulator, three-step shift selects either 170 Hz, 425 Hz or 850 Hz shift with manual fine tune control of space channel for odd shifts. High/low tone pair select. Mark only or space only copy capability for selective fading.

CONVENIENT KEYBOARD FEATURES, automatic keyboard-operated transmit, (KOX) or manual keyboard transmit. **Unshift on space,** reverts to LETTERS case after reception of each space character in Baudot code. **CR/LF is automatically inserted** every 60, 72 or 80 characters while transmitting. **Cw identification,** in RTTY mode. **Echo function,** prerecorded cassette tapes can be read and transmitted. **Test messages,** "RY" and "QBF". **Transmit word mode,** characters can be transmitted in word groupings.

Crystal Controlled AFSK Modulator:

High Tone Pairs	Shift	170 Hz	425 Hz	850 Hz
	Mark	2125	2125	2125
	Space	2295	2550	2975
Low Tone Pairs	Shift	170 Hz	425 Hz	850 Hz
	Mark	1275	1275	1275
	Space	1445	1700	2125

• **Printer Interface for Hard Copy,** all modes for parallel ASCII printers. Loop keyer for conventional teleprinters. • **Composite Video Output,** for any standard video monitor. •**Kansas City Standard AFSK Output,** KCS tone pair for ASCII. • **Large Capacity Display Memory,** two page display memory contains 32 X 16 lines per page. • **Split-Screen,** with a keyboard command, the display can be divided in two; the upper half for transmit and the lower half for receive. Messages can be composed while receiving. • **Buffer Memory,** 53 character type-ahead keyboard buffer. • **Word Wrap-Around,** In receive mode, word wrap-around prevents the last word on a line from becoming split in two. Moves whole word to next line. • **Automatic Letters Code Insertion,** if desired, LETTERS (diddle) code can be transmitted continuously in a pause of transmitting from the keyboard. • **Audio Monitor,** a built-in audio monitor circuit with automatic transmit/receive switching enables checking of the transmit/receive tones. • **Transmitter Keying Circuitry,** keys either grid block, cathode keyed, or solid-state transmitters. • **Power Requirement,** The Theta 7000E requires only 13.6 Vdc @ 1 amp. Plugs into 13.6 Vdc accessory jack on PS7 or PS75 power supplies. • **Effective Packaging for RFI Protection,** well designed metal cabinet and protective circuits prevent RFI. • **Terminal Size:** 15.8"W x 11.8"D x 4.7"H (40 x 30 x 12 cm) • **Weight:** 11 lbs (5 kg) • **Monitor Size:** 8.7"W x 9.8"D x 8.9"H (22.1 x 24.1 x 22.6 cm) • **Weight:** 11 lbs (5 kg)

Model 1230 **LA7 Line Amplifier** **$49.95** Suggested List

Line output, Input levels as low as 15 mV rms (47 kilohm) will result in an output of 1 mW nominal into a 600 ohm balanced line. Output level adjustable by internal pre-set level control. Interfaces low level audio to RTTY terminal unit or phone line that requires a 600 ohm balanced/unbalanced input. One 36" phono to phono cable supplied. • **Size:** 4.5"L x 1.3"H x 2.5"W (11.4 x 3.3 x 6.4 cm). **Weight:** .3 lbs. (.14 kg).

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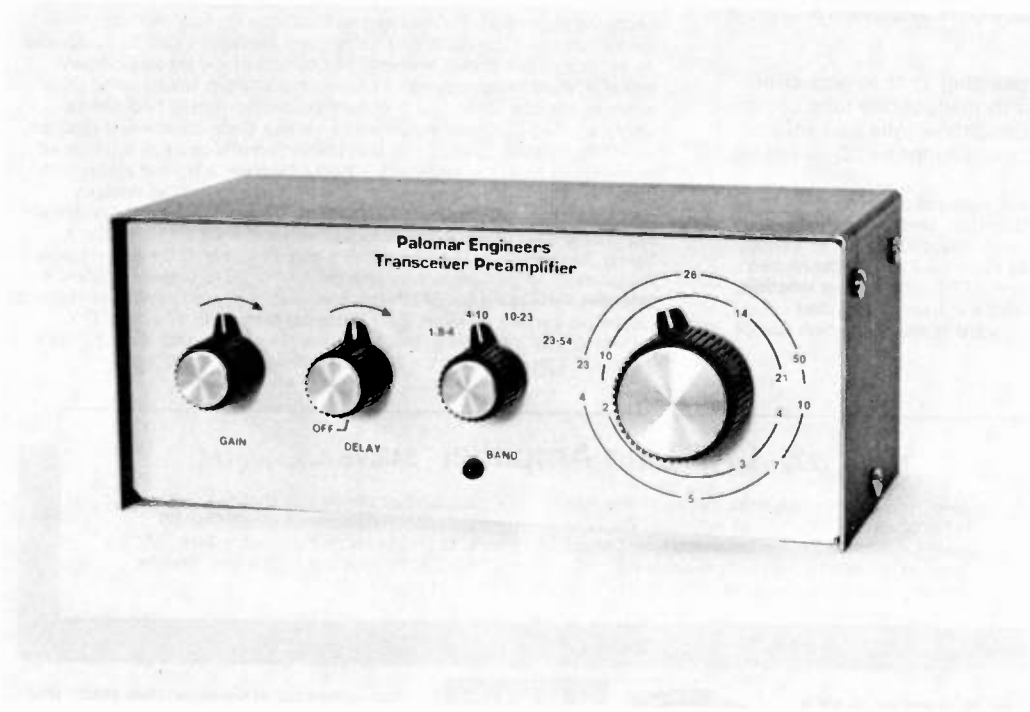
Inside the Palomar Preamp

—big ears for your receiver

Regardless of the sophistication, cost, or complexity of one's amateur radio equipment, there always seems to be room for adding a few custom accessories to round out the station's inventory. One of the most common accessories is the receiving preamplifier. Most of the best-designed (and costly) transceivers and receivers sold today have enough sensitivity and front-end rf selectivity to make the purchase of a preamplifier of questionable usefulness—though this "armchair speculation" does not always hold water. Older and especially vacuum-tube era and SWL-oriented equipment can almost always profit from the installation of a preamp. Thus I looked forward with anticipation to trying out one of the new Palomar Engineers P-310X transceiver preamps. I obtained one at the 1981 ARRL National Convention at Orlando, to try out with some 1980s vintage gear.

The new Palomar unit is the successor to an earlier model, introduced about three years ago, that was styled along the lines of most Palomar accessories: die-cast aluminum cabinet with a bright red-orange cover. The older unit covered the 1.8-54-MHz range and featured circuitry and gain comparable to the newer version, but it had a transmit-receive (T/R) relay that occasionally gave trouble. The new bi-linear P-310X is actually one of a line of four similar preamps offered by Palomar. Its closest cousin is the P-312X, which is similar but is designed for 12-V dc operation. The P-308 is a receiver-only ac-powered preamp, while the P-305 is the same receiver-only unit but intended for 9-V dc operation using a standard transistor radio battery. Though all models are similar, the P-310X is the top of the line; its bi-linear circuitry features T/R sensing for automatic cutout of the preamp while transmitting and the built-in power supply allows convenient hookup to an ac outlet by means of the six-foot three-conductor power cord.



Palomar Engineers P-310X transceiver preamplifier (Photo courtesy of Palomar Engineers)

The preamp uses a tuned rf amplifier which covers all of the ham bands from 160 through 6 meters (1.8 to 54 MHz) and all radio services in between. The continuous coverage feature also makes it suitable for general-coverage and SWL purposes. At the heart of the unit is a low noise dual-gate FET transistor amp which affords a 1.5- to 3.5-dB noise figure. Input and output im-

Continued on page 180

Introducing incredible tuning accuracy at an incredibly affordable price: The Command Series RF-3100 31-band AM/FM/SW receiver.* No other shortwave receiver brings in PLL quartz synthesized tuning and all-band digital readout for as low a price.† The tuner tracks and "locks" onto your signal, and the 5-digit display shows exactly what frequency you're on.

There are other ways the RF-3100 commands the airways: It can travel the full length of the shortwave band (that's 1.6 to 30 MHz). It eliminates interference when stations overlap by narrowing the broadcast band. It improves reception in strong signal areas with RF Gain Control. And the RF-3100 catches Morse communications accurately with BFO Pitch Control.

RF-6300 8-band AM/FM/SW

Want to bring in your favorite programs without lifting a finger? Then consider the Panasonic RF-6300 8-band AM/FM/SW receiver (1.6 to 30 MHz) has microcomputerized preset pushbutton tuning, for programming 12 different broadcasts, or the same broadcast 12 days in a row. Automatically. It even has a quartz alarm clock that turns the radio on and off to play your favorite broadcasts.

The Command Series RF-3100 and RF-6300. Two more ways to roam the globe at the speed of sound. Only from Panasonic.

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

†Based on a comparison of suggested retail prices.

This Panasonic Command Series™ shortwave receiver brings the state of the art closer to the state of your pocketbook.

With PLL Quartz Synthesized Tuning and Digital Frequency Readout.

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just slightly ahead of our time.

Tim Daniel N8RK
73 Magazine Staff

Four New Books for the Experimenter

Imagine that it is a rainy Saturday afternoon. Sol has gone on a rampage, leaving your favorite DX band in disarray. Instead of searching for a new country to work, you decide to warm up the soldering iron and build a simple yet useful project. Next you turn to the bookshelf to find a source for your rainy day fun.

Beginner's Handbook Of IC Projects

The lucky experimenter will find a copy of the *Beginner's Handbook of IC Projects* by David Heiserman. This 216-page Prentice-Hall publication covers building, troubleshooting, understanding, and testing elementary integrated circuit projects. The emphasis is on construction. Each of the 84 projects has a schematic diagram accompanied by a parts list and brief description of circuit operation. The author encourages the builder to use a solderless breadboard to debug and experiment with the circuits; they can later be built in a more permanent fashion.

The circuits in the *Beginner's Handbook of IC Projects* range from a "Simple Light Flasher" to a "15-Channel Rf Synthesizer." The parts required to build the projects include garden variety TTL chips as well as more exotic linear ICs. If your junk box is not up to snuff, then you can get most of the components from Radio Shack or one of the mail-order houses. Detailed pinout and function information for the ICs is given in an appendix.

The projects in this handbook are not earth-shattering achievements that will change your life, but they are certainly fun and educational. If you are a hands-on type who enjoys simple yet state-of-the-art projects, then consider adding *Beginner's Handbook of IC Projects* to your library. Both hardbound and paperback editions are available from Prentice-Hall, Englewood Cliffs NJ 07632.

Ed Noll's Solid State Circuit Files, Volumes I and II

Have you ever wondered just what a common collector amplifier does or how a counter circuit works? Your search for this kind of information might lead you to *Ed Noll's Solid State Circuit Files*. This two-volume set is published by Howard W. Sams and Company. Each book is designed to give electronics buffs practical experience with the circuits that form the building blocks for our modern-day technological wonders.

Volume I of *Solid State Circuit Files* covers bipolar transistor, FET, and linear IC circuits. There are more than 60 circuits, starting with simple transistor amplifiers and progressing to the popular linear IC devices. Each file includes a circuit diagram, a detailed technical description, and a suggested procedure for experimentation. Digital circuits are featured in Volume II. The 61 files are evenly split between CMOS and TTL applications that range from basic gate functions to multichip counter-display designs.

The student or serious experimenter who is armed with *Solid State Circuit Files*, a breadboard, and a handful of parts can obtain a good understanding of what makes a circuit tick. If you have already mastered the basics, then the circuit files can be a helpful reference when you want to refresh your knowledge of a specific circuit: Volumes I and II of *Ed Noll's Solid State Circuit Files* are available from Howard W. Sams and Co., 4300 West 62nd St., PO Box 7092, Indianapolis IN 46206.

Troubleshooting Solid-State Circuits

The third book that you might reach for on a rainy afternoon would be *Troubleshooting Solid-State Circuits* by George Loveday and Arthur Seidman. The core of the text centers on a "concise description of major solid-state devices and their operation in practical circuits...followed by a discussion of how these devices and circuits fail and what troubleshooting techniques are employed to isolate and correct the fault in minimum time."

Troubleshooting Solid-State Circuits is written as a study text for a course in electronics troubleshooting. There are exercises for the student to solve and answers to the exercises in the back of the book. This is *not* a how-to-do-it style book. You won't find step-by-step instructions to build a super-duper bang box; instead, you will have a resource for learning how basic circuits operate and how to diagnose their ills.

The first chapter can be particularly helpful to a beginning troubleshooter, since it describes how to use measuring instruments as well as the basic procedures used to diagnose even the most complex electronic equipment. A 106-page softbound edition of *Troubleshooting Solid-State Circuits* is available from John Wiley & Sons, 1 Wiley Dr., Somerset NJ 08873. ■

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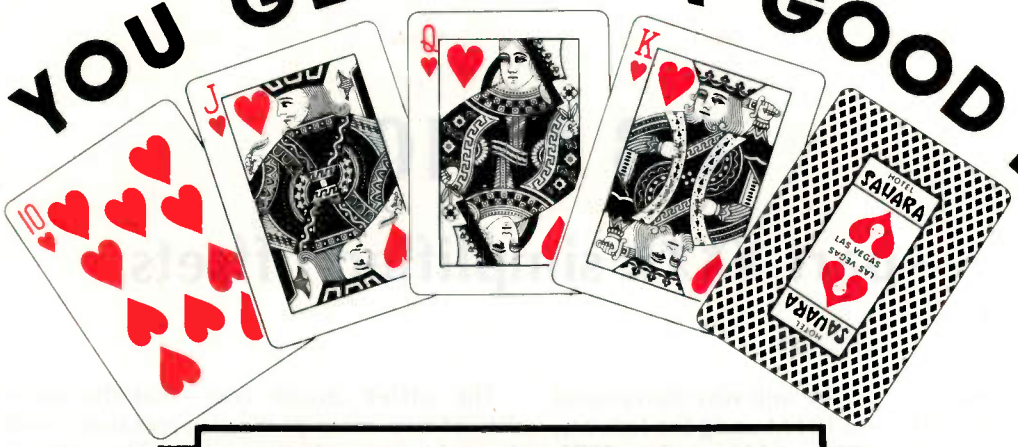

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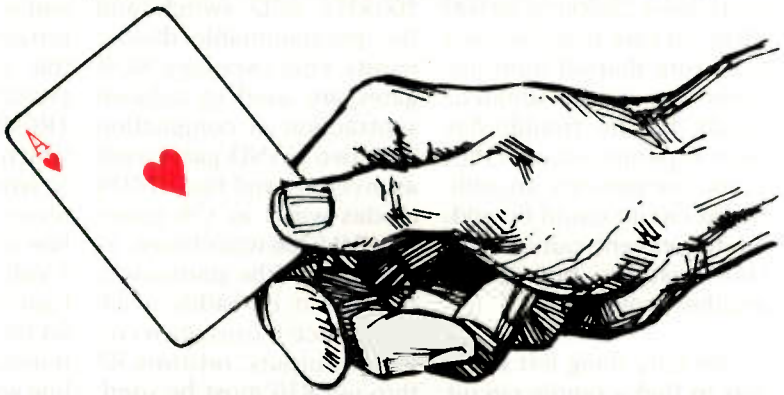

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CB to 10

— part XXXI: simplified offsets

With the growing number of CB-to-10-conversion articles, an urge to do my part and liberate one from 11 meters finally got the best of me. I obtained a Realistic TRC-452 and was then faced with the problem of which of the many band plans to use. A listen on 10 with the FT-101 only served to compound the problem. Then along came the January, 1980, *73* with a CB-to-10 FM conversion, and I was sold!

A Sams for the 452 was obtained and studied at great length. The TRC-452 uses a uDP-585 chip as the heart of the synthesizer. This chip has a BCD programmable divider, so it was decided to use thumbwheel switches for channel selection.

The unit was then placed on 10 FM using the January, 1980, and November, 1978, *73*s as a guide. The coverage using the thumbwheel switches is 29.000 to 29.990 MHz, so care must be used to ensure that all transmissions are in the amateur bands, but no trouble has been experienced with this. If you are nervous, an additional circuit could be added to prevent out-of-band transmission, but that's another project.

The only thing left to do was to find a *simple* circuit to obtain the 100-kHz offset used by repeaters on 10. Another search through back issues of *73* yielded the 600-kHz offset for 2m which became the inspiration for the circuit in the accompanying diagram.

The offset circuit consists of two main portions: the subtraction logic and the switching logic. It is placed between the 100-kHz BCD switch and the programmable divider inputs. Four exclusive NOR gates are used to achieve subtraction in conjunction with two NAND gates used as inverters and four 1N914 diodes wired as OR gates. The 74LS266 was chosen, as were all of the parts used, because it is readily available. Since it uses open collector outputs, resistors R7 through R10 must be used, but if a 74135 exclusive NOR gate package can be located, the four collector resistors can be eliminated, further simplifying construction. Resistors R1 through R6 are all pull-down resistors to ensure that the gates see the correct logic levels.

The 74157 is a quad 2-line-to-1 data selector. A pair of 7400 NAND gates and a 7805 regulator to interface the offset circuit to the radio make up the switching logic. The TRC-452 uses an 8-volt line which goes low on transmit to switch the radio between receive and transmit. This line is brought down to the 5 volts required by the TTL logic by the 7805. A switch on the front panel is used to remove the 8-volt transmit line when no transmit offset is desired.

If you sit down and work out the innards of the subtraction logic, it will become obvious that it is a binary rather than a true BCD subtraction, but this is really only a problem using BCD switches when 1 is subtracted from zero. The answer is 15 instead of the 9 we would get with a BCD subtraction. Rather than add more circuitry to gloss this over, I decided to use a NAND gate left over to sense this invalid code and inhibit the offset. This is the function of U3C and conforms with the main design goal of a simple, easy-to-build circuit.

Hopefully, this 100-kHz offset will be of use to others who are converting this or similar CB units for use on 10-meter FM. Pick up your soldering iron and have at it! I'll see you on 10 FM. ■

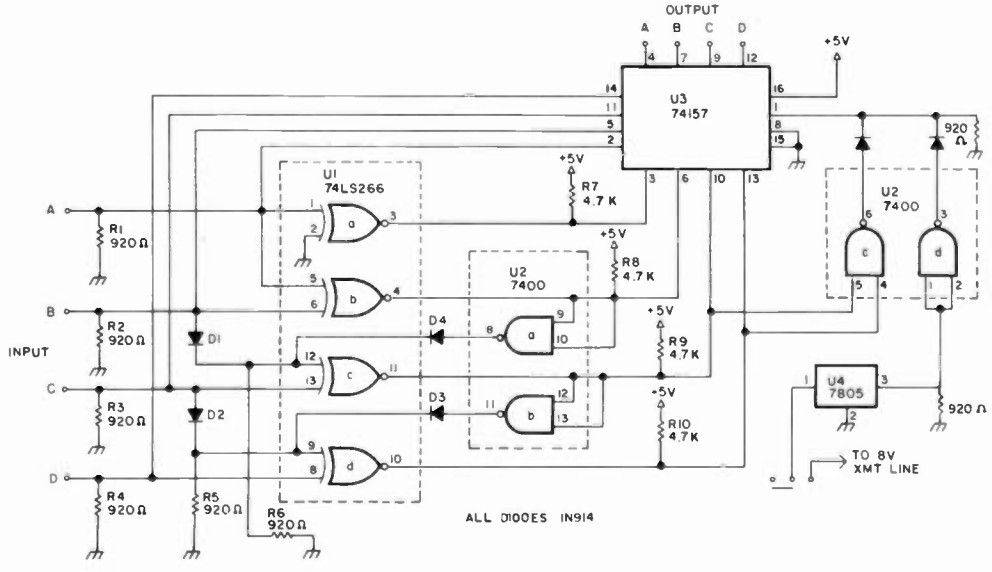

Fig. 1.

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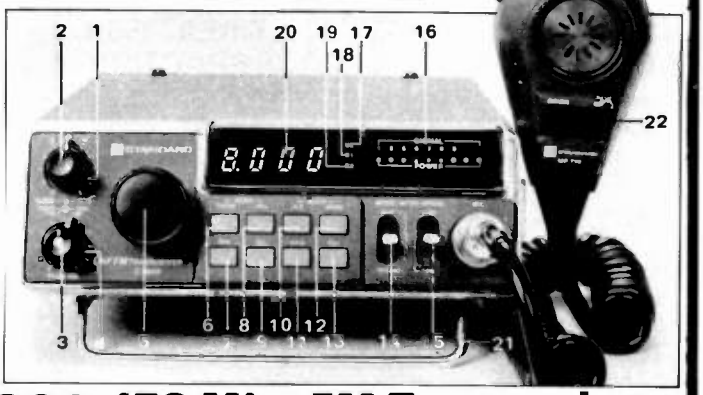

C-7800 450 Mhz FM Transceiver

(1) Mode selector (2) Squelch (3) Push on/volume control (4) Power selector (5) Channel selector (6) Memory enter key (7) Spare key (8) Memory recall key (9) MHz key (10) Scan all key (11) Call key (12) Scan memory key (13) CCL Key (14) Scan mode switch (15) Scan speed switch (16) S/RF meter (17) UL indicator (18) R1 indicator (19) R2 indicator (20) Freq. display (21) Stand (22) Frequency up-down control

8-bit Microcomputer:

The C-7800 incorporates an 8-bit microcomputer with high processing capability. The brand-new LSI, which has been developed especially for this transceiver, has a huge memory capacity twice that of conventional LSIs. A full 16K bits for read only memory (ROM) and 0.6K bits for random access memory (RAM). This is the brain of the C-7800 which precisely controls the many active functions such as multi-mode scanning and 5-channel memory. It actually memorizes, thinks, and makes decisions for quick and correct channel control.

The microcomputer offers the following functions:

• Capable of memorizing, or programming any five (5) frequencies. • Scans up and down the five stored channel frequencies. • A frequency range from 438 Mhz to 449.975 MHz divided into 12 steps of 1 Mhz each, and each 1 Mhz span scanned up and down at 25 or 50 KHz intervals. • Automatic search for busy or vacant channels. • Two switchable scanning speeds. • A higher priority given to the call channel. • Memory back-up. Preprogrammed channel frequencies are maintained in the memory when the main power to the unit is switched OFF. An abnormal low supply voltage makes an internal DC-DC converter maintain the back-up voltage at a constant level. • Up to 480 channels can be selected using the non-contact channel selector which has 24 steps per rotation (240 channels at 50 KHz interval and 480 channels at 25 Khz).

RECEIVER SECTION

Receiver type	Double superheterodyne
I.F. frequencies	1st: 21.4 MHz, 2nd: 455 kHz
Sensitivity:	0.5uV (20 db QS), 0.4uV (12 dB SINAD)
Pass bandwidth	±7.5 KHz (-6dB)
Selectivity	Greater than 60 dB at ±25 kHz
Squelch threshold sensitivity	0.2uV
AF output	2w into 8 ohms @ 10% distortion
AF load impedence	8 Ohms
Standby current	0.6A

TRANSMITTER SECTION

Transmitter power output	10 watts/1 watt
Output impedence	50 ohms
Spurious response rejection	-60 dB
Maximum frequency deviation	±5 kHz
Modulation type	Variable reactance
AF response	300 Hz to 3000 Hz
Microphone input impedence	600 ohms
Supply voltage/current	13.8 vdc/4.5 A
Size	6.6"w × 2.3"h × 9.4"d, 6.6 lbs

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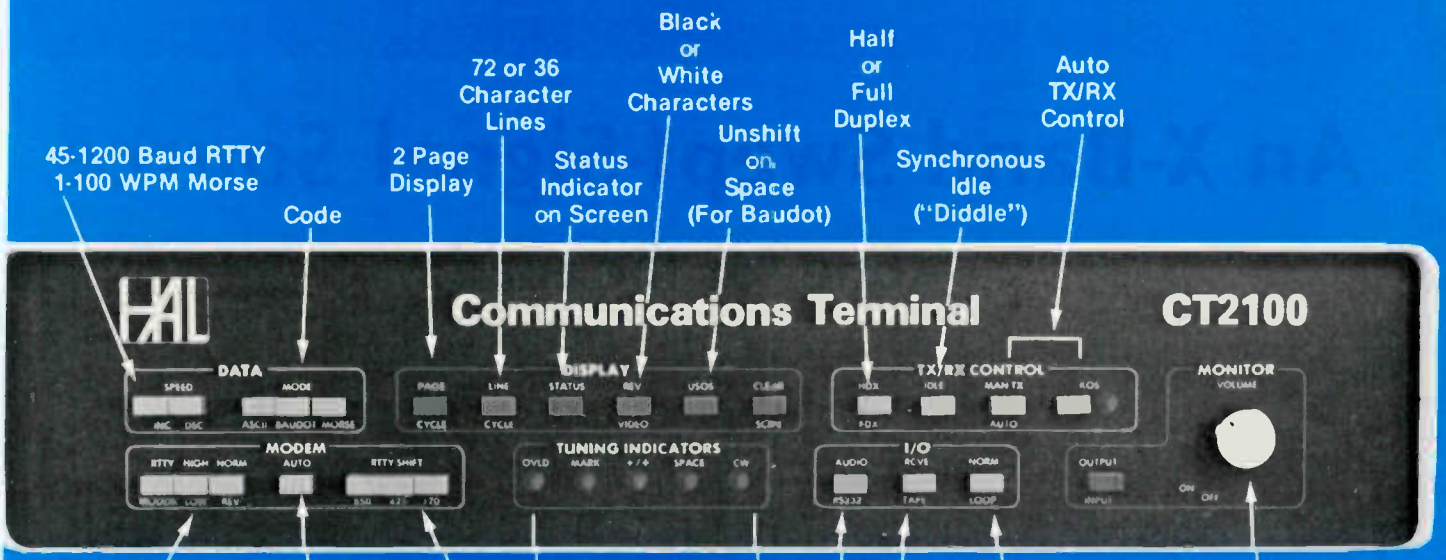

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An X-Band Swept-Signal Source

—one for the road

Tuning up a waveguide filter for an X-band requirement can be a tedious job. A swept-frequency oscillator seemed to be in order. The sweep circuit must tune an oscillator across the band of interest. It should provide a voltage ramp which rises in amplitude, abruptly falls to zero, and then repeats itself. The width and amplitude must be adjustable in order to control sweeping in the band of interest. This same sweep voltage could be used to provide the horizontal sweep for an oscilloscope, and when a detected output is applied to the vertical amplifier of the oscilloscope, a visual pattern of the passband of the filter can be observed. This form of presentation also would be helpful when tuning up an X-band horn antenna, although a sensitive receiver would have to provide the vertical sign.

A sweep circuit was designed which was applied to the varactor tuning capacitor of a Gunn diode oscillator. It performed very well for both applications. A waveguide cavity wavemeter then was inserted in the detection waveguide to provide a discontinuity in the trace which could be moved as the cavity wavemeter was adjusted. This provided markers that would assist in indicating passband widths, and when the amplitude was calibrated, also indicated levels of attenuation or gain.

The filter being processed using the above technique is part of the front end of a radar detector which is centered on 10.525 GHz, the X-band police radar assignment. The filter forms a preselector for a varactor-tuned Gunn oscillator transceiver front end manufactured by Microwave Associates. The detected output of the transceiver is fed into a 30-MHz i-f amplifier. The combination makes an extremely sensitive radar detector.

The output of the superheterodyne receiver described above is directed into an alarm system which was tripping on signals from other services which were outside of the police radar band. The receiver also is used on the X-band amateur assignments. When the manual tuning control voltage is replaced with the output of the sweep circuit and the detected output and sweep voltages are applied to an oscilloscope, a panoramic view of the spectrum can be observed.

A second, swept Gunn

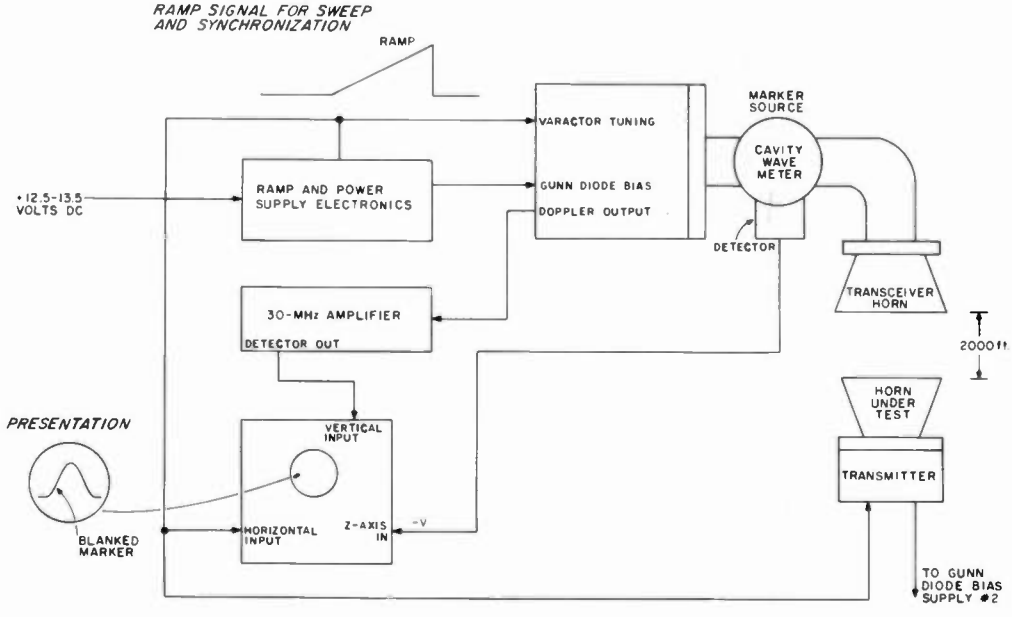

Fig. 1. Block diagram of method of presentation of swept signal.

oscillator is used in the manufacture and tune-up of horn antennas for radar detectors which I manufacture. The receiver described above is located at a considerable distance from the transmitting horn, and the sweep voltage from the transmitting oscillator is applied to the receiver varactor tuning over a long cable. This allows the receiver to be swept in synchronism with the transmitter and the resulting oscilloscope presentation used to assist in making adjustment to the horn antennas.

Considerable care in setting up an antenna range as described must be exercised. It must, at my location, be arranged so that the transmitting horn is at right angles to the nearby highway (which is in view) so that jamming will not occur to the Blue Wagons parked along the highway.

A block diagram (Fig. 1) of the test setup will give a good idea of how to apply the sweeper circuit to a similar Gunn diode setup. A Gunnplexer is used in the amateur band receiver, but without the oscilloscope since mountaintopping is hard enough without the weight of my old Tektronix 535. The circuitry shows how it is all done, with emphasis on sweeping the transitting oscillator's 50-milliwatt output. The use of a higher-power Gunn oscillator is anticipated which will increase the transmitting distance.

Let's take a look at the sweeper circuit (Fig. 2). It consists of a pulser keying a monostable oscillator to produce a very linear ramp voltage. This voltage is fed into a source-follower because the output of the ramp is taken from the junction point of the timing capacitor, C, and its switch. This is a fairly high-impedance point and loading can destroy the ramp linearity. The FET source-follower is fed into an emitter-follower which provides the output voltage and current required to drive the varactor tuning over the required voltage excursion.

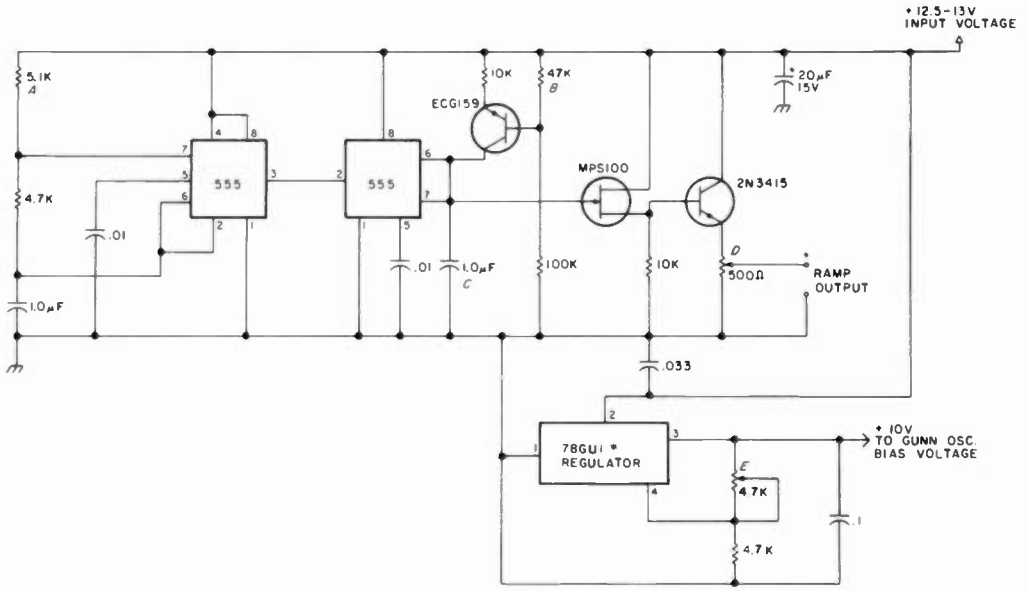

Fig. 2. Sweep circuit and power supply for a swept-frequency Gunn oscillator.

The two integrated circuits are 555 timers. One is connected as an astable oscillator to produce the trigger pulse for the second 555 which is connected as a monostable circuit. The timing of each of these units can be made adjustable and some further description will assist in deciding how fast it should be made to sweep.

A 50-milliwatt Gunn oscillator swept over a 100-MHz frequency band in 0.8 seconds would cause only small problems to any kind of radar since the time on a particular frequency would be only a very small part of the sweep time. But I needed an oscilloscope presentation and, of course, a faster sweep, at least a 30-Hz rate. A sweep rate at this speed will draw little attention to its originator because it is below the radial velocity of an X-band signal.[1]

This velocity factor, 31.4, multiplied by the desired detection speed of a radar determines the rate which is used for the display system of the radar. Example: 1884 divided by 31.4 Hz equals 60 miles per hour. So, if the swept rate is less than 31.4 Hz, it will not indicate because most police radars are calibrated to plus or minus 1 mph. The radar receiver, of course, will detect the signal, and, in fact, it may just jam it so that it cannot indicate any speed. The best way to use this device is keep it pointed away from roads and highways when tuning up your radar detector.

The circuitry shown uses all fixed values so that the sweep frequency will be below the radial velocity described. The components marked A, B, and C can be changed to suit the needs of the constructor. Resistors A and B can be potentiometers and capacitor C will have to be changed accordingly. Consultation of data sheets[2] for the timing rates for the monostable and astable circuits will save considerable time in choosing the right values.

The MA 87125 varactor-tuned Gunn oscillator transceiver used in the swept-signal source requires 650 milliamperes of current for the Gunn diode bias. A circuit shown as part of the sweeper circuitry, marked bias regulator, will provide ten volts maximum at the desired current for this purpose. If a greater power output Gunn unit is used, a larger regulator will be required. A 78-series regulator will handle currents over 1 Ampere.

The circuitry shown was built as a breadboard on a small piece of perfboard with flea clips serving as solder points for the components. No particular care was given to parts placement and no problems were encountered with the circuit wired in this manner. Several other units were made to be used mobile and were mounted on a printed circuit board manufactured by Peters Publications, PO Box 62, Lincoln MA 01773, and will be available shortly at a moderate cost.

When construction is complete, it is advisable to make the following simple tests without connecting the Gunn system to it. To do this, apply 12.5 to 13.5 volts to the input voltage terminal. This voltage can be supplied from an automo-

bile storage battery or any convenient source. If a vehicle battery source such as a cigarette lighter jack is used, additional filtering is needed to keep out alternator or generator whine. Adjust potentiometer D to provide a reading of 4 volts as indicated on a voltmeter. This will guarantee that the sweeper starts off at the center of the tuning range of the varactor tuning system for the Gunn oscillator. Next, adjust potentiometer E to indicate 10 volts at the point indicated for the Gunn diode bias voltage.

You may now connect the transceiver to the sweep circuit card. Be sure that you remove the dc supply while you are connecting the circuit to the transceiver. This unit costs considerably more than you want to throw away by blowing a Gunn diode or varactor with a spike caused by a soldering iron or some other fluke.

When all connections are completed and you are sure of them, turn on the dc supply. You should be able to detect rf output from the Gunn oscillator with an rf detector. If none is available, connect a voltmeter to the Doppler output solder pin and terminate this point with a 500-Ohm resistor. When the Gunn diode is oscillating, the correct output voltage should be 0.2 volts across this resistor. If it is higher, adjust the screw found in the waveguide flange (just behind where the antenna connects) until the 0.2 volts appears. Make sure the antenna is pointing away from reflecting surfaces when making this adjustment.

Now that these adjustments have been made, you can be certain that the oscillator is sweeping from 10.465 GHz up to 10.525 GHz. With the voltmeter connected across the varactor tuning pin, readjust potentiometer D so that the meter now reads 8 volts. With the voltage set at this point, the ramp will pull the oscillator through its range and sweep approximately ±60 MHz either side of the center frequency according to the manufacturer's specifications.[3] The sweep linearity is considerably better than the tuning linearity of the varactor diode, so bunching up of the swept frequency will exist on the high end. A small jump occurs at the low end which is caused by the breakover point of the same diode, also contributing to a nonlinear start of the ramped frequency.

When using this device outside or in a vehicle, it must be remembered that the oscillator is subject to temperature problems as is any free-running oscillator for which temperature compensation has not been made. The manufacturer states that these units are tuned at the factory to the specified center frequency ±5 MHz with 4 volts on the tuning varactor, and that the electronic tuning stability is −350 kHz per degree C. With this information available, it should be evident that the sweep frequencies available from this unit are seriously affected in the New England weather, so in the winter the antenna range is not in use and 20 meters is again my meat. ■

References

1. Sterling Olberg W1SNN, "Mobile Smokey Detector," *73*, Holiday, 1976.
2. *Motorola Linear IC Handbook*, third edition, p. 8-294.
3. Microwave Associates Bulletin No. 7618C, MA-87105 series.

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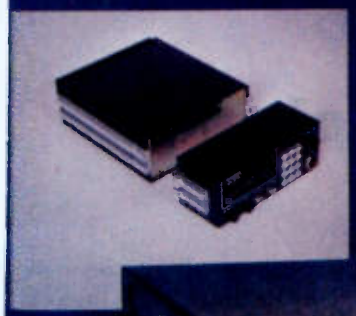

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— do your nicads measure up?

Once upon a time, I was sent two boxes of AA cells for use in a pair of HTs. Both of the HTs received well after the cells had been installed, but only one would transmit. Swapping battery packs revealed that the problem was in the batteries, not in the HTs. The relatively low drain in the receive mode was supportable; the high drain in the transmit mode was not.

The solution was to grade the cells, using the setup shown in Fig. 1(a). This test is similar to the lead-acid cell tester which used to be used before car batteries were sealed. See Fig. 1(b) for this antique device. Caution: Do not test any high capacity cells this way with a VOM. Be sure your VOM will handle the peak currents shown.

Short-circuit currents for three common sizes of carbon-zinc cells are shown in Table 1. These are typical and may vary. Note that extended testing is self-defeating. About 5 seconds should be enough for you to take a reading.

The trouble with cells is that they all have some amount of internal resistance (R_{int}). When this is low in relation to the load resistance (when the HT was in the receive mode, for example), then it may be ignored. When the internal resistance of the cell is high in relation to the load, as with the HT in the transmit mode, then most of the cell voltage will be dropped across R_{int}. The load will receive only a fraction of the total cell voltage and the load current will be limited by R_{int}.

In the case of a battery of several cells, as in the HTs mentioned, one or two bad cells did render an entire pack seemingly useless. "The batteries are dead." Really, it is better to say, "Some or all of the cells may have a high internal resistance." More words, but cheaper than replacing otherwise good cells.

Internal resistance increases with the age of any dry cell. This is why the term "shelf life" is used. Most cells will always measure full *voltage*, even near the ends of their useful lives. Only really fresh cells will deliver full *current*.

Finally: The subject of this article is the testing of carbon-zinc dry cells. Alkaline, nicad, gell, and lead-acid cells should be tested with discretion. For high capacity cells, a circuit similar to Fig. 1(b) with a low value resistor at R1 could be used until you have some idea of what the peak current will be. Be kind to your meter! ■

D	3.3 A
C	3.7 A
AAA	2.7 A

Table 1. Short-circuit currents for three common cell types.

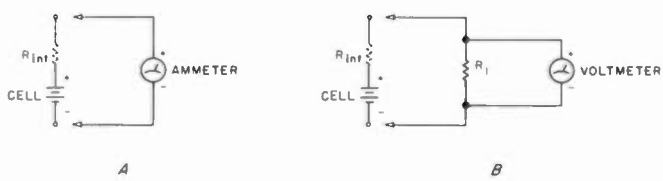

Fig. 1. Cell testing with a VOM (a) and an automotive cell tester (b). R_{int} is shown with dotted lines because it is invisible in most cases. This is discussed in the text. R1 would be perhaps 0.01 Ohm for an automotive cell tester, and from 1 to 10 Ohms for typical amateur applications.

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411

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LETTERS

TURKEYS

The article "Wild Turkeys 1, FBI 0" (August) was one of the most informative general interest stories I've ever seen in a ham publication. Mr. Howard seemed dismayed, however, that the individuals suspected of planting the remote jammer were not prosecuted. I would like to offer the following thoughts on the matter:

What if the FBI had already staked out the jamming site when Mr. Howard and his two friends first attempted to locate the transmitter? And what if the club members had found the transmitter, and then were approached and questioned by the FBI agents? Again, here are some licensed hams in the vicinity of an illegal transmitter, only instead of hunting coyotes, they are "trying to find a jammer, so they can put it off the air." No, Mr. Howard, without any more than circumstantial evidence, the Feds were right in refusing to prosecute the suspects.

Bob Morrow WB6GTM
Palo Alto CA

The title you selected for the article on page 12 of the August issue of *73* ("Wild Turkeys 1, FBI 0") reflects your prejudice and shows, I believe, a shameful lack of journalistic integrity.

Anyone reading only the title would have thought that the FBI really goofed up badly. After reading the article, one finds it was not the FBI who goofed up, but the FCC and perhaps the US Attorney.

Being somewhat curious, I contacted the author of the article, who advised me that he thought the FBI did a good job, and that, in fact, he had sent a letter of appreciation to them for their assistance. He also said the title he submitted for the article was "The Wily Coyote Hunters." In his opinion, it was the FCC that was the "paper tiger" in this case.

If we really seek to encourage the FBI in the pursuit of jammers and other illegal radio operations, I think praise and some thanks are in order. Heaping unfounded criticism on them is not likely to help our cause. If you must cast stones, it would appear you could find a more deserving target.

Steve Russell W0OGJ
Freehold NJ

While we appreciate the efforts of the FBI on behalf of the amateur community, we still stand behind the title we chose. The FBI, as our country's most powerful law enforcement agency, must bear the responsibility for educating its agents in the art of gathering evidence for successful prosecution. Considering the FBI's annual budget, we have a right to expect more than good intentions. Should we criticize the FCC for not prosecuting a case in which the only evidence was highly circumstantial? The FCC is to be congratulated for refusing a case that could only have wasted taxpayers' money. Individuals in our society are still innocent until proven guilty. May it always be so.—KA1LR.

NICKEL QSLS

Wow! That's a great idea on QSL cards. I need California on 20m SSB. I think a nickel is about right. Here's my check. Please hurry!

Larry Buhrman WA4GKG
Chattanooga TN

No split orders.—Wayne.

A SIMPLER WAY

In reference to the article titled "Solar-Powered Alignment Tool" in the August *73*, there is a way to determine a north-south or east-west line from the sun without the use of tables, clocks, calculations, etc., as are needed in said article.

The method requires only a small area of relatively level ground and a stick (two or three

feet long) stuck into the ground or other similar device that will cast a shadow so the shadow of its top can be spotted on the ground. One marks the top of the shadow, say with a small rock, at one time and then a couple of hours later marks the top of the shadow. A line through these marks will lie in an east-west direction quite accurately.

If one should wish to determine the time of local noon, he could construct a line perpendicular to the east-west line; that is, a north-south line. Then a stick could have one end stuck into the north-south line and lean over the line by the use of a plumb bob at the top end to align the stick with the line. High noon will be at the time the shadow of the stick exactly falls over the north-south line.

At this time the boom of an antenna can be given a north-south alignment by turning the boom so its shadow and that of the mast line up.

The above method of determining direction was discovered by a very young boy twenty or thirty years ago.

Fredrick Ketterer KA4IYV
Elberta AL

Shades of Stonehenge!—Wayne.

RADAR ROUNDUP

Glad to see that you haven't forgotten about Big Brother's foray into the world of electronic enforcement, and our attempts at passive electronic countermeasures.

I recently had the pleasure (?) of spending a total of 24 hours driving time between Cincinnati and the nation's capital, averaging 55 mph and including a few stops. Aside from sheer distance, the next most irritating factor was the 55-mph speed limit. This time I made the trip in a VW Beetle, so I felt no urge to push it past 55, but we do have faster cars in the garage and 55 in one of those would have been all the more unbearable. In that distance, the difference in time between 55 and 70 mph is approximately 1 hour and 10 minutes on one leg of the trip—a good deal of time that could be spent not trying to stay awake at the wheel (that leg was 10 hrs at 55, the other leg being considerably longer due to a side trip).

If I make any money on that

See List of Advertisers on page 130

trip, then I'll consider billing the government at an according hourly rate for those 2 hours and 20 minutes.

I learned a few other things: Radar detectors are not permitted in motor vehicles in Virginia, but at least they warn you of that at the border. Maryland enforces their speed laws. West Virginia apparently doesn't. Pennsylvania certainly does—they had plenty of troopers out taking radar readings, while perhaps one mile down the road (the PA turnpike), some poor motorist was stranded and displaying a white cloth as the little toll ticket instructed him to do. The troopers seemed more interested in making money though, and they must bring in some great sum, for the fine for doing 56 to 60 mph was $45.00! The sign said "Radar for your protection," but it should have read "Radar for our profit." Finally, I learned that two-meter radios can interfere with radar speed devices when, as I drove by one trooper taking readings while I was in conversation on simplex, the trooper threw his arms up in disgust and walked back to his car. This phenomenon happened several times—that's what they deserve for purchasing such shoddy equipment.

It seems that using a device for radio detection and ranging to enforce the speed laws is in poor judgment, due to the nature of the system and possible inconsistencies that might arise from improper use of this system by law enforcement agencies. Let radar be used by the DOD and the FAA, and let the police and Highway Patrol use stopwatches.

Until that day, keep up the fight against government injustice, or this alleged government for the people will become a government against the people. (People in Virginia should keep a Kleenex box on their dashes.) I've done more dangerous things than driving 70 mph. How about you?

Marc A. Boone WD8ROA
Cincinnati OH

You're just baiting me.—Wayne.

REVERSE RADAR RAP

I am an avid reader of your editorial columns and never miss an issue. I am always checking for the latest information that you have about radar. I have some information that I think you should tell your readers about.

First, any crystal-type radar detector will modulate the return radar beam, with a frequency of between 45-55 mph, if the radar detector is within 100 yards of the *police* unit.

I purchased an old "speedalyzer" radar unit at a swapfest and ran some tests with it on my bench. I found out that the microwave diode in the radar detector causes a "chopping" effect and passively chops the return beam up in little pulses. (Signal comes in, diode conducts, shorts out waveguide, no signal. Diode unconducts, signal appears again, starts all over.)

What this will do is that if anyone is driving normally, at a speed below 50 mph, and passes a squad car, it will cause the police radar to read 50 mph regardless of what speed the car is going (provided it is going slower than 50 mph).

The worst part about this is that the units do it even when they are turned off (since the diodes require no power).

Please caution your readers about this problem. I got a speeding ticket because of this problem and it took me 3 years of fighting before I got it dropped. I threatened to go to a jury trial, with all the press, and demanded a test run to show them that I could make their radar read any speed that I wanted to without my car moving an inch.

The court DA said that they couldn't stand the publicity and didn't want the hassle of all the people demanding their money back, so they threw it out of court.

Other people might not be so lucky and have to pay the fine, not realizing that their radar detector was to blame.

Ken Slate W9ITW
Ripon WI

Troublemaker.—Wayne.

MONEY FOR SCHOLARS

The Ed Redington Memorial Scholarship Fund, established last year in honor of W4ZM, has continued to increase. It is

hoped that sufficient funds will be received to establish a perpetual scholarship in Ed's memory.

Many individual and club contributors have indicated that they expect to make annual contributions to the fund in order to spread their tax deduction over a longer period. This is to remind them that it is now time for their 1981 contributions.

With the fund still short of its goal, it is hoped that many others will follow the lead and make additional contributions this year and in coming years to ensure a sustaining fund for this worthy cause.

Won't you help us reach that goal? You may wish to suggest additional contributions at your next club meeting. Everyone who knew Ed appreciates the value of this living memorial to him. Donations in any amount will be most gratefully accepted and acknowledged. Send your contributions to: Foundation for Amateur Radio, Attn: Ed Redington Scholarship Fund, c/o Richard F. Vincent K3AO, RFD #1, Box 230, Bryantown MD 20617.

Bill Miller K4MM
Fairfax Station VA

PARIAH

I read your editorial in the June edition. I wish I could express my thoughts on paper.

I agree with you on the way the ARRL operates. I am a member of ARRL and one of their clubs.

What I want to know is where is the courtesy and good fellowship the hams used to have? The CBer has more fun and courtesy than the hams of today.

If you are a novice you are ignored and can't even get into the clique. The ARRL has a magazine that takes an engineer and a computer to figure out. I thought ham radio was supposed to be fun and a hobby—not engineering.

The lifeblood of any organization is the lowly novice. Where are the "Elmers" they talk about? I need help and have been ignored by the snobs in the club. There isn't too much for the novice in the magazine.

Your magazine is in plain language. Even if you talk about a General class, you name the person and not a lot of numbers.

The hams are getting rude

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and discourteous on the air. I was told to get the hell off the air till I learned.

I better shut up because I could go on and on.

I enjoy reading your magazine and hope to continue to do so.

Frank D. Windsor KA6OPZ
Agoura CA

Frank, one of the few benefits of having been a ham for forty years is having read letters like yours for that same period. This may be a new situation to you, but old-timer hams have been putting down beginners right from the first days. I suspect that the first ham sneered at the second one as a newcomer. You just live with it and try to find someone newer to take out your own frustrations on. The bright part of it is that only a small percentage of the hams express their insecurity this way... the majority of them will bear with your lack of experience and help you over the first tough days. It is difficult enough to get on the air and have your mind blank out completely as to what to say without having some clown give you the pariah treatment.— Wayne.

RESURRECT ELMER

(Reprinted from the National Contest Journal.*)*

Elmer is dead. That's right, friends, Elmer and H. Scratchi and L. E. Rapp appear to have gone to the big Wouff Hong meeting in the sky. To those of you who have no earthly idea what the last two sentences are about, I dedicate this. For the rest of you who have a special place in your heart for "The Old Sock," 6L6s, and Blue Racers, bid those days farewell, because ham radio has evolved into the day of the Fox-Tango, the green stamp, the 8877, code readers, and "you're in the log." Before you throw this into the trash can next to the commode, let me tell you that I know every generation in the history of man has criticized the next generation, and the younger group doesn't want to hear any of this rot, but, read on, because this tale comes from one who isn't so old and conservative, and the scenario is sad, to say the least.

Ham radio was born of traditions of fellowship that make it unique to nearly every other form of human endeavor. Those traditions are not being passed along, causing hams to become as selfish and nondescript as the rest of our society. When many of us started in ham radio we had an "Elmer." Typically he was a middle-aged man who talked softly, never worked phone, didn't care much for DX or contests, and encouraged you without ever letting you do anything the "easy way."

He made you study, make mistakes, find your mistakes, fix them, and sweat your tail off to get a two-tube transmitter operating. Along the way, he instilled in you a pride and sense of tradition, a belonging, an obligation, and a respect of ham radio. Night after night you would sit on 7.172 trying to work 200 miles, while he was able to talk clear across the country with his 200 Watts and tribander! When you told him about your first DX contact, both of you lit up with pride. When you worked your first contest and made 62 Qs in 48 hours, you felt like you really did something. You did—you paid your dues!! The privilege of using the airwaves was not taken lightly. That piece of paper you got from the FCC was more sacred than your mother's picture!

For those of you still reading this, it appears that in the late 60s the morality of the world went through a change and, unfortunately, so did ham radio. It wasn't just a normal generational change, but a mutation. The scenario for a new ham now goes something like: from CBer to illegal CBer, to a collection of books and tapes with other CBers, to a Novice license. No more Elmer! The Novice rig is now a TS-520, a TH6 at 50', and a memory keyer. Then more books, more tapes, six tries, and, voilà, a General license. Once again the VISA card comes out and, in no time, it's a TS-830, a 3K, a 70' tower, and a processor. After three months on 20 sideband, you have the current breed of amateur.

"Hey, this DX station isn't on a list, what am I going to do?" "I paid three grand for this radio station—if I can't work him, nobody will." "You're transmitting on his frequency, you goddam idiot." "This is my frequency." It's sickening. The latest chap-

ter seems to be that since amplifiers are now available commercially that run five to ten kW, it's morally acceptable to use one. Before, you had to covertly build a pair of 4-1000s, and, somehow, that was immoral and unethical.

I sat in a DX forum recently and listened to one of the top DXpeditioners brag about how he lied, cheated, and intimidated people to get to operate from a semi-rare DX spot. Lawsuits are becoming commonplace in ham radio. Two-meter FM is one step from channel 19. I don't have a solution, but I do know that I really don't look forward to turning on the old radio any more. Contests have fallen into the battle of the bucks, the unethical power, the poor operating practice, and the lack of the amateur spirit. I hope that the Commission doesn't get so fed up with our problems that they deregulate us into nonexistence. Pray for the resurrection of Elmer.

Tom Taorimina K5RC
Houston TX

Tom... balderdash! One tends to see what one wants to see. And, yes, all of those horrible things you are seeing are there, but they are not as prevalent as you imagine... nor are they anything all that different. Tom, twenty years ago... before those awful 60s... we had Dxers going out and lying up a storm to get into rare countries. Some lied about where they were and the contacts still are all okay for the League awards. We did have a bunch of bad language... particularly in southern California... but that has died down in most parts of the country. Pileups are the same now as they were twenty years ago... filled with silly operators jamming the DX station because they can't hear him... fighting with each other... and so on. Tom, I've been at this hobby for 44 years now and I honestly see few changes overall. Oh, hams are building a lot more these days and more of them make an effort to keep up with technology than forty years ago, but other than that I can cover every complaint you have with similar beefs forty and fifty years ago... back in the "golden ages." All you have to do is read "The Old Man" in those faded pages of QST to know

Continued on page 171

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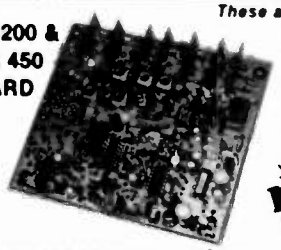

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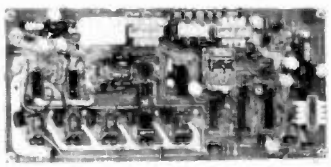

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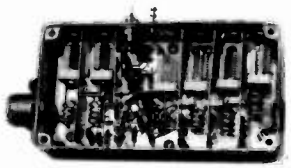

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TRA-1 "Courtesy Tone Beeper" Board

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

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

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

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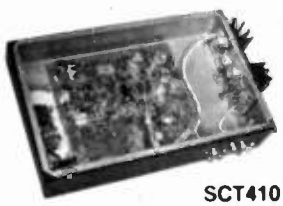

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new

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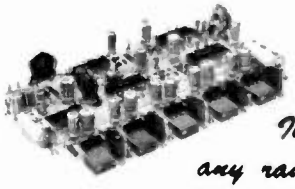

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Birmingham AL 35210

Investigating Icom's 730

— quite a rig

Icom's initial announcement of the IC-730 high-frequency transceiver created a flurry of excitement among many amateurs. Here in an attractive and very small package was a transceiver boasting numerous features previously found only in larger and more expensive units. Could the pint-sized gem truly alter one's thoughts concerning small-sized rigs as "main station" units? Ponder that question while we take a closer look at this feature-stocked unit.

Prior to my acquisition of the 730, I studied the amateur transceiver market quite diligently. I felt that all-solid-state design was paramount yet also desired reserve rf output capability for ease of mind when operating high-duty-cycle modes such as SSTV and RTTY. The ideal transceiver would also have an interface port permitting external microprocessor control. Finally, I wanted a rig equally usable in my main station or in a mobile or portable installation. My inquiries during the 1981 Dayton and Atlanta conventions indicated the Icom 730 could easily handle these prerequisites. During the waiting period for the 730 to become available stateside, I carefully monitored a friend's problem with an IC-720, comparing factory concern and results against previous experiences with other companies. The results were quite impressive: Icom performed repairs within a two-day period and included extensive written reports when they returned the rig. Importantly, telephone conversations with Icom's technicians were always congenial and helpful. The prospect of dependable service was the final nudge to purchase an Icom.

The Receiver

The 730's receiver employs quadruple conversion and a double balanced mixer in its front end. That combination (18-dBm intercept point and .3-microvolt overall sensitivity) produced one of the most enjoyable receivers I've ever used. Since band and power-line noises often play havoc with the supersensitive receiver in my other transceiver, I "tee-connected" both rigs in parallel for comparison. The 730 definitely received weak signals with better clarity and readability than my other unit. Wow!

Three tuning rates are front-panel selectable on the 730. The 1-kHz rate zips from one band edge to the other in three or four dial spins, the 100-Hz rate is approximately equivalent to the Kenwood TS-130's, and the 10-Hz rate (10 times slower!) provides massive bandspread for shaking fingers.

The 730's i-f shift is unique in two respects: It's tuned with a slider pot and *it really works*. I had expected the rig's optional passband tuning to be vital for my personal use, so I was quite surprised and pleased with the i-f shift's ability to dodge adjacent channel interference. It's great, particularly when used in conjunction with the receiver incremental tuning. The optional passband tuning, incidentally, is implemented when the 730's optional narrowband i-f filters are installed.

A dual MOSFET rf preamp which provides approximately 10 dB gain is front-panel selectable. This flexibility, when used in conjunction with the internal noise blanker, allows me to enjoy operating 20, 15, and 10 meters when my other rig is purely overcome with noises. Too much gain can, indeed, be more detrimental than not enough gain—in any rig. The 730's noise blanker, incidentally, can be switched between wideband (line noise and woodpecker) and narrowband (ignition and pulse noises). The fast agc in most transceivers is too quick for my use—they pump and drive the S-meter wild. The 730's agc, conversely, operates smoothly on either slow or fast agc.

All the new WARC bands are, naturally, included in the 730, although 160-meter coverage is omitted. WWV reception is provided in the 10-MHz band.

The Transmitter

Since I'm actively involved in full-duty-cycle modes like SSTV, I'm squeamish of solid-state finals which strain to produce full output. The 730,

Continued on page 181

HI-Q BALUN

- For dipoles, yagis, inverted vees & doublets
- Replaces center insulator
- Puts power in antenna
- Broadbanded 3-40 MHz.
- Small, lightweight and weatherproof
- 1:1 Impedance ratio
- For full legal power and more
- Helps eliminate TVI
- With SO 239 connector

$10.95

HI-Q ANTENNA CENTER INSULATOR

Small, rugged, lightweight, weatherproof

Replaces center insulator

Handles full legal power and more

$5.95 With SO 239 connector

HI-Q ANTENNA END INSULATORS

Rugged, lightweight, injection molded of top quality material, with high dielectric qualities and excellent weatherability. End Insulators are constructed in a spiral unending fashion to permit winding of loading coils or partial winding for tuned traps.

May be used for

- Guy wire strain insulators
- End or center insulators for antennas
- Construction of antenna loading coils or multiband traps

$4.95

Patent No. 4,091,350

DIPOLES

MODEL	BANDS	LENGTH	PRICE WITH HI-Q BALUN	WITH HI-Q CENTER INSULATOR
Dipoles				
D-80	80,75	130	$28.95	$24.95
D-40	40,15	66	25.95	21.95
D-20	20	33	24.95	20.95
D-15	15	22	23.95	19.95
D-10	10	16	22.95	18.95
Shortened dipoles				
SD-80	80,75	90	31.95	27.95
SD-40	40	45	28.95	24.95
Parallel dipoles				
PD-8010	80,40,20,10,15	130	39.95	35.95
PD-4010	40,20,10,15	66	33.95	29.95
PD-8040	80,40,15	130	35.95	31.95
PD-4020	40,20,15	66	29.95	25.95
Dipole shorteners - only, same as included in SD models				
S-80	80,75			$11.95 pr
S-40	40			$10.95 pr

All antennas are complete with a HI-Q Balun or HI-Q Antenna Center insulator, No. 14 antenna wire, ceramic insulators, 100 nylon antenna support rope (SD models only 50) rated for full legal power. Antennas may be used as an inverted V and may also be used by MARS or SWLs.

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Nylon guy rope 450# test 100 feet	$3.49
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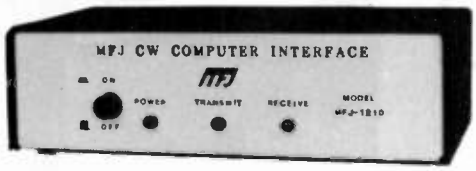
TRS-80* I, III OWNERS:

Send and receive CW with MFJ's new CW transceive program and interface. Just plug-in interface, load program and operate. Gives you Tri-Split screen, 3295 character buffer, 10 memories, "Fist Fixer."

All you need to send and receive CW.



$99.95

*TRS-80 is a registered trademark of Tandy Corporation

TRS-80 Models I and III CW Transceive program and interface lets you send and receive CW. No modifications to rig or computer.

Tri-Split screen for receive, transmit, message index. On screen transmit/receive "LEDs", transmit speed indicator, "Fist Fixer."

TRANSMIT: 3295 character (or more) buffer. Preload buffer while receiving. Transmit when ready. Ten 199 character memories. Repeat/link memories. Erase character, buffer, screen. 12-55 WPM. Store 2200 characters for group practice.

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Requires TRS-80 Model I or III with at least 16K. Program supplied on cassette tape.

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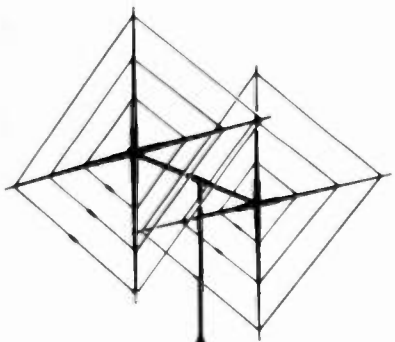

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AMATEUR ELECTRONIC SUPPLY *Amplifier Round-up Sale*

HENRY 1KD-5 80-15m Linear Amplifier 1200w PEP input, 700w PEP nominal output. Single Eimac 3-500Z, tuned input. ALC, conservative rated power supply, built-in antenna relay. Size: 8¾"h × 14"w × 15"d, 48 lbs.

Regular $695 - ***Sale Price $649.95***

HENRY 2KD-5 80-15m Linear Amplifier. 2000 watts PEP input, 1200w PEP nominal output on SSB, 1000 watts CW, RTTY & AM. Two Eimac 3-500Zs, 100 watts drive, tuned input. ALC, heavy-duty power supply, full metering, built-in antenna relay. Size: 10½"h × 15"w × 17½"d. Wt. 62 lbs.

Regular $945- ***Sale Price $895***

HENRY 2K Classic 80-15m Linear Amplifier. 2000 watts PEP SSB - 1000 watts CW, RTTY & AM. Two Eimac 3-500Zs, 80-150 watts drive, tuned input. ALC circuit, heavy duty power supply, fully metered, air cooled, built-in antenna relay. Size: 32¾"h × 16½"w × 15"d. Wt. 125 lbs.

Regular $1295 - ***Sale Price $1229***

HENRY 3K Classic 80-15m Linear Amplifier. All of the famous Henry amplifier features, a rugged 8877 tube, rugged heavy duty power supply components & special antenna relay for semi break-in CW. ***Tentative - $2695***

- New from DRAKE -

DRAKE L-75 160-15m Linear Amplifier. 1200 watts PEP, SSB, 1000 watts CW, AM, RTTY & SSTV. Single 3-500Z, 60 watts drive, tuned input. Built-in power supply, relative power output indication, adjustable AGC, 2-speed fan & bypass switching. Size: 13¾"w × 6¾"h × 14¼"d, 42 lbs.

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including 3-500Z tube

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Regular $179.95 - ***Sale Price $159.95***

MIRAGE B-1016 Similar to B-108, except 5-15w in/160w nominal out @ 10w; 1-2w in gives 30-60w out. Size: 5⅜"w × 3"h × 12"d, Wt. 5 lbs. 13.6 Vdc @ 20-25 Amps.

Regular $279.95 - ***Sale Price $249.95***

MIRAGE B-3016 Same as B-1016, except rated 15-45w in/160w out @ 30w input. Requires 13.6 Vdc @ 20-25A.

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John Ackermann AG9V/1
73 Magazine Staff

The Complete Idiot's Guide to DX

The Complete Idiot's Guide to DX, *by Stuart Gregg NF4Z, Bash Educational Services, Inc., 1981, PO Box 2115, San Leandro CA 94577*

Many hams think of DXing as a part of our hobby that only the elite can enjoy; reading the various DX columns and newsletters leaves the impression that the only way to work the world is to have giant antennas atop gigantic towers and to run the legal limit and then some. And even if the hardware is available, the expertise isn't. DXers keep their secrets to themselves and speak a strange language of their own for which translators are hard to find.

The recent sunspot peak produced a lot of new DXers and reduced the number of people who thought that a monster station was a necessity for successful DXing, but the lack of information for the newcomer still remained. Now that we're on the downhill side of Cycle 21, it's even more important to learn the tricks that let the big guys work the rare stuff when the sunspots aren't helping.

Nowadays, most budding DXers learn by doing, and the process is sometimes a very unpleasant one for the rest of us in the pileup. The *real* lids are enough to keep us busy without having also to worry about ops who simply haven't yet learned any better. It's not the newcomers' fault—the problem is that there just haven't been any good books that provide enough information in one place to allow a beginner to jump into the fracas without fear.

The lack of DX textbooks won't be a problem for long. At least two new books aimed at the fledging DXer have been published recently. One, *The Complete Idiot's Guide to DX*, by Stuart Gregg NF4Z, is quite good if you take the title seriously. It *is* a guide for the total newcomer to DXing. If you've worked 200, or even 100, countries, you won't find much new here, but if you've just stumbled across your first pileup, *The Complete Idiot's Guide to DX* will tell you what's going on and how to make the best of it.

Author Gregg starts from the premise that the reader has never worked a DX station before and goes through a step-by-step description of how to make the contact. He describes both the traditional method of DXing and the more recent innovations of DX nets and lists. He wisely avoids getting involved in the controversy over these methods, and instead limits his comments to the mechanical details of how lists and nets work.

The Idiot's Guide contains a lot of good, solid information for the beginning DXer. It also has some problems, as any first edition of a book covering such a complex subject will.

The book's discussion of station equipment attempts to point out that modest antennas and medium power will do a good job, but some of the anecdotes Gregg tells us leave the distinct impression that it's a lot more fun to have a California kilowatt. Gregg points out the advantages of CW operation but misses the main one—that a "little-gun" station has a much better chance of getting through on CW than of battling through the QRM on phone. Although the book admittedly is not about antennas, it would be nice to see some hard information on simple antennas that will work DX. Such creatures do exist, but the thrust of Gregg's discussion is simply that if you can get away with it, bigger is better. That's not much comfort for those of us who *can't* get away with it!

These are minor, perhaps philosophical, problems. But there are some things that a book on DX must have that this one doesn't. For example, there is no reference to the importance, nay, the absolute necessity, of using GMT (or UTC) time on QSL cards. The sad fact is that if your card doesn't carry the right time, in the right format, you are very unlikely to get one back from a DX station. Anyone who's ever handled cards for a DXpedition or contest can vouch for the pain that it is trying to find a QSO for which the time isn't accurately shown on the card.

The listing of operating events includes several small contests I hadn't heard of before, but misses both the IARU Radiosport

Continued on page 179

↙See List of Advertisers on page 130

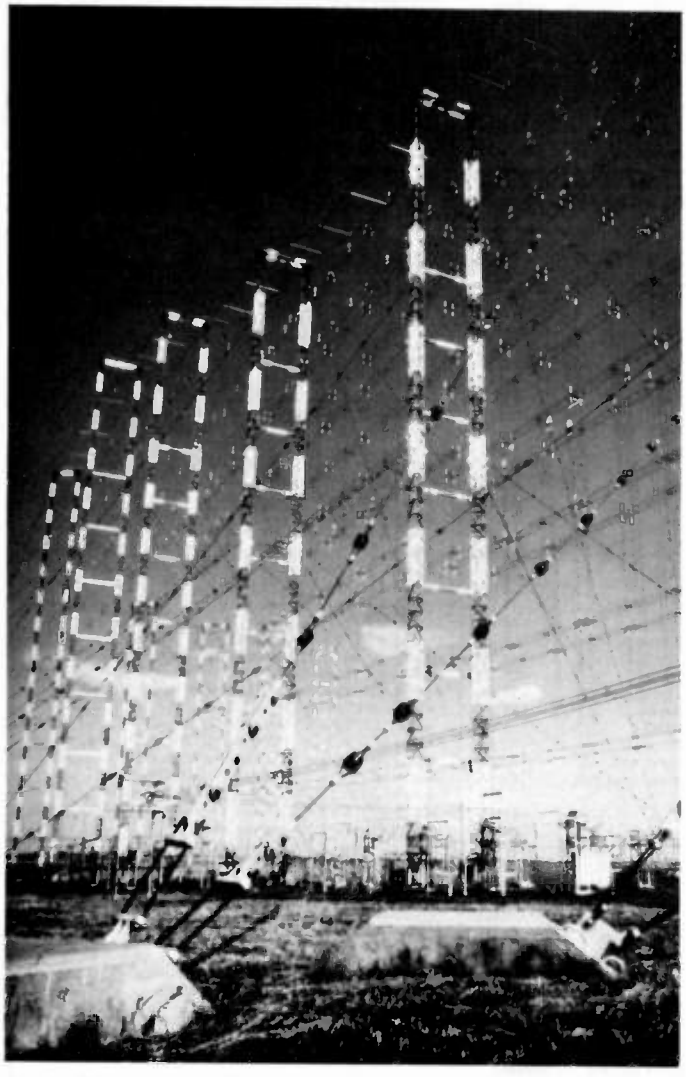
Eyeball QSO with Radio RSA

Roger N. Peterson
25 Orchard Lane
New Canaan CT 06840

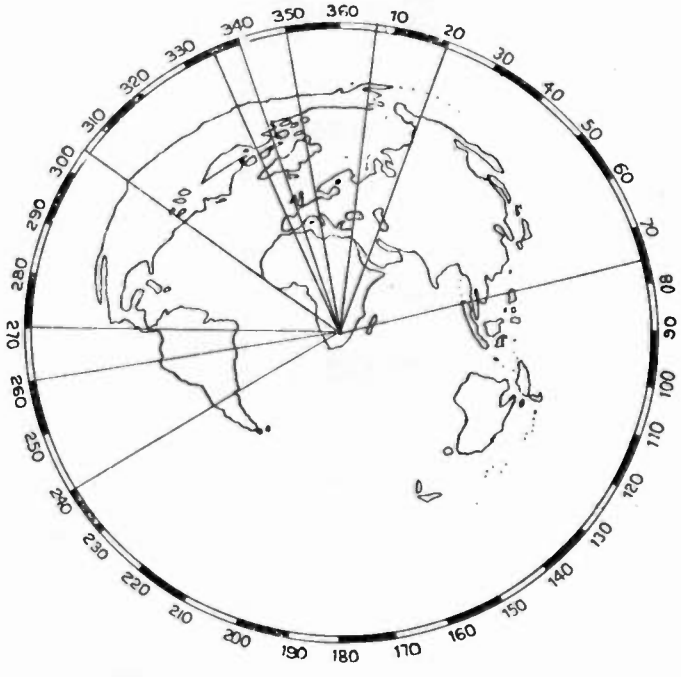
Have you ever dreamed of visiting that far-away, exotic country whose radio station you are listening to on your receiver? I'm sure you have. We all do. This time, however, I did something about it.

I was tuned to Radio RSA —the Voice of South Africa—and was enjoying a program called "Touring Africa." It was all about the famous Krueger National Park there, where visitors drive around in British Land Rovers to view the elephants, lions, rhinos, and other wild animals that roam free and without danger of being shot at by hunters. Listening to this fascinating program got me interested in seeing all this for myself. It would certainly be a switch from the usual Florida or Caribbean island vacation that so many of us from the northeastern part of the US aim for in the winters.

So here I was, a few months later, being driven through the streets of Jo-



Radio RSA—the voice of South Africa uses this antenna array to reach the US.

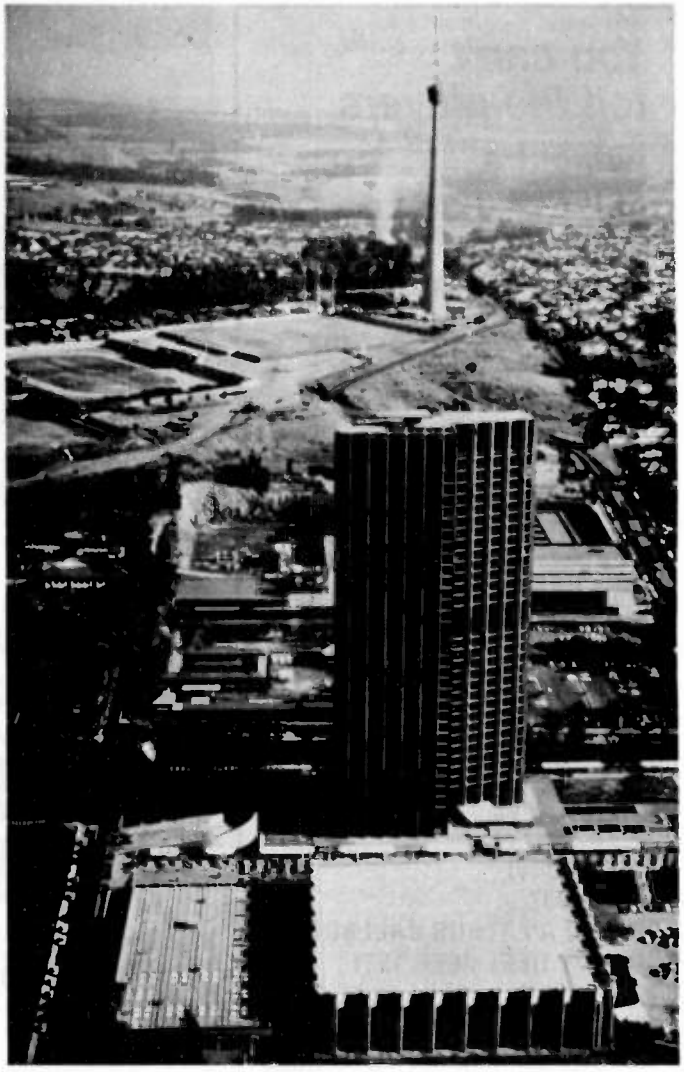


This great circle map indicates the general broadcast directions for Radio RSA's Meyerton transmitting station at its center in South Africa.

✓462

✓See List of Advertisers on page 130

Antenna side-switching hut showing a portion of antenna routing system. Each "square" is a motor-driven switch.



Broadcasting center of Radio RSA in Johannesburg. Large tower in back holds FM radio antenna.

hannesburg, the largest city in South Africa, by Pieter Martins, the principal engineer of Radio RSA and host of the station's popular DX program.

This had come about simply because when I made my travel arrangements, I also wrote a letter to Pieter to try to arrange a visit to Radio RSA. So on this day, Pieter had picked me up in his car at my hotel and was starting the visit with a trip out to view the transmitters and antenna installation located about thirty miles south of the city.

As we drove out of the city, we passed huge man-made hills, piled up from years of gold mining in the area, and several block houses which dated back to the Boer War. As we got nearer to the installation, I spotted some tall steel masts, and when we entered the village of Meyerton, I saw a multitude of these high masts towering into the blue African sky. Not much like my own antennas, strung between two trees in the backyard of my Connecticut home!

Ultra-Modern Transmitter and Antenna Installation

We parked the car and entered the main transmitter building. This structure has an antenna side-switching house and contains the consoles that control the transmitter tuning, antenna selection, and slewing. There are three 500-kW and four 250-kW transmitters. The larger ones had only recently been installed (spring, 1979) and were responsible for booming a big signal into the US in recent months.

Pieter explained how, from the consoles, by the pressing of a single switch, the powerful transmitters could be coupled to any of the station's 34 respective high-gain antenna arrays to cover any of Radio RSA's target areas. These consoles have preselection facilities so that a new frequency and antenna with appropriate orientation may be selected in seconds.

The transmitters have an interesting cooling system. Cooling is by a vapodyne system which utilizes the latent heat of steam. This system uses a small amount of distilled water and eliminates the need for old-fashioned water pumps. The steam is condensed on the mezzanine level of the building by heat exchangers and returns to the transmitter tube anodes as water. From there it is once more circulated in the closed cooling system.

From the top of the large transmitter cabinets, the feeders go by way of crossbar switches in ducts down vertical shafts which connect up with two tunnels and then to the round antenna feeder side-switching house. This unique system of an underground route for the ducted feeders had to be used due to their large surface area. This would have presented a hazard in strong gusts of wind in the case of overhead feeders.

The radio feeders enter the feeder switchhouse along five horizontal rows

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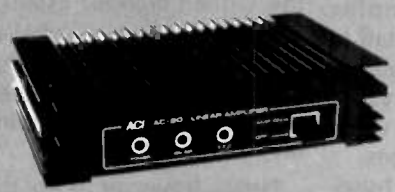
2 METER AMPLIFIER $39.95



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One of the 500-kW transmitters.

of switches. These feeders are switched vertically and leave from the top of the building to the appropriate overhead feeder and accompanying antenna.

Each of the directional antenna arrays on the 500-hectare site consists of two curtains spaced a quarter of a wavelength apart. Each curtain is made up of three or five stacks of four half-wave dipole elements in a chain. When power from the transmitter is fed into the front curtain, radiation from the individual dipoles is additive in the direction of the main listening zone, the total power gain achieved in some instances being as much as 20 dB. The antenna arrays have seven general directions (see Fig. 1). By phasing, it is possible to swing the beam electronically 15 or 30 degrees away from its center position to direct a transmission to a different target area. The general directions are 335° and 340° for West Africa and Europe; 76°, 20°, and 7° degrees for East Africa and the Middle East; 305° for North America; 240°, 260°, and 270° for South America, and 350° for Central Africa.

As we left the transmitter and antenna installation and drove back toward the city, Pieter described the South African Broadcasting Corporation organization and headquarters complex. Radio RSA is the External Broadcasting Service of the S.A.B.C. Other services include television and FM radio. Some of you may have DXed Springbok Radio and Radio 5 in past years. These are both part of the S.A.B.C.

This complex is located in the Auckland Park section of Johannesburg, a primarily residential area. It looks like a college campus, with its 40-acre area, two high structures, and a number of two- and three-storied buildings which house studios. The dominant structure is a 55-story tower which houses the FM antenna. Facing this is a large, multi-storied office building. This complex houses facilities and staff to broadcast 16 radio and 2 television program services, totaling 2,317 hours a week in 18 different languages.

The building which houses Radio RSA is very modern and contains all of the latest broadcasting equipment. Because of all the different language broadcasts, the staff personnel that you see in the corridors and studios make you think that you are in the halls of the UN building in New York City. For example, the Lozi language announcers all come from the Caprivi area in southwest Africa. The Swahili and Chichewa announcers hail from Malawi. In other language services, the announcers are either South Africans or people who have been recruited from Europe. Radio RSA also broadcasts programs in Dutch, Portuguese, French, German, Tsonga, Afrikann, and English. Soon, Radio RSA will add Spanish as they step up their broadcasting activities to South America.

Radio RSA Programs

There is much to listen to on Radio RSA. In fact, some people think it is shortwave listening at its best. First is the news. No other shortwave broadcaster covers the African continent like Radio RSA. They send out 42 news broadcasts a day, of which 7 are in English. In addition, they have a number of back-up programs to help the listener understand the situation in different parts of Africa.

News bulletins are written by Radio RSA News Department specialists and they have the resources of five international news agencies, regional news offices, and a network of correspondents in many parts of the world. Recently, a survey was made to find out what shortwave broadcasts African delegates to the United Nations listened to. Some three-fourths of them reported listening regularly to Radio RSA to keep informed of what was going on back home.

News, however, is not the only thing you will want to hear on Radio RSA. The station has many interesting programs throughout the week. I mentioned "Touring Africa"—the program that got me interested in visiting this country in the first place. This program is on once a week and will take you to all the interesting sights in South Africa: Capetown, perhaps the most beautiful city in the world; Durban, which is on the Indian Ocean and has some of the cleanest and whitest beaches I've ever seen; the Cape of Good Hope, where you see the Atlantic Ocean meet the Indian Ocean, and much more. You can hear this program on Saturdays at 2100 GMT and on Sundays (Saturday night in US) at 0200 in English.

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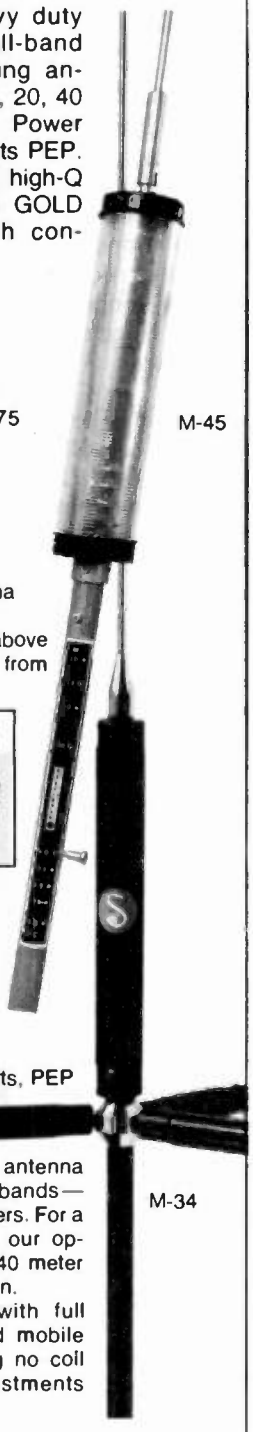

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Radio RSA broadcasts an excellent program every morning at 1300 GMT and also at 0300 GMT. It is called "Good Morning Africa" and while not directed to North America but to neighboring nations on the African continent, is easily picked up here in the US. It features short commentaries, live interviews, and music. Again, it is in English.

If you are interested in sports, Radio RSA devotes Saturday mornings from 1300 to 1500 GMT to various seasonal athletic games. This might be a professional golf tournament with Gary Player and other international pros. Or, it might be a rugby game or cricket match. As in Australia, South Africa's summer is our winter and vice versa. So don't be surprised to hear a ski meet from the Drakensberg Mountains in July or a surfing contest from a beach on the Indian Ocean in January.

Some of the most interesting programs heard on Radio RSA are interviews with either famous or interesting people. In fact, I feel that Radio RSA has the best interview programs of any of the shortwave broadcasters, including the mighty BBC. Try these on a program called "South African Panorama" on the English broadcasts at 2100 and 0200 GMT on Mondays, Tuesdays, Thursdays, and Fridays.

Just for DXers

If DXing the African continent is of interest, don't miss Radio RSA's "DX Corner" each week. This program is hosted by Pieter Martins, my guide, and he has a good one. From time to time, Pieter has guests who are members of DX clubs, hams, or visiting hobbyists from other parts of the world. If you want to keep up with the frequency and time changes of the African nations' broadcasters, this program is a must. You can hear it on Tuesdays at 1120 GMT, Saturdays at 2140 GMT, and Sundays at 0240 GMT.

Where to Tune In for Radio RSA

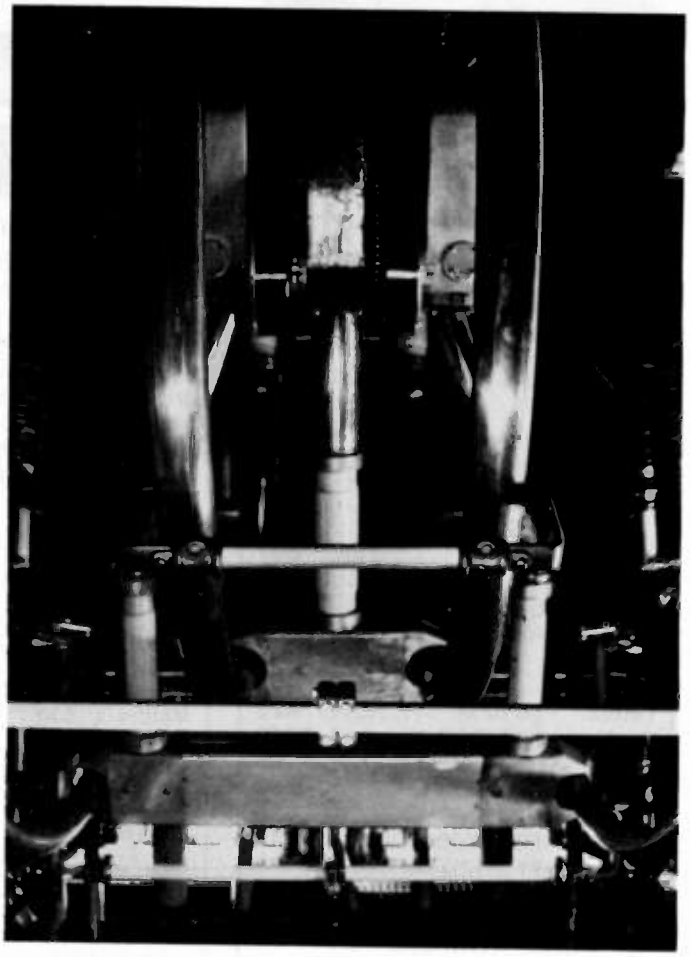
This station is on every day of the week in English. They direct their broadcast to North America at 0200 GMT on 11.900, 9.615, 9.585 and 5.980 MHz. However, their signal is so strong that you can usually receive them when their programs are directed to Europe or other parts of Africa.

In the late evenings here, at 0300 GMT, try Radio RSA on 11.900, 9.585, or 7.720 MHz. It is usually very easy to hear them. When you get up in the mornings, try them at 1100 GMT on 25.790 MHz, also on 21.535 or 15.220 MHz. At 1300 GMT, on the same frequencies, Radio RSA comes in even stronger and you should have no trouble at all in bringing their broadcasts in. Finally, in the afternoons at 2100 GMT, the station comes in loud and clear on 17.780 or 15.155 MHz.

Radio RSA broadcasts every day on the frequencies and times indicated above. You can obtain a program of their broadcasts by writing Radio RSA, PO Box 4559, Johannesburg 2000, South Africa.

Finally, what about the rest of my trip to South Africa. That, of course, is a story in itself. To those of you who have ever thought of going there, I can recommend it highly. In fact, I liked it so much that I hope to go back again for a return visit. That is, if some other exotic shortwave broadcasting location doesn't entice me there first.

I wonder what it's like in New Zealand? ■



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Both the **Varifilter** and **Signal Enforcer** offer peak and notch capabilities to allow you to either reduce signals on all but a selected frequency (peaking) or to eliminate signals on a selected frequency where interference is present (notching).

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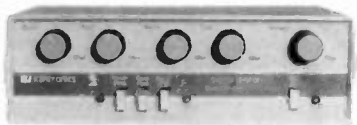

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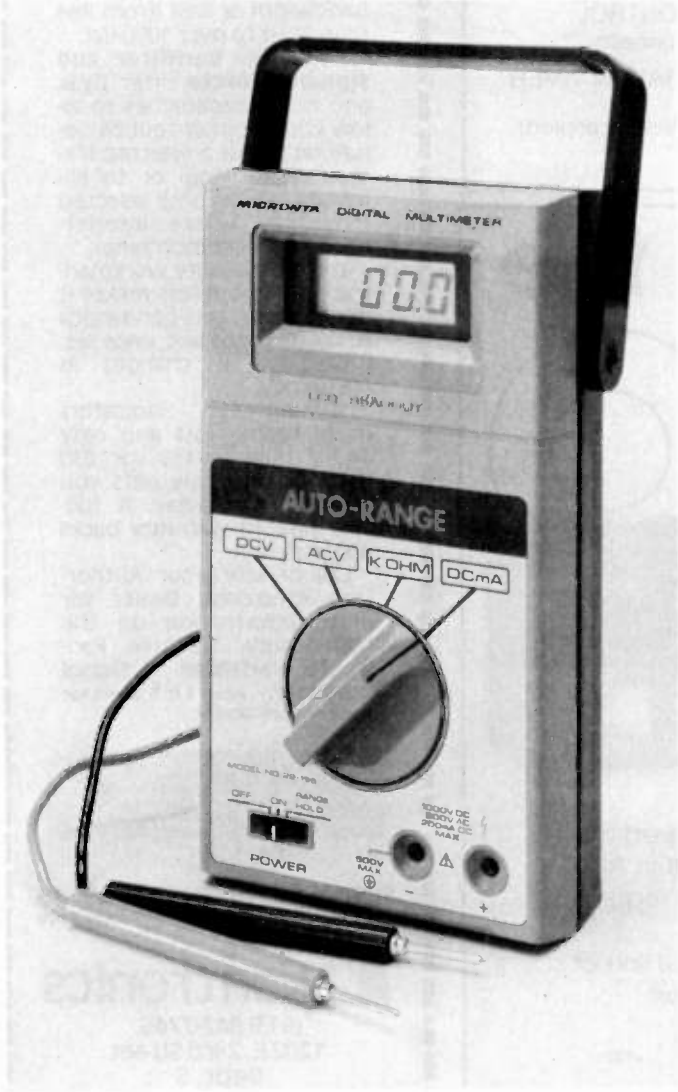


The Micronta LCD Auto-Range Digital Multimeter. (Photo courtesy of The Tandy Corporation)

There is little doubt that a multimeter is the most-used item of test equipment among hams, electronics technicians, and hobbyists. A typical multimeter measures current, voltage, or resistance in various ranges, depending on switch setting. Until recently, multimeters used common analog meter readouts—a needle moving along a marked scale. Then, not long ago, digital multimeters appeared. They read the value in LED digits. LEDs consume considerable power, so these instruments usually needed to be plugged into ac power or had short battery life.

With the advancement of technology, the LCD (liquid crystal display) is displacing LED readouts in most instrumentation, and many LCD digital multimeters (DMMs) are now available. Using standard alkaline batteries, many of these DMMs can be used continuously for hundreds of hours before battery replacement. This makes the units truly portable and independent of ac line transients and noise.

The typical LCD DMM uses either a rotary switch or a bank of push-buttons to select range and mode. First you must decide *what*

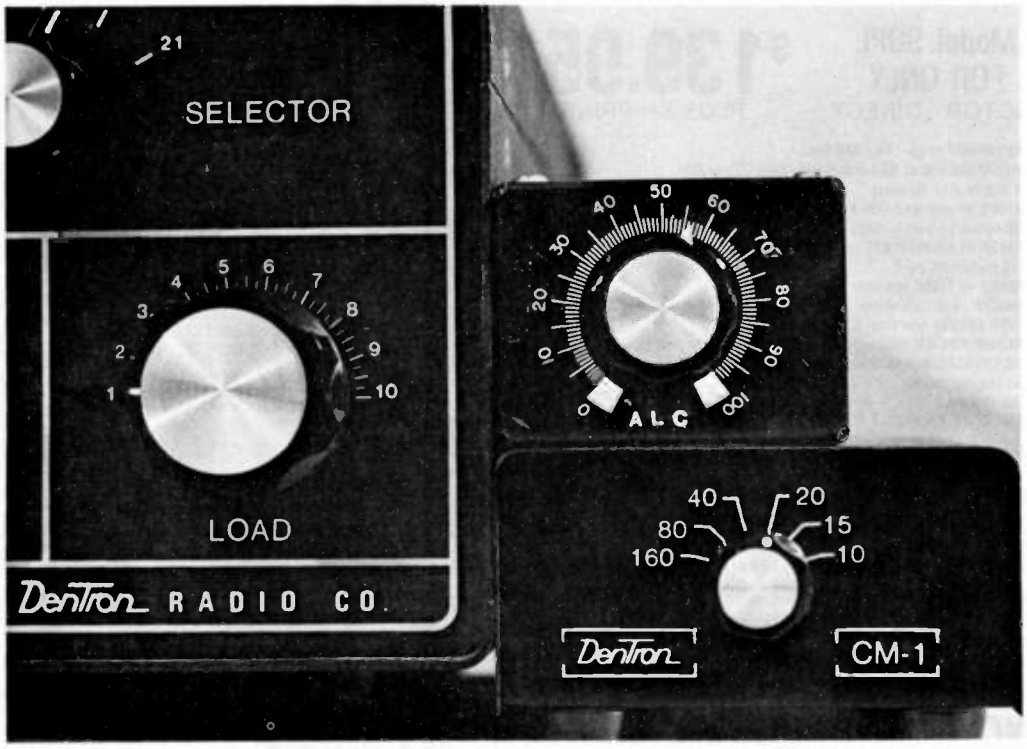
Continued on page 179

John P. Weber, Jr. K4JW
102 Southgate Blvd.
Melbourne FL 32901

Mods for the Clipperton-L

— smooth sailing ahead

When my trusty old home-brewed linear gave up the ghost, I started to shop around for a replacement. Being a professional loafer, I had to watch the green stamps, so the first requirement was low cost. Since I am partial to 572-Bs (low replacement cost), the DenTron Clipperton-L looked like just what I wanted. After getting it home from the dealer, cutting off the ac plug, and rewiring it for 220 V, I hooked it up to my TS-820S and away we went!



Remote alc pot located on top of CM-1 accessory.

Wow! The pilot lights were *bright*; when you went to transmit mode, it looked like the sign on the local massage parlor! Realizing that this might keep me awake during round tables, I swapped the Power and Transmit bulbs with a type #327, a 28-volt bulb that gives reduced, but adequate, brightness and will last longer than the 14-volt bulbs supplied.

Next, I looked at the output waveform on my monitor scope. Ouch. There was hum on the rf envelope! But, running tests with local hams on both CW and SSB disclosed that the inadequate power supply filtering was no problem. This again proves that the average ham receiver has poor audio frequency response at low frequencies, especially with small speakers in inadequate baffles. So, I left it alone.

I started to compare notes with other Clipperton owners and found that they

had problems similar to those I am about to discuss. These findings are based on five separate amplifiers, so they are not just a fluke with my amplifier.

Of the five amplifiers, three soon developed noisy cooling fans. The objectionable noise changed pitch, indicating the fan was changing speed. This noise was blamed on defective sleeve bearings (a sleeve-bearing fan should be *quieter* than a ball-bearing fan) and replacement fans were requested from DenTron under warranty. They were sent without charge and were noted to be from a different manufacturer. *Warning*—Disconnect the power cord when working on the fan when the amplifier is wired for 220 V because the power switch disconnects only one side of the line.

Some of the fans had a heavy wire grille (to prevent you from sticking your pinkies in the rotating blades), while other fans had a fine-wire mesh grille, evidently intended to provide better rf shielding. The 4-1/2"-diameter hole where the fan is mounted makes an ideal place for rf (and harmonic!) radiation to escape if it's not shielded. So, another letter to DenTron produced a fine-mesh fan grille, which also was sent out without charge.

There are two ways to mount the grille: I scraped the paint off *both* faces of the die-cast fan housing to ensure good electrical contact between the grille and fan housing and also from the fan housing to the chassis.

The alternate method is to place the fine-mesh grille against the chassis and mount the old fan with the protective grille on top of it. You can use four rubber grommets to shock-mount the fan, which cuts down on the noise, but be sure to seal around the edge so the fan is exhausting air from the chassis and not through the open space between the fan and chassis.

Using a GR Strobotac, I found the fan speed dropped only 20 rpm, indicating that air delivery was substantially unchanged. I also added ½" to the rear feet of the amplifier to increase clearance from the shelf. Be sure you allow enough room behind the amplifier (distance from a wall, drapes, etc.) so airflow is not impeded.

So far, these problems were minor irritations. The real jolt came when a nearby ham came over and said, "You got spurs that jingle-jangle my new TS-120." He brought over an H-P spectrum analyzer he had borrowed from work (every ham shack should have one, if you have 10 kilobucks to spare!) and we hooked it up to my TS-820S/Clipperton-L combination.

Gadzooks! The screen looked like a Christmas tree—spurious emissions and harmonics all over! Well, first, the 820 did need neutralizing (my fault when installing new finals) and then the in-band emissions were gone. After this, we checked the TS-820 into a dummy load, and its harmonics were well below its −40-dB specs. But, when it drove the Clipperton, the harmonic output of the 820 went up. The answer is simple, my friends. The 820 wasn't seeing a 50-Ohm resistive load, but some complex impedance that exceeded its linear operating range.

Examination of the Clipperton's input circuit disclosed that it was untuned and had no swamping resistor. Taking readings of the vswr between the 820's *output* and the Clipperton's *input* showed the lowest vswr to be 1.65:1 and the highest to be over 3:1! (See Table 1.)

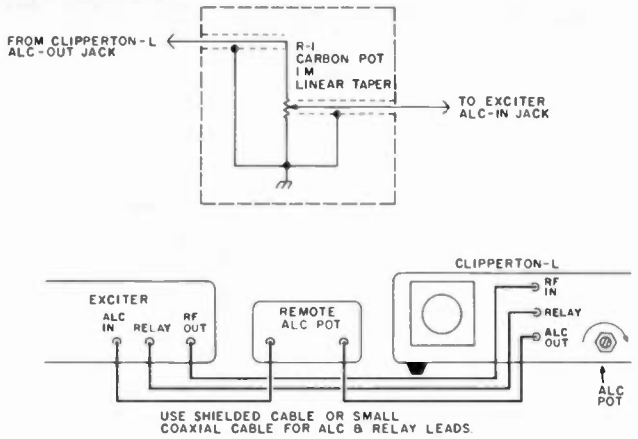


Fig. 1. Remote alc control arrangement.

No wonder that some of the solid-state-output rigs either won't drive the Clipperton or just shut down, depending on their design. By the way, the catalog specs the input at 1.5:1, average.

One solution is to put an antenna tuner between the exciter and the Clipperton—if you don't mind twiddling knobs. Another solution is to put in pi-networks for each band to match the exciter to the Clipperton, but there is no *easy* way to do this the way the unit is laid out.

The third solution is to buy the outboard attachment that DenTron sells as the CM-1 accessory. This contains pi-networks using toroidal inductors (which cannot be optimized for each band) and caps, as well as a relay to permit straight-through operation when operating barefoot. The CM-1 is touted as a "plug and play" unit, but you have to run a 12-volt lead through the fan lead hole in the Clipperton and solder it to the relay +12-volt lead inside. I found it easier to drill a hole near the internal relay, use RG-174/U, and run it to the CM-1 (be careful not to get metal chips inside!).

Examining two of the CM-1s showed that they did

Frequency (MHz)	Clipperton-L Power Output (Watts)	Input Vswr
29.0	650	1.75:1
21.225	680	1.65:1
14.20	600	1.97:1
7.15	550	2.15:1
3.75	350	3.11:1
1.90	500	2.56:1

Table 1. Output power of Clipperton into 50-Ohm dummy load without input matching. Alc setting is advanced such that output power of 700 Watts is reduced to 600 Watts.

Band	DenTron Data to FCC Power (Watts)		K4JW Measurements Power (Watts)		Clipperton input vswr	CM-1 network input vswr
	P_{in}	P_{out}	P_{in}	P_{out}		
160	882	390	1000	460	2.6:1	1.8:1
80	891	440	1000	675	3.1:1	1.5:1
40	819	520	1000	580	2.2:1	1.5:1
20	748	340	1000	600	2.0:1	1.5:1
15	614	340	1000	500	1.7:1	1.3:1
10	na	na	1000	400	2.0:1	2.0:1

Table 2. Type-acceptance data vs. author's measurements before and after input (vswr) matching; na = not applicable.

Low-pass filter with short RG-214 coax lead, ground-braid to chassis. Note the fine-wire mesh fan grille. Lead at upper right is RG-174 carrying 12 V dc for CM-1 relay.

not agree with the schematic supplied. One used a common network for 15 and 20 meters while the other used separate networks, although the one using a single coil seemed to do a good job.

Now for the alc pot located on the *back* of the Clipperton. Nothing in the operating manual mentions its adjustment, so, in response to another request to DenTron I was told to use either sine-wave or trapezoidal scope patterns and to set them for 100% modulation. Lacking a scope, you can adjust the alc pot to produce 1 kW input.

Alc is part of a control loop for the *system* of the exciter and linear; its setting should prevent the exciter from driving the amplifier into a non-linear condition which generates harmonics, spurs, etc. Now, I realize this poses a problem for the designer. If the amplifier is to be used with one particular exciter, he can select fixed values for the alc system (maybe!). But, when the amplifier is to be used with many different exciters, each having its own alc characteristics and voltage requirements, he has to employ an adjustable system. So, it becomes apparent that the alc adjustment pot should be accessible from the *front* of the amplifier. One of the popular amplifiers does have this facility, and its manufacturer tells you to set it on *each band*!

Without poking more holes in the Clipperton, this can be accomplished as shown in Fig. 1. A 1-megohm linear-taper carbon pot is mounted in a small chassis box. Shielded leads are used, one to the exciter, the other to the alc output jack on the Clipperon. Turn the Clipperton pot wide open (clockwise) and use the new alc pot to set the amplifier to 1 kW dc input on each band. This is about 0.580 Amps at 1700 V when in the "CW-X" position.

It is useful to put a scale labeled from 0 to 100 on the front of the box so you can log the approximate readings for each band. The alc pot can be mounted on the CM-1 accessory, or both can be mounted on the side of the Clipperton (don't cover up the screw used to hold the top cover on the amplifier).

Harmonics still plagued me. Why wasn't my good Drake TV-3300 LP filter working to specs? First, there is no easy way to mount it to the back panel of the Clipperton. Second, the 10" piece of old coax I was using between the filter and the Clipperton was leaking like a sieve!

I replaced this with a 4" length of RG-214, which is a silver-plated, double-shielded cable that can be used up into the gigahertz range. You can make a reasonable substitute by taking two lengths of RG-8/U, cutting the outer jacket off one piece and sliding the braid off the other piece. Slide this braid over the first piece of coax, making it a double-shielded cable. After the connectors are attached, cover the outside with PVC tape. Take another piece of RG-8/U and strip the shielding off to make a heavy grounding braid between the case of the low-pass filter and the chassis ground of the Clipperton.

What had been happening was that the shunt caps in the low-pass filter were grounded to its case, and I had a ground loop. Also, "sheet currents" were flowing over the surface of the poorly-grounded filter case allowing harmonics to pass on to the antenna. Now the Drake did the job it was supposed to—greater than −80dB at 40 MHz.

One day I lost bias—so I thought. The output waveform was distorted and the resting plate current was zero. Examination showed no contact through the relay used for transmit-receive. This relay has a 3PDT configuration, one set of contacts being used to switch the bias from cutoff (through R3, 47k) to operating bias (9.1 V from a 1N3308 zener). The contact was pitted. In order to burnish this and the other relay contacts, it is necessary to remove the relay spring, pull the armature back, and burnish all contact surfaces. Insulation barriers prevent inserting the burnishing tool while the relay is in place.

Some instability was noted after the Clipperton had been converted for 10-meter operation. By making sure the Load control on the Clipperton is set at *least* above "3" on 15 meters and above "5" on 10 meters, the instability usually will disappear.

Going around the Clipperton with an rf sniffer and using the spectrum analyzer connected to an antenna approximately 100 yards away, the results showed these fixes did the job. Incidentally, I use an SPC transmatch between the Clipperton/low-pass filter and the antennas, giving me more harmonic attenuation and aiding in the presentation of a 50-Ohm resistive load to the amplifier at the operating frequency.

I use a relay switching system on my tri-band quad, so the 10-meter section is not electrically connected to the feedline when operating 20 meters, thus further reducing the radiated second harmonic. (It's kind of embarrassing to be called on the land-line by a local and told that you are QRMing their 10-meter round table when you are operating on 20!)

Conclusions

1. Whether your exciter is solid-state or vacuum-tube output, use an antenna tuner or CM-1 pi-network between the exciter and the Clipperton.

2. Install a variable alc control pot where you can easily set it for each band.

3. Ground everything—the exciter, the Clipperton, the low-pass filter, transmatch, etc. Use braid as short as possible.

4. Throttle back on the audio gain; 1 kW input is *not* always necessary.

DenTron now has come out with a "new model" of the Clipperton-L. They have put the tuned networks in the input and inside the box. An extra section has been added to the band-selector switch which switches can-type relays mounted on a PC board they put on the left-side wall. These relays switch in the proper input pi-network.

It is understood that older units can be sent back to the factory for modification and/or a kit for field-modification will be available.

My thanks to Walt Kunde K5BVM for consultation and checking my tests, to Mike DeZego WA4RXC for instrumentation and help in running tests, and to W4TL, K4WB, and W4LQS for info on their Clippertons. ■

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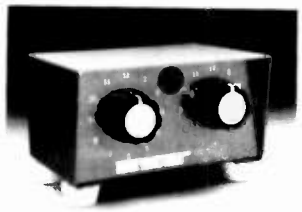

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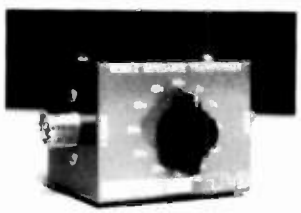

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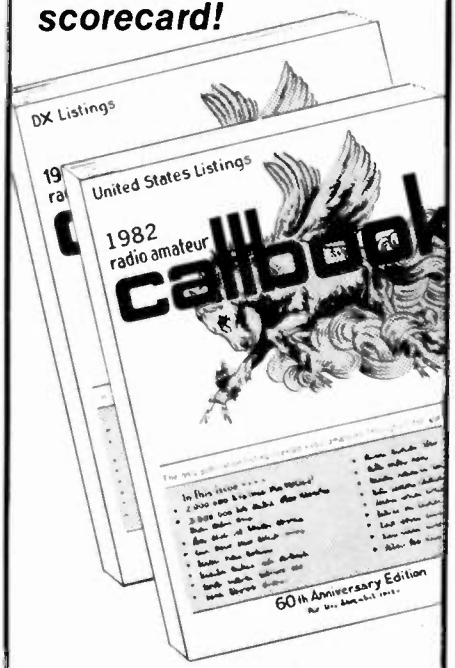

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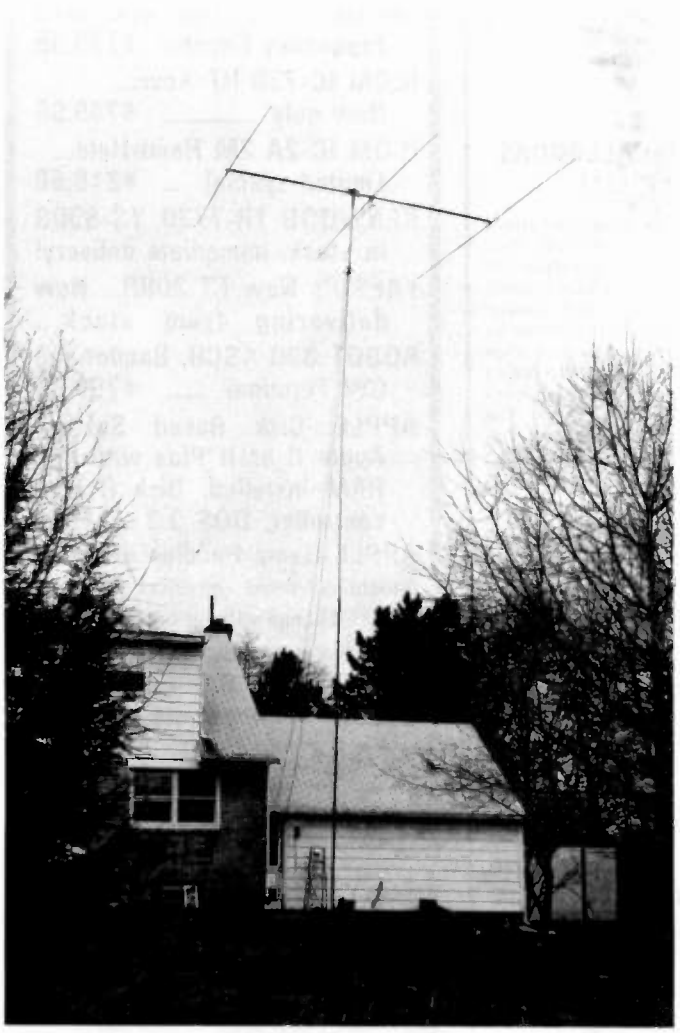

Photo A. The portable antenna system has a 10-meter beam atop a pole made from short sections of TV mast, guyed by two inverted vees that give complete coverage, 80 through 10 meters.

This antenna system was designed for travel. It can be assembled and put up by one man in less than 30 minutes, and it packs neatly in a Chevette. Despite the portability, it does an excellent job of radiating. A mast made up of five-foot steel sections supports a 10-meter beam. The guy wires are multiband inverted vees covering 80 through 10, with the traps located near the ends, making the radiating portions several half wavelengths on 20, 15, and 10. This results in some gain and in wide operating bandwidths on all of the bands.

The mast is almost 35 feet high. The five-foot sections of steel TV masting are strong but wobble a bit at the joints. (Aluminum tube of the same size is available but it is not strong enough.) By leaning the mast against two of its guy wires—see Photo B—one man can lift the mast and beam and add a section at the bottom. When raised to full height and the other two guys are tied, the base

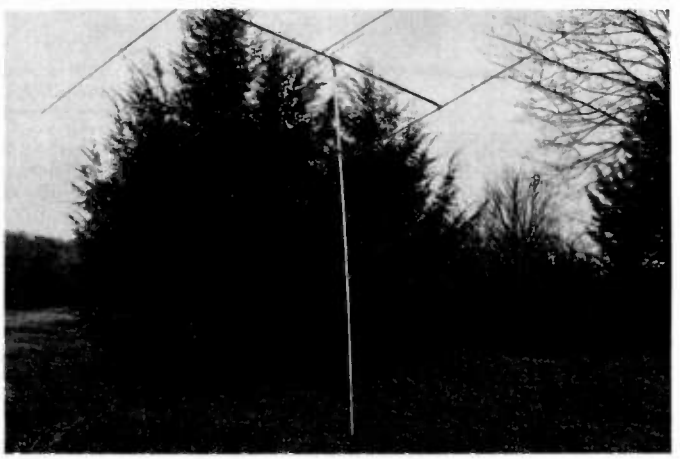

Photo B. By leaning the mast against two of its guys, one man can lift it from the bottom and insert another 5-foot section of the mast. The whole structure is light enough so that this is no problem.

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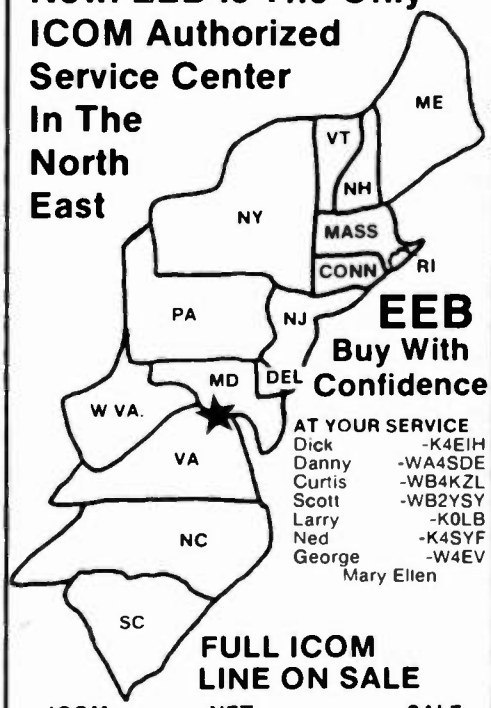

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Table 1. Element lengths for three-element beams based on driven-element-to-director spacing of 6' 4" and a driven-element-to-reflector spacing of 5' 6". From graphs in ARRL Antenna Book.

of the mast is moved under the top. An extra set of guy strings part way up will keep the mast straight and the beam level, but I don't usually bother.

The whole structure can be put on a rooftop if a fairly flat one is accessible and fewer mast sections are used. A chimney can be a base and so can a vent pipe of the drainage system. A U-bolt on the mast can be bent to hook on the pipe, as shown in Fig. 1.

The beam is the Radio Shack CB beam. Reduce the element lengths to those in Table 1. Notice that the boom length is adequate to make a three-element, 15-meter beam if that is preferred. The ends of the elements will accept 3/8" tubing extensions. The gamma match needs no modification on 10, and there is room enough to extend it to match a 15-meter driven element. If you buy a new CB beam, watch out for the assembly instructions; they have interchanged the reflector and director spacings.

The beam becomes quick-take-apart with a few simple changes during assembly. The boom joint can be loosened on one side only, and that half of the boom slid out of the joint. Each element-to-boom clamp is modified as shown in Fig. 2. One half of the element stays with the U-bolt and clamp and the other half slides out after the hose clamp is loosened. Cut off the end of this half-element right at the middle of the hole for the U-bolt, and don't use a bolt through the clamp and element as is done on the other side. During assembly, that half-element is pushed right up against the U-bolt as a stop, and then you know it is located correctly. The outer tube needs to be slotted under the hose clamp.

I color-coded the elements and boom to simplify layout of the parts on the ground before assembly. Red and green spray paint for the reflector and director are appropriate! Spray after the beam is assembled so that the paint doesn't interfere with electrical connections.

A short length of steel masting is attached to the boom joint. This is visible in Photo B. A tapered end of one of the mast sections is inserted in it to mount the beam on the mast. This leaves enough slip to rotate the beam around the mast. No rotor is used. I tied string to the ends of the boom and rotate it and secure it with the string. The mechanical and electrical complexity of a rotor in the system isn't warranted.

The two multiband vees are fed by the same 52-Ohm coaxial cable. Guy rings, one insulated from the mast by several layers of tape, support the center of the vees—see Fig. 3. Hose clamps under the rings prevent them from sliding down. A chassis coax connector was soldered to the lower galvanized ring with the inner conductor connection passing through one of the holes in the ring. A short wire connects this to the upper ring. The two halves on each vee are joined to these two rings so

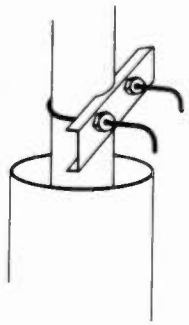

Fig. 1. A vent pipe makes a secure base for the antenna mast. With the U-bolt bent to hook on the edge, the pipe will support a short length of mast upright until the guys are tied.

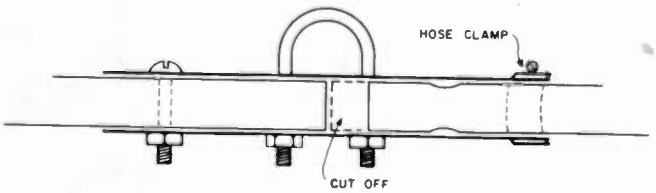

Fig. 2. The boom-to-element clamp modifications. The half-element on the right is held in place by the hose clamp. Its end has been cut off at the hole for the U-bolt. The U-bolt nuts are loosened to remove the element from the boom, and the hose clamp loosened to separate the two halves of the element.

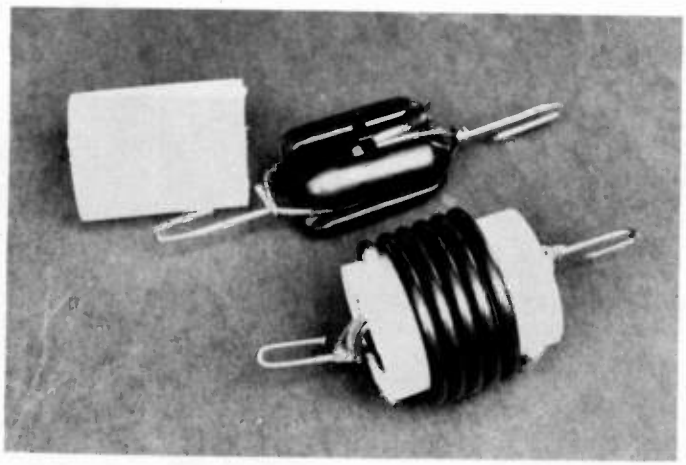

Photo C. One of the traps made from coaxial cable. The white polyethylene tube is a tight fit over the plastic egg insulator and serves as a coil form.

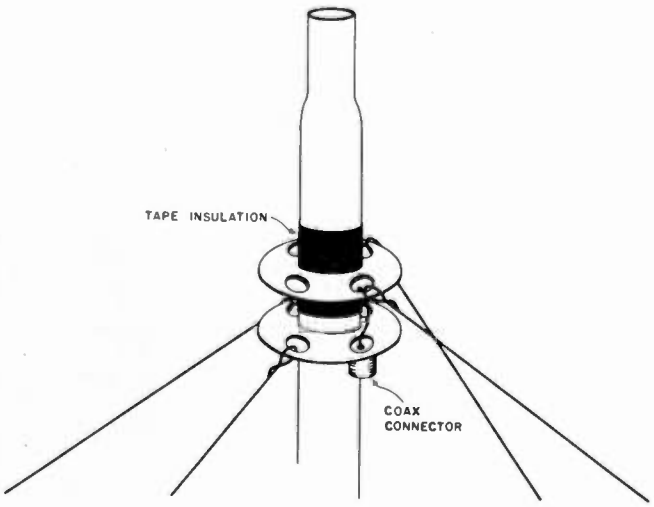

Fig. 3. Two guy rings are used to support the center of the inverted vees. The top one is insulated from the mast by electrical tape, and a hose clamp beneath it prevents it from slipping down. A chassis coax connector is soldered to the lower ring and its center conductor is connected to the upper ring.

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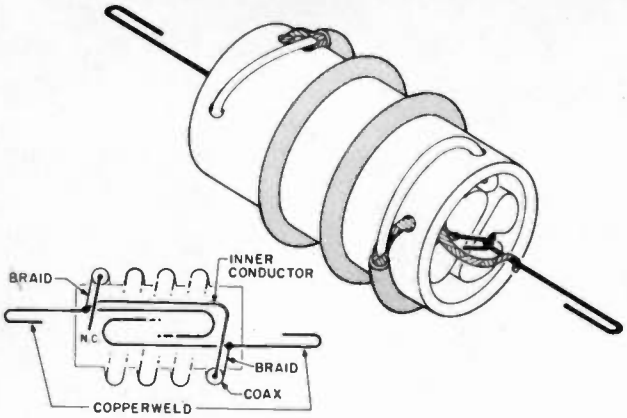

Fig. 4. Showing the connections so that a single length of coaxial cable becomes both coil and capacitor for a trap. The braid connects to the copperweld wire which will join the trap to the antenna. The inner conductor separates from the braid, passes through a hole 90° from the braid hole, and is routed through the egg insulator to be soldered to the braid and copperweld at the other end of the coil. The inner conductor at the upper end of the coil does not connect to anything. To hold it in place and insulate it, it is tucked into a shallow diagonal hole in the polyethylene coil form.

Photo D. There isn't much there after the beam and its boom are disassembled.

that the wires at one ring go off at right angles to each other. During travel, the guy rings and vees all stay connected to their mast section.

The vee for 40, 15, and 10 meters is a bit unusual. The 10-meter trap isolates three half waves in the middle and acts as a loading coil on 15 and 40. This is critical since harmonic antennas, such as a half wave on 7 MHz working as three half waves on 21 MHz, do not work out exactly. A half-wave dipole is too short to be three half waves on its third harmonic because of the lack of end capacity for the middle wavelength at the higher frequency. In this antenna, the loading coil effect of the 10-meter trap compensates for this; the trap is near a current loop for 15 meters and loads it more than it does 40 meters, bringing both bands into resonance with low swr on the same length of wire.

The long inverted vee works on 20 and 80 meters, with the traps cutting off three half waves on 14 MHz. The traps are near the ends of both vees, out of the high-current parts of the antennas, which makes for good radiating efficiency. Another advantage of this layout is the wide bandwidths on most of the bands. Many trap antennas have very narrow operating bandwidths because of the heavy loading.

Automotive primary wire was used for the vees. The stranded copper is flexible, coils nicely, and doesn't kink. It also has a thick vinyl insulation which is a help when the antenna must pass through trees or against buildings. Vacation sites are seldom ideal.

Photo C and Fig. 4 show the construction of the traps. Each trap is made from a length of RG-58 coaxial cable connected so that the braid is the coil and the capacitance between the inner conductor and the braid becomes the trap capacitor. In brief, the coax braid makes excellent trap coil with very high Q, and the distributed capacitance of the cable is a high voltage, stable capacitor. Notice the cross-connection of the inner conductor from the right end of the coil (Fig. 4) to connect to the left end of the coil. There would be no capacitor formed if it were simply joined to the outer braid at the right end of the coil.

The trap is built up on a plastic egg insulator and a two-inch length of 1½" polyethylene tubing as a coil form. This tubing, with a 1/8" thick wall, is a tight fit over the insulator and also helps to protect the free end of the inner conductor. This point, at the left end of the coil in Fig. 4, has high voltage with respect to surrounding parts of the trap and needs protection. Drill a diagonal hole into but not through the wall of the polyethylene and put that free end in it.

Start building a trap by forcing an egg into the polyethylene tube and attaching short lengths of wire, preferably copperweld, around the egg as is normally done with an antenna insulator. These wires inside the coil will have some capacity and so will be part of the trap circuit. Don't attach the antenna wire yet, since this adds extra capacity and prevents finding the correct trap resonant frequency. Remove about three inches of outer jacket from the end of the coax and push the braid back and loosen it. Work a hole in the braid, fold the cable, and feed the inner conductor and its insulation through the braid. The two are now separated as shown in Fig. 4.

The braid goes through a

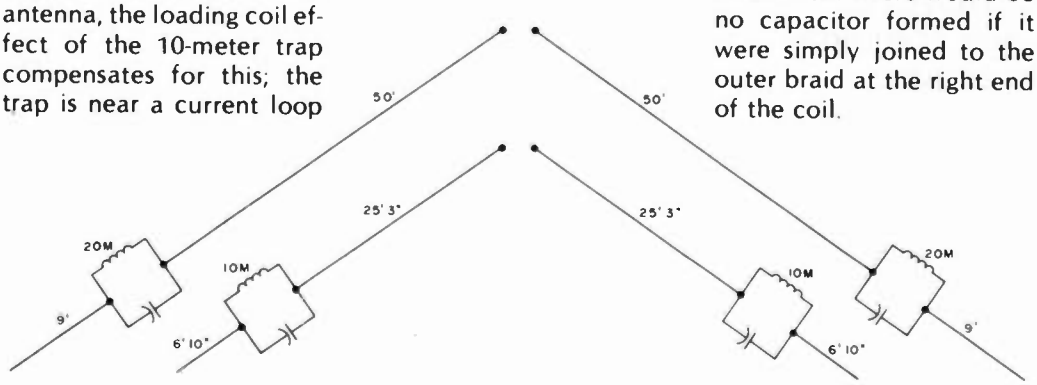

Fig. 5. Dimensions of the inverted vees. The long one is three half waves on 20 meters and a half wave on 80. The shorter one below is three half waves on 10 meters with the ten-meter trap slightly loading the entire length so that both 15 meters and 40 meters are resonant.

hole in the coil form and is soldered to the copperweld wire. the inner conductor goes through a hole a quarter turn away from the braid, passes through the egg beside the copperweld, and is soldered to it at the other end. Wind 3¾ turns of coax onto the polyethylene form for a 10-meter trap— 6¾ turns for a 20-meter trap. The holes should be drilled near the ends of the form so that the turns can be spaced out for tuning. A dip meter checked against a calibrated receiver is needed. Tune each trap for the middle of its band. After it is installed in the antenna, it will dip lower in frequency by about 1 MHz for the 10-meter trap and about .5 MHz for the 20-meter one.

All the electrical connections are soldered, and corrosion should not be a problem. The coils need to be secured in place after tuning, and the coax should have some weatherproofing so that water does not get inside. Silicone rubber is an excellent insulator. If it is in a tube, it is sticky and smelly as it comes out, but Dow-Corning sells a silicone rubber roofing material that will brush on. It comes only in quarts— about $7 in the discount stores. The trap could also simply be wrapped with electrical tape.

This antenna system has been up and down countless times in its development and tuning, and it also has been to the mountains and to the shore several times. It really is portable. The compromises (no rotor, wobbly mast, lightweight guys) are all mechanical; electrically it works very well.

Either the vees or the beam could be beefed up for a permanent installation, of course. Parts will function alone, too. I have not taken the beam to the shore where the houses are so close together. Also, if there isn't enough room to stretch out the 80-meter leg, I just use part of it as a guy wire and still have a good performer on 40, 15, and 10 from the other half. The tuning can be affected by nearby objects or the ends coming down close to the ground. It is best to tune it at home under conditions similar to those it will meet on vacation and accept the inevitable variations under field conditions.

Readers are encouraged to build the traps described here for their own use, but manufacturers are cautioned that a patent application has been filed on them and all rights under the Patent Code will be strictly enforced. ■

Photo E. The beam can be disassembled and repacked in its original carton for travel. It extends up between the front seats of my subcompact.

Note: A kit of parts to aid in making traps is available from R. H. Johns—Scientific Instruments, 3379 Papermill Road, Huntingdon Valley PA 19006, for $4.50 plus $1.00 postage. Each kit contains parts for four traps, egg insulators, polyethylene coil forms, and #14 copperweld wire. Coaxial cable, RG-58A/U, with stranded inner conductor to facilitate separating the inner and outer conductors from each other, is available at $.25 a foot. About 15 feet is needed for the four traps.

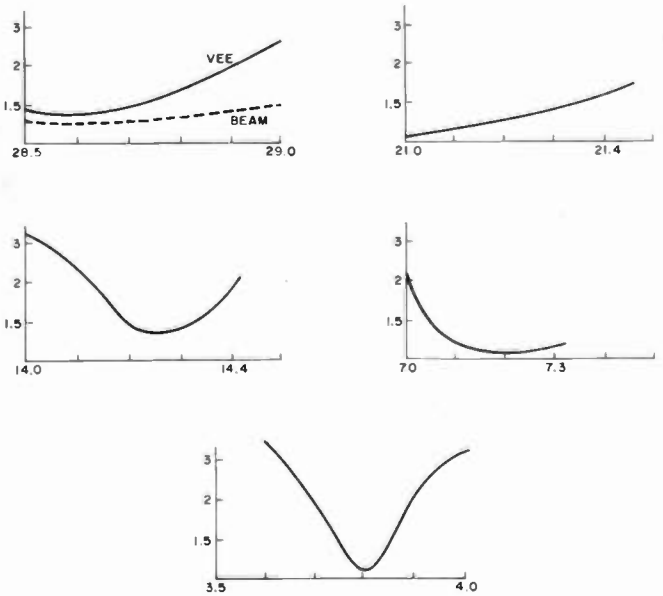

Fig. 6. Swr plots for the family of inverted vees.

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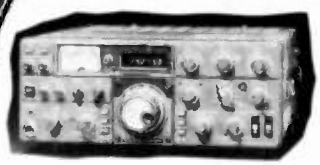

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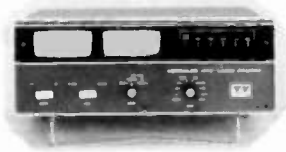

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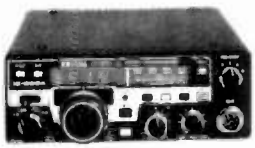

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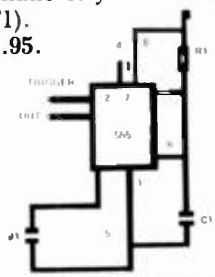

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KIM's Magic Fingers

— RTTY transmit program

Author's Note: A substantial period of time has elapsed since the following program was first written. Since then, many things have elapsed. Although the following program is a working version, there have been many improvements in radioteletype algorithms for the 6502. Therefore, the article should be looked upon as a basis for the "first-time user" to get some ideas to start from. Some of the subroutines may be valuable in the creation of a sophisticated system.

There have been numerous articles on the KIM-1, and many of those available are right up the ham's alley. Among those offered have been CW receive and transmit programs and RTTY receive programs, but I have yet to see a RTTY transmit scheme published. For all you fellow KIM-1 owners who are RTTY fanatics, this article will be just what you are looking for.

The old mechanical monsters have their good points, e.g., hard copy, and the 28 is quieter than most others. The 28 ASR is even like a regular typewriter to the touch, but nothing is like an all-electronic keyboard. If you are among those who type faster than 60 wpm, then even the "ole 28" is a bit of a pain, especially when you go too fast, lock up the keyboard, and characters are missed in your frenzy.

Having had a KIM-1 for about six months along with an SWTP ASCII keyboard, I proceeded to arrange a method of transmitting 5-level Baudot with this combination. I had several standards which had to be met:

- No limitations on typing speed.
- Automatic case shift for FIGS and LTRS.
- Automatic CR/LF/LTRS on receipt of a CR from the keyboard or after 65 characters and the end of a line.
- No splitting up of a word at the end of a line.
- Practicality: a system that would not give more trouble than it saved.

This whole project was tackled in several steps. Initially, I had to come up with a good routine to convert the ASCII character into a Baudot character and send it serially out of one pin on the PIA. This was not too terribly difficult.

(I must give credit at this time to someone whose article provided me with many ideas. The January, 1977, issue of *73 Magazine* contained an article on using the KIM-1 as a CW keyboard. I used James Pollock WB2DFA's ideas for the interface of the ASCII keyboard and the usage of the 256-character buffer. Both of his schemes worked smoothly on the Baudot program.)

At this point, we are able to transmit Baudot and type as fast as we want, but still have to put in the case shift manually. This was the next thing tackled. Once solved, the end-of-line (EOL) sequence, along with the character counting and space detection for the auto EOL sequence, was added. Finally, the whole thing was starting to look up!

Being (admittedly) the proud type, I wanted my print to be somehow distinguishable from "ordinary" print. This was added in the EOL sequence and appears as a colon neatly down the left margin. That will make people say "Ah ha, there is

Address	Function
0000	Baudot character currently being output.
0001	Baudot character currently being output.
0002	ASL counter in actual output subroutine.
0003	Character counter (number of chracters in the line currently being written).
0004	Contains the original ASCII character received from the FIFO buffer.
0005	LTRS/FIGS flag position. This will be a 00_h when in lowercase (LTRS) and will be a 20_h when in uppercase (FIGS).
17BF	Contains the value of the FIFO pointer.

Fig. 1. Buffers.

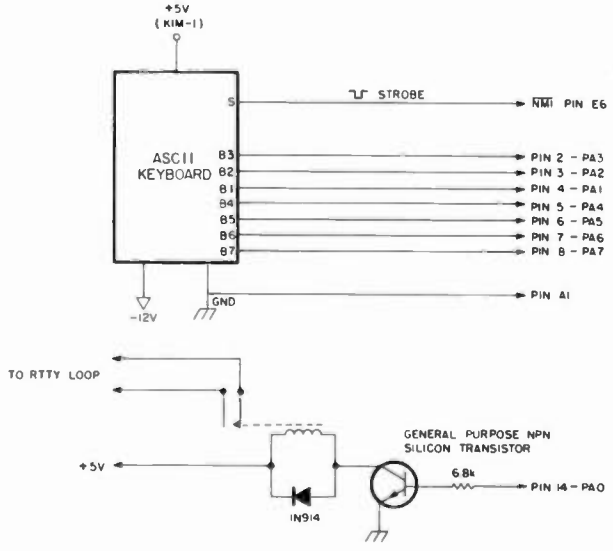

Fig. 2. KIM-1 interface circuitry.

ENTRY POINT

```
0200 A9 01        INIT   LDA imm.01    PA1-PA7 are inputs
0202 8D 01 17            STA abs 1701  PA0 is output
0205 8D 00 17            STA abs 1700  initiate at mark ( high )
0208 A9 00        CLEAR  LDA imm 00
020A AA                  TAX           clear X register
020B A8                  TAY           clear Y register
020C 8D BF 17            STA abs 17BF  clear FIFO pointer
020F 85 05               STA abs,z     clear " case " flag
0211 A9 BC        INTER  LDA imm BC    set NMI interupt vector
0213 8D FA 17            STA abs 17FA
0216 A9 02               LDA imm 02
0218 8D FB 17            STA abs 17FB
021B D8                  CLD
021C 4C D0 02            JMP abs 02D0 go to FIFO fetch routine
```

INTERUPT ROUTINE

```
02BC AD 00 17     GET    LDA abs 1700  Get character from keyboard
02BF 99 00 03            STA abs,y 0300 Save in FIFO buffer
02C2 C8                  INY
02C3 40                  RTI
```

FIFO ROUTINE

```
02D0 CC BF 17     FIFO   CPY abs 17BF  caught up yet ?
02D3 F0 0D               BEQ DIDDLES  yes? well go to diddles
02D5 AD BF 17            LDA abs 17BF offset into buffer
02D8 AA                  TAX
02D9 EE BF 17            INC abs 17BF increment pointer
02DC 20 20 02            JSR FETCH 0220
02DF 4C D0 02            JMP FIFO 02D0
02E2 A9 7F        DIDDLES LDA imm 7F    load LTRS for diddles
02E4 85 01               STA abs,z 0001
02E6 C6 03               DEC abs,z 0003 Decrement char. counter
02E8 20 60 00            JSR OUTPUT 0060
02EB A9 00               LDA imm 00 set Case flag to Lower
02ED 85 05               STA abs,z 0005
02EF 4C D0 02            JMP FIFO 02D0
```

OUTPUT SUBROUTINE

```
0060 18           OUTPUT CLC
0061 A9 07               LDA imm 07
0063 85 02               STA abs,z 0002
0065 06 01               ASL abs,z 0001
0067 B0 03               BCS MARK 006C
0069 4C 7E 00            JMP SPACE 007E
006C A9 14         MARK  LDA imm 14 set timer for 22 ms.
006E 8D 07 17            STA abs 1707
0071 A9 01               LDA imm 01
0073 8D 00 17            STA abs 1700 Set pin to MARK
0076 2C 07 17            BIT abs 1707   time finished ?
0079 10 F6               BPL            for more time
007B 4C 8D 00            JMP 008D to skip SPACE routine
007E A9 14        SPACE  LDA imm 14     set timer for 22 ms.
0080 8D 07 17            STA abs 1707
0083 A9 00               LDA imm 00
0085 8D 00 17            STA abs 1700  Set pin to SPACE
0088 2C 07 17            BIT abs 1707  time finished ?
008B 10 F6               BPL           for more time
008D C6 02         FINSH DEC abs,z 0002
008F 24 02               BIT abs,z 0002 is whole char. finished?
0091 30 03               BMI           branch if finished 0096
0093 4C 65 00            JMP 0065 to ASL again
0096 E6 03         COUNT INC abs,z 0003 increment char. counter
0098 A9 41               LDA imm 41 ( 65 decimal )
009A C5 03               CMP abs,z 0003 65 characters yet ?
009C F0 01               BEQ 009F       branch if yes
009E 60                  RTS
009F A9 20               LDA imm 20 ( ASCII for space code )
00A1 C5 04               CMP abs,z 0004 is last char. a space ?
00A3 F0 03               BEQ 00A8 branch if it was a space
00A5 C6 03               DEC abs,z 0003 decrement counter
00A7 60                  RTS
00A8 A9 00        EOL    LDA imm 00
00AA 85 03               STA abs,z 0003 reset char. counter
00AC A9 0B               LDA imm 0B    carriage return code
00AE 85 01               STA abs,z 0001
00B0 20 60 00            JSR OUTPUT 0060
00B3 A9 23               LDA imm 23 line feed code
00B5 85 01               STA abs,z 0001
00B7 20 60 00            JSR OUTPUT 0060
00BA A9 6F               LDA imm 6F    code for FIGS.
00BC 85 01               STA abs,z 0001
00BE 20 60 00            JSR OUTPUT 0060
00C1 A9 3B               LDA imm 3B    code for : ( colon )
00C3 85 01               STA abs,z 0001
00C5 20 60 00            JSR OUTPUT 0060
00C8 A9 7F               LDA imm 7F    code for LTRS.
00CA 85 01               STA abs,z 0001
00CC 20 60 00            JSR OUTPUT 0060
00CF A9 13               LDA imm 13    code for SPACE
00D1 85 01               STA abs,z 0001
00D3 20 60 00            JSR OUTPUT 0060
00D6 A5 00               LDA abs,z 0000
00D8 85 01               STA abs,z 0001 Restore previous character
00DA A9 00               LDA imm 00
00DC 85 05               STA abs,z 0005 Set case flag to LTRS
00DE 60                  RTS
```

FETCH ROUTINE

```
0220 BD 00 03     FETCH  LDA abs,x      fetch character from buffer
0223 4A                  LSR acc.       shift to preserve identity
0224 AA                  TAX
0225 86 04               STX abs,z 0004 original ASCII character
0227 B5 00               LDA abs,z,x    Look it up !
0229 85 00               STA abs,z 0000 baudot character
022B 85 01               STA abs,z 0001 baudot character
022D A5 04               LDA abs,z 0004   load ASCII character
022F C9 20               CMP imm 20     is it a SPACE ?
0231 F0 39               BEQ 026C       Branch if it is a SPACE
0233 C9 0D               CMP imm 0D     is it a Carriage Return ?
0235 F0 3B               BEQ 0272
0237 EA EA               NOP
0239 EA EA               NOP
023B EA EA               NOP      Reserved for future expansion
023D EA EA               NOP
023F 29 20               AND acc.imm.20  mask off case bit
0241 C5 05               CMP abs,z 0005  is case same as previous ?
0243 F0 27               BEQ 026C
0245 A9 00               LDA imm 00  is it not LTRS ?
0247 C5 05               CMP abs,z 0005
0249 F0 12               BEQ 025D  FIGS load routine
024B A9 00        LTRS   LDA imm 00
024D 85 05               STA abs,z 0005 set case flag to LTRS
024F A9 7F               LDA imm 7F    LTRS character
0251 85 01               STA abs,z 0001
0253 20 60 00            JSR OUTPUT 0060
0256 A5 00               LDA abs,z 0000 get previous character
0258 85 01               STA abs,z 0001  Restore!
025A 4C 6C 02            JMP 026C       to skip FIGS routine
025D A9 20        FIGS   LDA imm 20
025F 85 05               STA abs,z 0005 set case flag to FIGS
0261 A9 6F               LDA imm 6F     FIGS character
0263 85 01               STA abs,z 0001
0265 20 60 00            JSR OUTPUT 0060
0268 A5 00               LDA abs,z 0000 load previous char.
026A 85 01               STA abs,z 0001 restore previous char.
026C 20 60 00            JSR OUTPUT - now send that char. -
026F 60                  RTS
0270 EA EA               NOP
0272 20 A8 00            JSR EOL
0275 60                  RTS
```

Program listing.

Zero page address	contents	Baudot Char.
000A	23	LF (line feed)
000D	0B	CR (carriage return)
0020	13	SP (space)
0021	5B	!
0022	47	"
0023	17	#
0024	4B	$
0025	7F	% (not available)
0026	2F	&
0027	6B	' (apostrophy)
0028	7B	(
0029	27	)
002A	7F	* (not available)
002B	7F	+ (not available)
002C	1B	, (comma)
002D	63	-
002E	1F	.
002F	5F	/
0030	37	Ø
0031	77	1
0032	67	2
0033	43	3
0034	2B	4
0035	07	5
0036	57	6
0037	73	7
0038	33	8
0039	0F	9
003A	3B	:
003B	3F	;
003C	7F	(not available)
003D	7F	(not available)
003E	7F	(not available)
003F	4F	?
0040	6F	FIGS
0041	63	A
0042	4F	B
0043	3B	C
0044	4B	D
0045	43	E
0046	5B	F
0047	2F	G
0048	17	H
0049	33	I
004A	6B	J
004B	7B	K
004C	27	L
004D	1F	M
004E	1B	N
004F	0F	O
0050	37	P
0051	77	Q
0052	2B	R
0053	53	S
0054	07	T
0055	73	U
0056	3F	V
0057	67	W
0058	5F	X
0059	57	Y
005A	47	Z
005B	7F	LTRS

Look-up table.

one of them computer freaks," for sure!

We now will step through the various routines and see how this thing works. Have a look at Fig. 2. (This is from the article by Pollock and is presented here for those who might not have that issue of *73*.) Notice that the ASCII data is presented to KIM offset one place to the left. This is so that we have PA0 as our output pin. This "ASL" is made up for in the coding and is offset by an "LSR." Also, be sure the strobe on your keyboard is normally high, going low whenever data is available. This is required for compatibility with the NMI input on KIM.

Next, we look at Fig. 1, where we see all the buffers or temporary storage and flag locations involved in the program. Address 0000_h and 0001_h both will contain the Baudot value of the ASCII character that is to be transmitted. The reason for this will be explained later in the "Fetch" routine. Address 0002_h is the ASL counter. This ensures that we get the one start bit, five data bits, and our stop bits. Note that we are using 2 stop bits in this program, but this slows the rate so little that the extra coding could not be justified.

Address 0003_h is the counter that senses how far across the page we are. If we reach 65 characters, KIM will look for the next space and then put in the EOL routine. This assures us that we will not split up the last word on the line. Address 0004_h contains the ASCII equivalent of the Baudot character currently being processed for output. Address 0005_h is the Baudot case flag. If this contains 00_h, we are currently in lowercase Baudot. If this is 20_h, we are in uppercase Baudot. Address $17BF_h$ is the value of the FIFO pointer. If this location is not equal to the value of the Y register, another character will be fetched from the FIFO buffer and be transmitted. So on it goes until it catches up to the Y register.

You will find the entry point at the standard 0200_h. Here, the parallel interface is programmed as inputs and output, corresponding to what we require. The vital places are initialized at 00_h, and the NMI vector at $17FA_h/17FB_h$ is set to point to the interrupt routine. From here, the program jumps to the FIFO fetch routine where it will look at the pointer to see if there is something to transmit (see explanation of address 17BF). If the output routine has caught up to the input rate, the KIM will transmit "diddles" which are composed of LTRS functions. This may be deleted by changing address $02D4_h$ to FB_h.

Now a word about the interrupt routine. This simply looks at the keyboard inputs when an NMI is received and stores the ASCII character in the buffer at location 0300_h plus the value of the Y register; it then increments the Y register to point to the next empty spot.

We will now look at the output routine. It boils down to the fact that whatever is in address 0001_h is chosen so that when it is shifted to the left, each bit which is shifted into the carry position will correspond to the Baudot code. Take the code for the letter "A". In ASCII, this is 41. So, when an "A" is typed on the keyboard, it will enter a 41 into the buffer (after LSR to preserve identity). This 41 is used as an index for the look-up table and is transferred to the X register. The accumulator is loaded with the contents of address 000_h + X, which will be 41. The look-up table shows us that address 0000_h plus 41_h (0041_h) is the place for the letter A. Here the accumulator is loaded with the value 63_h. This is then stored at addresses 0000_h and 0001_h.

Then the accumulator is reloaded with the original ASCII value—in this case, 41_h. If it is a space code, the LTRS/FIGS detection and shift is avoided because every time a space code would be received, the machine would be shifted to uppercase. A look at an ASCII code table will show you why. Next, it is checked for a CR code. If it is pres-

ent, the KIM will jump to the EOL routine, send out the CR/LF/FIGS/:/LTRS/ SPACE codes, and set the line counter to 00_h and the case flag to LTRS. If none of the above has happened, then the character is checked for its case, i.e., upper or lower. If it is the same case as the previous character, the case shift routines are skipped, the character is output, and the program returns to the FIFO fetch routine. If the case is different, location 0005_h is checked to see what the last character's case was.

If it was LTRS case, and since we have already established it is a different case from the current character, we will jump to a FIGS load routine, which will be output. Here is where the purpose of storing the Baudot-encoded byte in two locations comes into play. After transmitting the FIGS command, we then have to transmit that uppercase character. Since 0001_h has been destroyed, the contents of 0000 is transferred to 0001 and then the shifted character is put out.

The EOL sequence is very simple. Each part of the EOL is consecutively loaded into 0001, and then we just JSR OUTPUT. When the EOL is finished, the counters are reinitiated at 00_h, the case flag is set to LTRS, and the contents of 000_h is transferred to 0001_h.

The output subroutine is actually very simple, also. Let's look at our ASCII "A". When this was looked up, the value of 63_h was stored at 0001_h. This 63_h breaks down to binary 01100011. Looking from left to right, we will always see a 0_2, and the last two on the right will always be 11_2. This corresponds to our one start bit and our two stop bits. The five in between will correspond to our Baudot code desired. A look at a Baudot code table shows us that "A" (Baudot) is actually 11000. Each time function is set for 22 ms, which occurs immediately before we set the output pin high or low, corresponding to the 1 or 0 of the carry position after the ASL. If 0002_h, our ASL counter, is minus, the character has been fully transmitted and the KIM checks how far it is along the line. If it has reached 65 characters and the current ASCII character being transmitted is a space, it will jump to the EOL routine. If not, it will just jump back from whence the JSR occurred.

Now you can see how easy it is to get your KIM doing wonderful things on RTTY. I have used this basic output routine in a great many things. One of the neatest ones was linking it to Tiny BASIC. This was a great addition to Tiny because it gave me a hard copy of the program, etc., but, boy, did it slow things down!

I hope this article has helped out those who would like to have their KIMs on RTTY but did not have the time to write the program, or whatever. It was a great educational experience for me, and a great deal of enjoyment was derived. KIM-1 has to be one of the best little rigs for this type of application, and many, many things can come to my mind when I start thinking about them.

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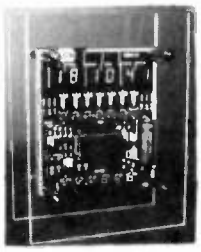

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AX-190 Upgrade

—Collins components can make the difference

A few months ago, I completed modifications to my AX-190 as suggested in 73 Magazine.[1] This made a great improvement in the front-end response of the receiver and, although I decided to stop with the additions in the first part of the article and leave out the preamp, signals that were hard to hear on 10 meters are now S9. I highly recommend this easy modification.

There is another area where the AX-190 falls short of being a good amateur receiver, however, and that is in the area of selectivity. The AX-190 in stock form shares its circuit with the SX-190, which is a shortwave listening receiver offering good performance on AM but rather poor selectivity for use on crowded ham bands. The receiver second i-f operates at 455 kHz and utilizes two transformer-filters with a rated bandpass of 4.1 kHz at 6 dB down. After thinking about outboard filters and even of building a passive audio bandpass filter into the speaker box, I finally decided to go the proper route and install a Collins mechanical filter in the i-f circuit. The price of new filters of this type is rather high, and if you are on a budget such as mine, I advise shopping for one that is surplus.

After looking over the schematic[2] and then opening up the receiver, I made the happy discovery that the second mixer (Q8) is mounted on the vfo board and is, of course, enclosed by the vfo box. Its output is fed to the input of the i-f board by a shielded cable soldered to pin 13. This point is an ideal place in which to insert a filter. Also, as I looked at the bottom of the receiver, I noted that the vfo enclosure edges are extended to the bottom of the chassis, forming a perfectly located shielded box with ready-made holes for connections. This means that a new circuit board can be inserted into the existing circuit with excellent isolation and no modifications to existing boards.

Before any work starts, it would be advisable to tune the calibrator signal in at a high frequency and peak all controls for maximum. If the S-meter reading is noted, the crystal calibrator then can be used to adjust the circuit on the new filter board for unity gain after installation. Capacitors C4 and C5 are adjusted for a peak, and then R2 is adjusted until the same S-meter reading is obtained.

The filter used is a surplus Collins 455-FA-21 with a bandpass of 2.1 kHz and it is mounted on an etched circuit board along with resonating capacitors and an amplifier using an MPF102. This board is etched with a

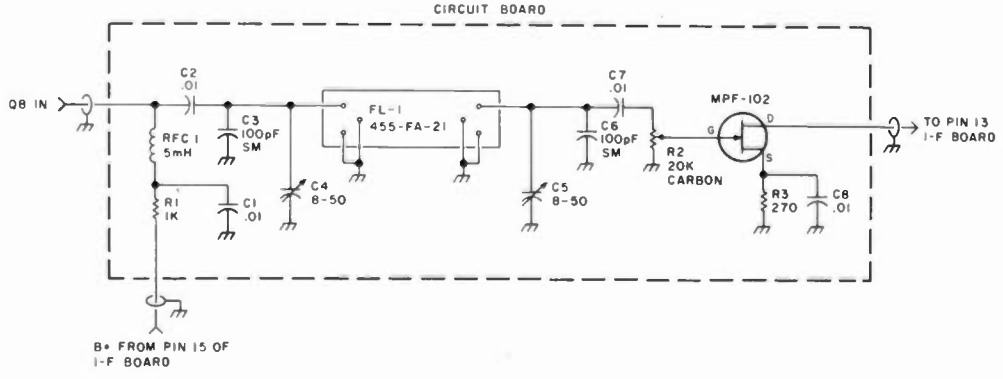

Fig. 1. A Collins filter for the AX-190. All connections to the circuit board are by shielded wire. See text for R2 adjustment. R2 is a surplus 10-turn, 20k carbon trimmer. R1, R2, and R3 are ¼ Watt.

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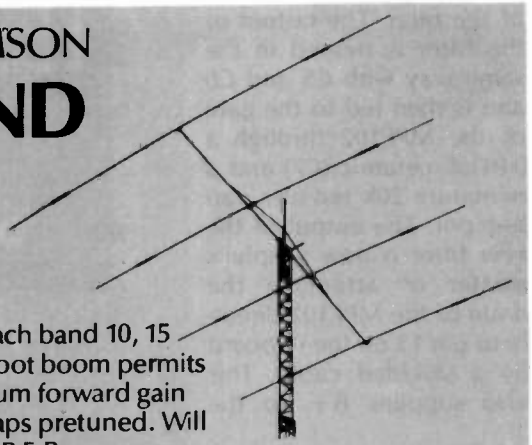

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maximum amount of ground plane remaining to provide isolation. I also added a shield on the foil side of the board between the input and output of the filter. The shield is simply a piece of circuit board material about ½-inch wide running the width of the board and attached with solder. I'm not sure it's necessary, but it is easy to do and certainly won't hurt.

The original shielded cable coming from Q8 to the i-f board is unsoldered from pin 13 and rerouted to the filter board which is mounted on the bottom panel of the vfo box. It may be necessary to splice on a small piece of cable, depending on how you mount the board. On the new board, the mixer product is coupled to the mechanical filter through a 0.01-uF ceramic capacitor (C2). A 100-pF silver mica capacitor (C3) with a paralleled 8-50-pF ceramic trimmer (C4) are used to resonate the input of the filter. The output of the filter is treated in the same way with C5 and C6 and is then fed to the gate of the MPF102 through a 0.01-uF ceramic (C7) and a miniature 20k ten-turn carbon pot. The output of the new filter is now simply a matter of attaching the drain of the MPF102 directly to pin 13 on the i-f board by a shielded cable. This also supplies B+ to the MPF102 as it did originally to Q8.

Of course, by this process Q8 no longer has B+, and this is restored by running another shielded cable from the power supply bus on the i-f board (pin 15) through a capacitor-resistor decoupling network on the new filter board. Just to be sure, I threw in an additional 5-mH choke. These components are labeled R1, C1, and RFC1 on the diagram, Fig. 1.

These modifications have resulted in a very satisfying receiver as far as SSB and CW are concerned, and comparisons with other highly-rated receivers are favorable. AM reception is no longer possible, but I'll accept that loss in the light of better performance in the other modes.

Many thanks are due to Dave Carlson VE7AQE who provided the circuit and the technical advice along with enough verbal abuse to get me going on this project! ■

References

1. "Improve the AX-190 Receiver," Paul J. Dujmich, *73 Magazine*, January, 1978, page 106.
2. Allied AX-190 Instructional Manual, page 23, "Schematic Diagram of I-f Section," Copyright 1971, Allied Radio Shack.

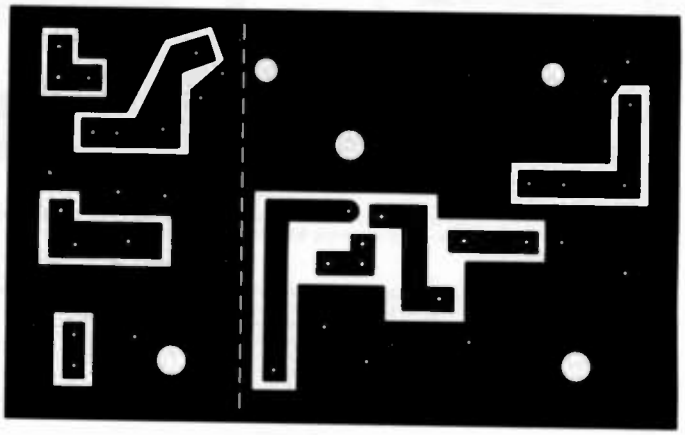

Fig. 2. PC board, foil side.

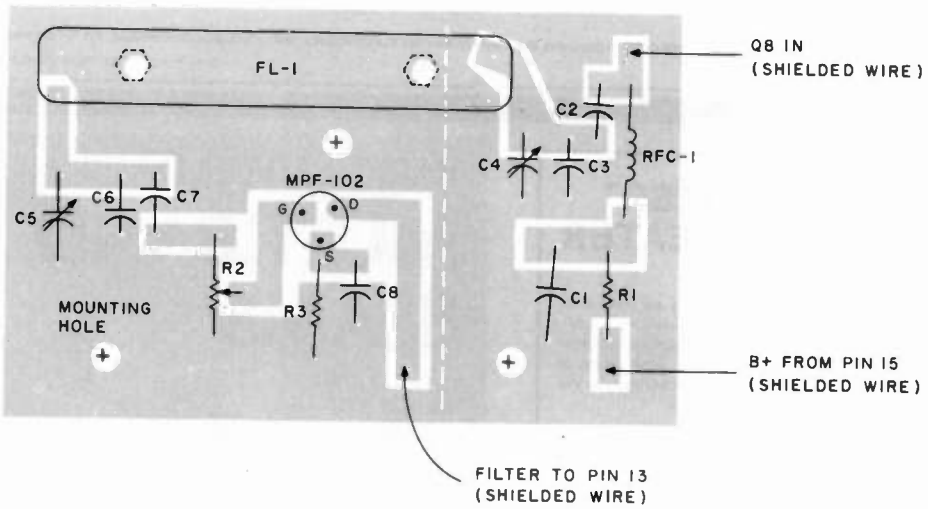

Fig. 3. PC board, component location.

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Older models of the digital clocks were six-digit versions displaying hours, minutes, and seconds. Later versions are four-digit types which normally display only hours and minutes. These can be set to WWV time, after a fashion, by advancing the clock to the next minute, stopping the clock, and releasing it on the minute signal.

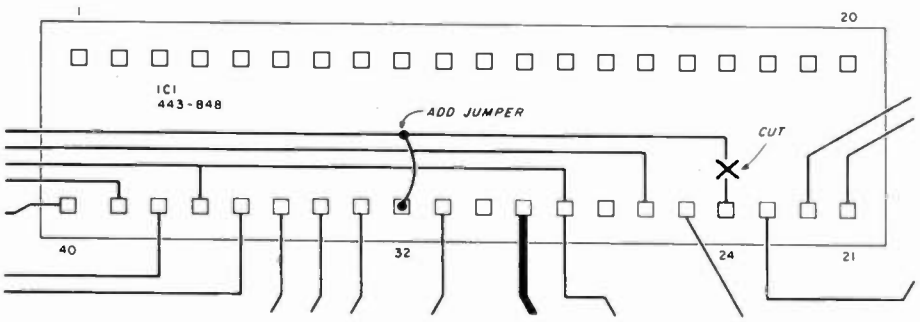

Fig. 1. Clock IC—printed circuit side.

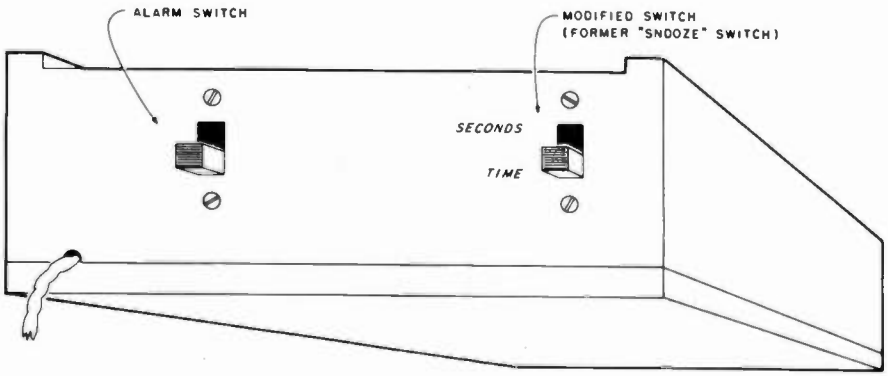

Fig. 2. GC-1107 clock—rear view.

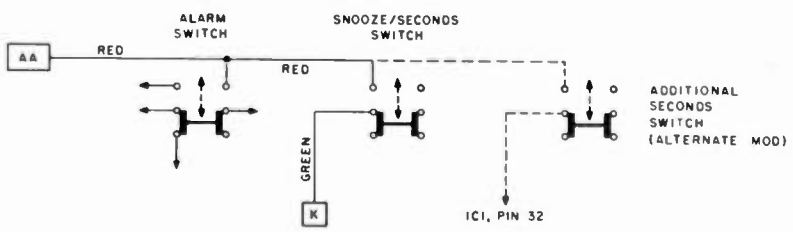

Fig. 3. Clock switch wiring.

A much more accurate method of setting the model GS-1107 clock is to modify the clock for a seconds display. This allows the clock to be set exactly with the WWV signal. The seconds display is handy also for timing. The modification is relatively simple, consisting of cutting a trace on the PC board, wiring in a jumper wire, and replacing the snooze switch. An additional switch can be added to give a seconds display if the snooze feature must be retained. A similar modification can be done to any digital clock using the National MM5316 clock chip.

Perform the following modifications:

1. Cut the printed-circuit trace to pin 24, IC1 (clock IC) (see Fig. 1).

2. Add a strap from pin 32, IC1 to the PC trace previously connected to pin 24 (see Fig. 1).

3. Replace the spring-return snooze slide switch with a regular one-pole/two-position switch (Radio Shack 275-430). Wire the new switch the same as

the original switch (see Fig. 3).

● Snooze switch will now provide two displays:

a) "Time" display: normal 24-hour format.

b) "Seconds" display: digit 4 = blanked, digit 3 = minutes (units), digit 2 = 10s of seconds, digit 1 = seconds.

● When used in "seconds" display mode:

a) Slow switch: Will inhibit 60-cps input to the clock IC and prevent time from advancing.

b) Fast switch: Will reset seconds to zero without changing the minutes count.

c) Both switches at once: Will reset time to 12:00:00 am in 12-hour format; to 00:00:00 in 24-hour format.

● To set the clock to synchronize with WWV:

a) With former snooze switch in "time" display mode, set clock to current time plus one minute.

b) Switch to "seconds" display.

c) Depress fast switch (resets to X:00), release fast switch, and immediately depress slow switch (stops clock and holds time).

d) Upon receipt of the WWV tone (on the minute), release the slow switch.

e) Verify that the display changes from X:59 to Y:00 at the next WWV tone pulse (on the minute).

f) Set former snooze switch to "time" display mode.

If an additional switch is added for the "seconds" function, connect the center contact of the switch to pin 32 of IC1 (clock chip). Connect the normally-open contact of the switch to the wire which is common to the snooze and alarm switches (+22 V from power supply terminals AA, AB, AD, and AG)—see Fig. 3. ■

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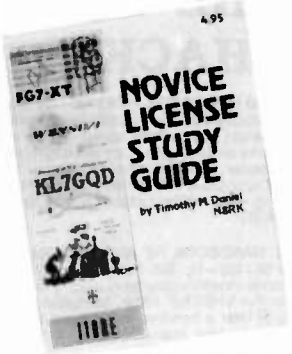

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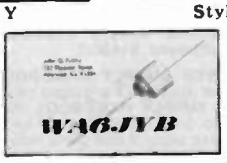

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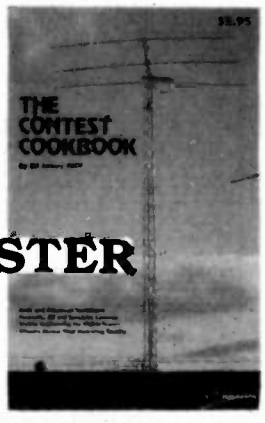

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BX1001	SHELF BOXES—2-7	$1.50 each
BX1002	SHELF BOXES—8 AND UP	$1.25 each
BK1200	SIMPLE, LOW COST WIRE ANTENNAS FOR RADIO AMATEURS	$ 6.95
BK7311	SOME OF THE BEST FROM KILOBAUD	$10.95
BK7311	SOME OF THE BEST	$ 7.95
BK7351	SSB THE MISUNDERSTOOD MODE	$ 5.50
CT7350	SSTV TAPE	$ 5.95
SG1081	STUDY GUIDE—ADV. CLASS	$ 6.95
SG1080	STUDY GUIDE—EXTRA CLASS	$ 5.95
SG7357	STUDY GUIDE—NOVICE CLASS	$ 4.95
BK1190	THE TEN METER FM HANDBOOK	$ 4.95
LB7359	TEST EQUIP LIB V1—COMPONENT TESTERS	$ 4.95
LB7360	TEST EQUIP LIB V2—AUDIO TESTERS	$ 4.95
LB7361	TEST EQUIP LIB V3—RADIO EQUIP	$ 4.95
LB7362	TEST EQUIP LIB V4—IC TEST EQ	$ 4.95
BK7348	TOOLS & TECHNIQUES	$ 4.95
BK1063	TTL COOKBOOK	$ 9.50
BK1064	TVT COOKBOOK	$ 9.95
BK7382	UNDERSTANDING & PROGRAMMING MICROCOMPUTERS	$10.95
BK1069	VERTICAL BEAM & TRIANGLE ANTNS	$ 5.50
BK7368	VHF ANTENNA HANDBOOK	$ 5.95
BK1198	VHF HANDBOOK FOR RADIO AMATEURS	$ 6.95
BK7370	WEATHER SATELLITE HANDBOOK	$ 2.50
BK1202	WORLD PRESS SERVICE FREQUENCIES	$ 5.95
BK1184	WORLD RADIO TV HANDBOOK	$18.50
BK7315	WORLD REPEATER ATLAS	$ 4.95

The 160 Winners!

—W8LRL and W4CN take top honors

Bill Gosney KE7C
2665 Busby Road
Oak Harbor WA 98277

"The biggest and best ever held"—those were the words uttered by nearly everyone who participated in the 1981 160-Meter Phone Contest sponsored by *73*. Most contestants expressed their surprise at the enormous turnout of active stations on the bands. Many old-timers indicated it was the first time in their lives they've seen so many phone-band operators on 160 at one time! They weren't joking, either; the statistics tallied after the contest showed nearly 1,000 stations participated in the weekend extravaganza. Look at the results compared to last year for example:

	Entries	Participants
1980	74	569
1981	117	917
%Increase	58.1%	61.2%

Greater scores were witnessed, bigger signals were apparent, certainly more stations were on the air than ever before, and the propagation seemed to favor most everyone's fancy. I said "most," fellas! As well-known top-band operator Paul Engle K9QLL stated, "Last year's winner wouldn't have even made honorable mention this year!" If you weren't there to see it for yourself, let us tell you, the competition was extremely fierce. The contest results pretty well sum it up.

Wally Eckles W8LRL from West Virginia took first-place honors in the single-operator category with a remarkable score of 383,625 points. Of particular interest is the fact that the DX countries worked by Wally made the difference in the outcome of the event. Wally's fifteen-country total could not be matched by the nine countries of second-place finisher and well-known HF contest station KØRF. Though KØRF had the most QSOs in the contest (804), nearly twice that of last year's winner, the three multiplier credits earned for each DX country worked allowed W8LRL to pull out into the lead when the final scores were tabulated.

John Vaughn and company (AC4A, WD4ARQ, N4DUH, KA4DWX, KA4FJJ, WD4OSN, WA4QWJ, NF4R, K4TXJ, KD4U, and N4XM), representing the Amateur Radio Transmitting Society, Inc., of Louisville, Ken-

ZF2DX in Grand Cayman Island operated by KØCVB and WAØDXZ (wearing glasses). KØCVB was 2nd in the world last year.

CONTEST FEEDBACK

"This was my first 160 contest; in fact, at contest time I had only been on 160 meters about two weeks total. Had a really super time and you can be sure I will be back next year with bigger and better things."—K1LPS.

"The 160 contest again turned out to be a great success! Congrats on a job well done. The new rules worked out just fine and I wouldn't change a thing for next year. My biggest thrill was working W1BB, W2FJ, and W2EQS all the same weekend. I guess there is a first for everything?"—WA9EYY.

"Thanks for a most enjoyable contest and thanks to everyone for the contacts. I had to miss most of the first night and half of the second. I am already looking forward to next year's event."—KC8P.

"Suggest you make the contest mixed SSB/CW."—AA1K.

"No W5s or W7s; where were they? A great contest, though."—K1NBN.

"Competition is getting heavier (and much, much louder). I guess it is time for a new antenna system. The band opened up nicely Sunday morning. Thanks for a fun contest."—WB1HIH.

"The word got out about the best 160-meter contest and I wish I could have worked the thousands of stations I could hear. Hope we have the entire 160-meter band next year and we can spread out a little."—K2DWI.

"All set for the contest, then 2 days before I got the flu. I was left with little energy. My coughing kept tripping the VOX. See everyone in the 3rd annual event, I am sure."—K3IXD.

"Found the conditions here on the east coast good to zero-land; not much heard to 5-, 6-, or 7-land, however; did hear HP3, KP2, and a VK6 at about 0100Z on the 18th. Certainly looking forward to next year."—K2SJB.

"Biggest thrills were working Hawaii and Nova Scotia answering my CQ."—W5LKP.

"Lots of fun and good turnout for the 2nd annual event. Only wish the DX conditions were better for some of us."—W3BGN.

"This is my very first 160-meter contest and only my second contest of any kind. I enjoyed it very much. I wish time would have allowed me to work longer."—K4ZGA.

"Contest rules as of now make no incentive to work more than one DX station in each country. I feel the rules should give extra points for each DX station worked."—W4PZV.

"Good contest! Unfortunately, I could only operate one night."—AE6U.

"Hadn't been on 160 since 1954 until the weekend of the contest. I strung up a new antenna and jumped in with both feet (until the rig blew up Friday night). This put me out of action until the following evening. I had a ball anyway! See you next year for sure."—N4ARO.

"Forty minutes late starting due to finishing the beverage antenna in the moonlight. It helped me work two European countries, however."—N4IN.

"My first 160-meter contest. Not a good score, but wanted to show my support. Enjoyed it nonetheless. Hope to improve

WD4OSN pictured here at his station after all the dust cleared. This station took top multi honors under the call W4CN.

W8LRL, overall 160-meter champion! An unbelievable score of 383,625 points, 775 QSOs, 47 states, 7 provinces, and 15 DX countries on single sideband. Need we say more about this popular contester, "Mr. Gentleman" of the "Gentleman's Band."

KA9F manned by WD9IHI in the foreground and station owner Neil in the back as they operate from the high school press box high above the football stadium where dipoles are strung across the field.

N7DF, top 7-land station for the second year in a row. Look at the spider-web. Could this be why?

my antenna system to be more competitive. Thanks to 73 Magazine for the sponsorship. See you again next year." —W5SOD.

"As always, it was again proven that 160 is the 'Gentleman's Band.' My thanks to the fellows who really tried to get me through to the east coast, even though I didn't make it (sob!)."—W6WBY.

"Lots of bug signals and weak ears. Big and little guns calling the coast to no avail! All in all, it was lots of fun. Sunday participation dropped off drastically it seemed."—KK6C.

"Heard many stations that couldn't hear me—HP1XRK, AH6BK, KC4OV, etc. My noise level was 59+. A fun contest, though, and there sure was a noticeable lot of activity." —AK7F.

"Never heard so much activity on 160 before! Worked more states in 4 hours than in the rest of my not-too-active 22 years. Used a 330-foot AM broadcast tower after sign-off. Having a 5/8-wave vertical sure was nice (hi). Next year we may even match the impedance."—K8EXF.

"Never has 160 sounded so continuous QRM."—W8IM.

"Sure was fun. Only wish I could have worked the second night."—K8CFU.

"Had a lot more fun than last year. Did a little better also (hi). Missed some prime time operating hours due to company. Sure looking forward to next year, though."—W8QBF.

"Really enjoyed the contest. A lot more activity than I expected to find. The event seems to be a great success. Thanks to 73 Magazine!"—W8LRL.

"Where were Wyoming and New Mexico? Missed several other multipliers, too. Enjoyed the contest again this year. Seemed to be much more activity and I was at least able to beat last year's score in spite of the limited operating time."—N9GT.

"Conditions were excellent. Local competition was very, very stiff!"—WBØCMM.

"Again I enjoyed the contest. Conditions were less favorable, though. Higher noise, weaker propagation. Pleased to note the higher turnout, especially VEs. Acquired 1 more state and 3 more provinces thanks to the contest."—VE4WR.

"Back to the drawing boards for the 160 antenna. I heard at least 25 stations from the US calling me, but they didn't hear my return signal evidently. Planning a sloper for future 160 work. Couldn't hear W1-land at all."—HP1XRK.

"This was my first effort in a contest since I got my license last April. I really had fun. Wish my antennas were a few feet higher (hi). All in all, had a great time."—VE1BWW.

"This was quite a contest. Last year's score would hardly be an honorable mention this year. Murphy got me and I missed some of the best hours of the contest due to a blown switchbox and preamp. Never heard so many signals on 160 before. There must have been over 1,000 stations on there! Sure hope the test continues every year!"—K9QLL.

"Wish I had submitted my records last year. I enjoyed the contest a great deal. One of the best, I think! Certainly more contesters this year. Hopefully, it will grow in popularity while not challenging in simplicity and good operators. It was zero degrees or less and had about 16" of snow. Made my new 160 antenna plans impossible."—N8AKY.

WA9EYY achieved 2nd highest multi-op score in the world assisted by K9ZDN.

Multi-op station WDØBNC was top zero-land station and third in the world. WDØBNC (left) and WAØTKJ (right).

W3YOZ preparing for the big event. Photo represents only one of three verticals mounted in the river with extensive radial systems. This station was 5th in the world and high scorer in the 3rd call district.

tucky, had a clear-cut victory in the multi-operator category with a score of 226,525 points. This team was followed by second-place finisher WA9EYY and his multi-operator assistant K9ZDN with 193,475 points. Unlike the race in the single-operator category, the difference in this heat was obviously the QSO count. A margin of 152 QSOs separated the first- and second-place stations, while the second-place station led in provinces and countries worked.

This year's multi-op effort was a surprise to us all. We hope this success will be incentive enough for more stations to come out of the woodwork, join the fun, and challenge the competition on 160!

John Summach VE3MFA from Burlington, Ontario, Canada, was high scorer for all of Canada with 444 QSOs and 142,080 points. Leading the single-operator category for DX stations was C6ADV with 171 QSOs and 49,590 points. ZF2DX and multi-op crew KØCVB and WAØDXZ led in their category for DX stations with 241 contacts and 73,505 points total.

Evidently propagation to North America was not in the Europeans' favor, as DF2LM and SP5IXI both reported making contacts only within the Eastern Hemisphere. We're as optimistic as they are, however; they'll be back next year to try again as conditions *will* improve, won't they?

Sorting through all the statistics by computer, we found KØRF leading the pack with the most QSOs (804), followed by W8LRL with 775 stations worked. Other entries with 300 or more contacts included: W4CN (697); WBØCMM (676); W9RE (592); W3YOZ (580); WA9EYY (545); WDØBNC (513); AA1K (488); WDØBRD (485); N4KG (483); KC8P (457); VE3MFA (444);

CONTEST SUMMARY
The Top Six on 160
SINGLE OPERATOR

Call	State	Score	QSOs	Points	States	Provinces	Countries
W8LRL*	WV	383,625	775	3875	48	7	15
KØRF	CO	333,660	804	4020	48	8	9
WBØCMM	CO	256,880	676	3380	47	8	7
W9RE	IN	224,960	592	2960	46	6	8
W3YOZ	MD	217,500	580	2900	45	6	8
AA1K	CT	202,520	488	2440	43	7	11

MULTI-OPERATOR

Call	State	Score	QSOs	Points	States	Provinces	Countries
W4CN*	KY	226,525	697	3485	47	6	4
WA9EYY	IL	193,475	545	2725	46	7	6
WDØBNC	KS	176,985	513	2565	47	7	5
WDØBRD	NE	169,750	485	2425	47	8	5
W9ZX	IL	120,725	439	2195	44	5	2
KA9F	IL	120,000	375	1875	42	4	6

*World high score

FINAL RESULTS
SECOND ANNUAL 160-METER PHONE CONTEST

Final results are listed in order by callsign, state, province or country, score, QSO points, QSOs, states, provinces, countries worked. (*) = State/province/country winners; (**) = District winner.

SINGLE-OPERATOR CLASS

Call	State/Province/ Country	Score	QSOs	QSO Points	States	Provinces	Countries
AA1K	CT**	202,520	488	2440	43	7	11
WB1GQR	VT*	70,560	294	1470	37	5	2
W1WCR	NH*	51,230	218	1090	36	5	2
K1NBN	ME*	36,075	189	925	31	5	1
WB1HIH	MA*	34,020	185	945	31	5	-
K1LPS	VT	22,100	130	650	26	5	1
K1KNQ	MA	21,930	102	510	35	2	2
W1BB	MA	13,950	90	450	24	4	1
K2DWI	NY**	17,255	119	595	26	3	-
K2SJB	NY*	13,485	87	435	29	2	-
W2CC	NJ*	20	2	10	2	-	-
W3YOZ	MD**	217,500	580	2900	45	6	8
W3BGN	PA*	72,675	255	1275	38	4	5
W3DHM	PA	61,425	195	975	41	4	6
AE3T	PA	53,200	190	950	42	5	3
K3LGC	DE*	48,760	184	920	36	5	4
KB3MI	PA	24,320	128	640	31	4	1
W3AJS	PA	9,100	65	325	21	4	1
K3IXD	MD*	3,840	32	160	21	-	-
W3ICM	MD	270	9	45	6	-	-
WB3GCG	MD	disqualified (excessive power)					
N4KG	AL**	185,955	483	2415	46	7	8
W4PZV	FL*	122,055	309	1545	42	4	11
N4IN	FL	113,620	299	1495	45	4	9
WB4OSS	KY*	100,005	339	1695	45	5	3
W4WWQ	VA*	73,810	242	1210	41	5	5
N4UU	VA	72,135	229	1145	42	3	6
W4VKK	GA*	61,800	206	1030	42	3	5
N4ARO	TN*	46,200	210	1050	35	3	2
N4CMJ	VA	39,560	184	920	37	4	2
N4CJ	VA	34,010	179	895	28	4	2
WB4ZPF	VA	26,000	130	650	31	3	2
N4MM	VA	23,500	100	500	38	3	3
W4TWW	SC*	16,660	98	490	26	2	2
N4DMS	GA	13,050	90	450	28	1	-
WD4RCO	GA	10,695	69	345	30	1	-
N4WZ	GA	10,350	69	345	30	-	-
K4ZGA	TN	3,220	28	140	22	1	-

W5LKP	TX**	101,520	282	1410	42	6	8
AE5H	MS*	100,345	329	1645	44	5	4
WD5DVD	LA*	24,990	119	595	33	-	3
W5VGC	NM*	16,660	98	490	33	1	-
W5GWD	MS	5,750	50	250	23	-	-
W5SOD	TX*	2,700	30	150	18	-	-
K6SE	CA**	113,520	344	1720	46	5	5
AE6U	CA*	102,480	336	1680	42	7	4
KK6C	CA	49,720	226	1130	32	4	2
W6WBY	CA	6,480	81	405	16	-	-
W6TYR	CA	2,310	33	165	10	1	1
WA9WAC/6	CA	1,350	27	135	8	2	-
N7DF	UT**	135,600	412	2060	42	6	4
WB7FDQ	AZ*	105,385	347	1735	43	6	4
K7VIC	MT*	74,715	293	1465	41	4	2
N7AM	WA*	68,850	270	1350	34	5	4
KA7BTQ	ID*	68,080	296	1480	39	4	1
W7ULC	OR*	43,460	212	1060	34	4	1
N7AKU	NV*	9,620	74	370	23	3	-
AK7H	WA	7,280	56	280	19	4	1
AK7F	WA	4,770	53	265	15	3	-
W7TO	WY*	30	3	15	2	-	-
W8LRL	WV**	383,625	775	3875	47	7	15
W8XV	OH*	135,680	424	2120	44	5	5
KC8P	MI*	134,015	457	2285	45	5	3
KB8AC	OH	110,745	321	1605	45	6	6
W8GIO	WV*	110,400	366	1830	43	5	4
W8QBF	OH	58,800	245	1225	38	4	2
KB8HW	MI	41,830	178	890	36	5	2
K8IP	OH	26,320	112	560	34	4	3
N8BJQ	OH	25,215	123	615	37	1	1
K8EXF	MI	11,220	68	340	31	2	-
N8BJU	OH	10,230	62	310	28	2	1
K8CU	MI	9,000	60	300	29	1	-
W8IM	OH	7,150	65	325	21	1	-
WB8AYW	MI	3,300	30	150	20	2	-
W9RE	IN**	224,960	592	2960	46	6	8
K9QLL	IL*	138,040	406	2030	47	6	5
WA0AVL/9	IL	123,690	399	1995	47	6	3
W9UP	WI*	99,125	325	1625	44	4	5
N9GT	IN*	87,450	330	1650	43	4	2
WD9IIX	IL	59,565	209	1045	39	3	5
K9BG	IL	35,500	142	710	41	3	2
WA9FTU	IL	23,110	126	630	34	3	-
WA9RHU	IL	13,860	99	495	25	3	-
K9GDF	WI	50	5	25	2	-	-
KØRF	CO**	333,660	804	4020	48	8	9
WBØCMM	CO*	256,880	676	3380	47	8	7
KAØY	IA*	92,055	323	1615	46	5	2
KAØM	MN*	30,995	151	755	39	2	-
WBØUFL	IA	11,745	81	405	29	-	-

CANADIAN STATIONS (SINGLE-OP)

VE3MFA	Ont*	142,080	444	2220	43	6	5
VE1BNN	NScot*	94,140	284	1420	36	7	8
VE1BWW	NBrun*	36,355	169	845	31	6	2
VE4WR	Man*	35,690	166	830	36	7	-
VE7FAO	BC*	19,845	147	735	17	4	2
VE5XU	Sask*	18,135	117	585	27	4	-
VE1BPY	PEI*	3,515	37	185	13	6	-
VE2DZE	Que*	3,400	40	200	13	4	-
VE7FBS	BC	1,450	29	145	9	1	-

W9ZX (439); W8VX (424); N7DF (412); K9QLL (406); WAØAVL/9 (399); KA9F (375); W8GIO (366); WB7FDQ (347); K6SE (344); AE6U (336); N9GT (330); AE5H (329); W9UP (325); KAØY (323); KB8AC (321); W4PZV (309); K9ZUH (300).

Our only disappointment (other than a disqualification which was made) was the representation from some of the Canadian provinces. With the rules changed to their favor from last year, we were expecting a greater turnout in this part of the continent. Out of a maximum of twelve provinces and territories possible, only nine were ever heard on the band, eight of which were logged by the three zero-land stations—KØRF, WBØCMM, and WDØBRD.

Speaking of multipliers, all fifty (50) states were heard on the band at one time or another. Yes, contrary to the belief of some east coasters, Hawaii was on there in full force (why no entries, though, fellas?), as was the state of Alaska. Of course, for the sake of the contest, Hawaii and Alaska counted as DX multipliers!

For the most states worked, KØRF's call pops up again, leading all other contestants with 48 states worked—a clean sweep! Others recording forty (40) or more states were: W4CN, W9LRL, WAØAVL/9, K9QLL, WDØBRD, WDØBNC, WBØCMM (47); N4KG, K6SE, WA9EYY, W9RE, KAØY (46); W3YOZ, N4CQ, N4IN, KB8AC, KC8P (45); AE5H, W8VX, K9ZUH, W9UP, W9ZX (44); AA1K, WB7FDQ, N9GT, VE3FMA (43); AE3T, W4VKK, N4UU, W4PZV, W5LKP, AE6U, N7DF, N8AKY, WD9GGY, KA9F (42); W3DHM, W4WWQ, K7VIC, K9BG (41); and ZF2DF (40).

With fifteen (15) countries to his credit, W8LRL was clearly the DX king as

Quad (1)
3-Element Vertical (1)
Discage (1)
Hytower Vertical (3)
Miscellaneous Verticals (21)
Inverted-L (11)
Tee Vertical (3)
Delta Loop (1)
Shunt-Fed Tower (3)
Receiver Loop & Preamp (5)
Inverted Vee (20)
80-Meter Vee w/tuner (3)
2-Element Phased Verticals (3)
Beverage (19)
2-Element Quad (1)
Zepp (2)
Longwire (12)
Sloper (12)
Dipole (12)
Marconi (2)

Table 1. Antennas used in the 160-Meter Phone Contest.

DX STATIONS (SINGLE-OP)

C6ADV	Bermuda*	49,590	171	855	33	4	7
DF2LM	West Germany*	11,700	78	390	-	-	10
HP1XRK	Panama*	6,460	34	170	17	-	7
SP5IXI	Poland*	360	8	40	-	-	3

MULTI-OPERATOR STATION RESULTS

W4CN	KY*	226,525	697	3485	47	6	4
WA9EYY	IL*	193,475	545	2725	46	7	6
WDØBNC	KS*	176,985	513	2565	47	7	5
WDØBRD	NE*	169,750	485	2425	47	8	5
W9ZX	IL	120,725	439	2195	44	5	2
KA9F	IL	120,000	375	1875	42	4	6
N4CQ	NC*	90,750	275	1375	45	3	6
K9ZUH	IN*	90,000	300	1500	44	4	4
ZF2DX	Grand Cayman*	73,505	241	1205	40	3	6
WD9GGY	IL	70,250	281	1405	42	5	1
N8AKY	MI*	63,700	260	1300	42	4	1
K8CFU/4	NC	60,090	238	1190	34	4	4
WA2GZB	NJ*	56,925	207	1035	39	7	3
N9AW	WI*	48,840	222	1110	37	4	1
VE6ANC	ALB	7,650	85	425	11	4	1

MULTI-OPERATOR PARTICIPANTS

WA2GZB and WB2QLO
W4CN, AC4A, WD4ARQ, N4DUH, KA4DWX, KA4FJJ, WD4OSN, WA4QEJ, NF4R, K4TXJ, KD4U, N4XM
N4CQ and WA4UNZ
VE6ANC and VE6BMW
N8AKY and WD8NLE, KA8LDO
K8CFU/4 and WA8VDC/4
N9AW and WA9TZE, K9BED, KA9GAZ, KA9FZI
KA9F and WD9IHI, KB9JT, KA9GGM, KA9GGL, KA9ICT, WA9NXM
WA9EYY and K9ZDN
WD9GGY and WD9BHK
K9ZUH and WB9PXR
W9ZX and W9MWK
WDØBNC and WAØTKJ
WDØBRD and WBØIBT, WBØIJL
ZF2DX and KØGVB, WAØDXZ/5

well as being the overall winner of the contest. Other DX accomplishments with 5 or more countries: AA1K and W4PZV (11 countries total); DF2LM (10); N4IN, KØRF (9); VE1BNN, W3YOZ, N4KG, W5LKP, W9RE (8); C6ADV, HP1XRX, WBØCMM (7); W3DHM, N4UU, N4CQ, KB8AC, KA9F, WA9EYY ZF2DX (6); W3BGN, W4VKK, W4WWQ, K6SE, W8VX, W9UP, K9QLL, WDØBRD, WDØBNC, VE3MFA (5). An additional 33 entries managed to verify four or less countries each.

This year 21 countries were represented during the contest, another great surprise we never expected. Contestants logged such countries as San Andreas, Grand Cayman Islands, Bahamas, Puerto Rico, Bermuda, Panama, Dominican Republic, Netherlands Antilles, Venezuela, Hawaii, Alaska, England, Isle of Man, Northern Ireland, Netherlands, Australia, West Germany, Poland, Mexico, Peru, and, of course, the United States and Canada. All we need to do now is convince these top-band DX stations to join us again next year and hopefully this time we can talk them all into submitting an entry. Just think, each of them could have won an award to hang on the wall and boast about!

After the big event is all

Atlas 350-XL (1)
Collins 75A3 (1); 75A4 (1); KWM-2 (1)
Drake T4X (2); T4XC (10); T4XB (10); TR7 (7); R4A (1); R4B (10); R4C (8)
Heathkit HW-12A (1)
Icom 701 (1)
Kenwood TS-180S (4); TS-830S (4); TS-520S (9); TS-820S (4); TS-820 (1); TS-520SE (1)
Signal One CX7A (1); CX11A (1)
Yaesu FT-101ZD (4); FT-901DM (7); FT-101E (4); FT-101EE (3); FT-101EX (1); FT-101D (1); FT-107M (1); FT-301S (1); FT-301SD (1); FL-101 (1)

Table 2. Equipment used in the 160-Meter Phone Contest.

W9ZX was among the top five multi-op stations. Achieved 439 contacts and 120,725 points with the dedicated assistance of W9MWK.

over and everyone has submitted his entry, one of the most interesting parts of the contest committee's job is to tally all the equipment and antennas used by the contestants. We get the biggest kick out of the lame duck excuses some people will use for not getting on 160—for years hams have been saying it required too much real estate or it required a special home-brew rig of some fashion. Well, for the second year in a row, we have the results to prove all that is a bunch of hogwash. Look at the stats for yourself. Most of the antennas you see listed in Table 1 were erected on small city lots.

Now take a look at the equipment in Table 2. It's an old wives' tale; I don't see a home-brew rig in the bunch (I take that back—a modified Heathkit HW-12A).

It's been a great contest; we have Dan WA2GZB and Ed K3IXD, both members of our contest committee, to thank for that. This dedicated pair has been with the contest from the very start. Both were instrumental in assisting me back in early 1979 when we burnt the midnight oil trying to establish the rules for the event we've all experienced here. Both have agreed to be with us again next year for the third annual event, which I must remind you is just around the corner.

Help us pass the word for our next big event in January! Will W8LRL win again? Will KØRF take it all or will W7RM, W7WA, and W2PV come out of the woodwork and surprise us all? We hope that whatever happens, it will be a fun time for us all as the FCC has just announced the relaxation of rules governing 160 operation. Who knows, we may see DXCC in a weekend before it is all over! I'll be pruning and tuning; how 'bout you? ■

AWARDS

Bill Gosney KE7C
Micro-80, Inc.
2665 North Busby Road
Oak Harbor WA 98277

FREE OPERATING AWARD

Not many things in life are free these days. Boy, isn't that the truth! The expense of administering an awards program is no exception. The sponsor of this next award, however, is about to change all that.

Read the rules very carefully. All amateurs are eligible and can easily qualify with the station they now have! Though the awards program focuses on computer operation in the amateur bands, the applicant *does not* have to own a computer to qualify! Confused?

The sponsor recognizes the fact not all amateurs own a microcomputer (recent surveys indicate only 20% do). All of us have been exposed to one on the air several times the past couple years, probably without even knowing it. The emphasis of this award, therefore, is to work other stations who are computerized, whether your station is or not.

Still confused? Perhaps the rules of the award program will clarify any areas of uncertainty.

As publicized in over 25 individual amateur radio publications throughout the world, the COMPU-WARD is sponsored by Micro-80 Incorporated (all employees are licensed amateurs). COMPU-WARD is available *free* to all licensed amateurs and shortwave listeners thoughout the world. Emphasis of this award is focused on the advancement of both the amateur radio and computer hobbies through demonstrated excellence in the art of computerized communications.

Stations applying for the COMPU-WARD *may* or *may not have* a computerized station of his or her own; however, it must be emphasized that all stations contacted *must* be computerized! The *contacted station* must have his transmitter interfaced with a computer such as a TRS-80, Apple, Pet, Heathkit, Atari, etc.

You might ask how to know if the stations are computerized or not. The first answer is obvious—ask! More routinely, however, you will be able to easily identify a computerized transmission. The CW sent will be absolutely flawless—perfect weighting of the characters and everything. The only thing that may throw you will be memory keyers. Most generally a station will mention the fact that he or she is computerized when he tells you the equipment he is using. On RTTY, the copy will be just like a newspaper column, most of the time with justified margins and lines.

To be valid, all contacts must be made on or after January 1, 1980. Two awards are being offered *free*: (1) HF Bands—29.7 MHz and below; (2) VHF/UHF—50.0 MHz and above.

All contacts must be made on one or any combination of the following modes (including any modes authorized by the FCC since the release of this announcement): RTTY, CW, SSTV, and ASCII. Crossmode communications will not be recognized for this award program.

Single-band and mixed-band endorsements will be given in each band segment (HF, VHF, UHF, etc.). Cross-band operation will only be accepted for OSCAR contacts. OSCAR contacts will be recognized as a VHF/UHF accomplishment even though some downlink signals are heard on 10 meters. Contacts through repeaters are also acceptable.

To qualify for either COMPU-WARD: Applicants *with* a computerized station of his or her own must contact a minimum of 15 other computerized stations; applicants *without* a computerized station of his or her own must contact a minimum of 25 computerized stations.

To apply for COMPU-WARD, prepare a list of contacts in prefix order. List each call worked, mode utilized, frequency or band of operation, and state whether you do or do not have a computer which you used to make these contacts. *Do not send QSL cards!* Have your list of contacts verified by a local amateur or radio club official.

Forward your list of contacts along with a large self-addressed stamped envelope (3½" × 9") to the following address. Foreign stations must provide 2 IRCs to substitute the need for a stamp for overseas mailing: COMPU-WARD Program, 2665 North Busby Road, Oak Harbor WA 98277.

QRP AMATEUR RADIO CLUB INTERNATIONAL, INC.: A HISTORY AND ITS AWARDS PROGRAM

QRP Amateur Radio Club International, Inc., was founded in 1961 by K6JSS as an organization for the growing segment of amateurs which enjoys the challenge of running low power.

The club's principle of helping reduce interference on crowded bands is reflected in its motto: Power is no substitute for skill. QRP ARCI's power limits are 50 Watts output on CW and 100 Watts PEP output on sideband, although its officially recognized definition of low-power operation is the internationally used five Watts output on CW and ten Watts output PEP on sideband. The club does not advocate the reduction of power limits authorized by any nation, however.

QRP ARCI has a comprehensive awards program, holds informal monthly QSO parties the first Sunday, sponsors two formal QSO parties (one in the spring and one each fall), sponsors weekly national and regional phone and CW nets, joins with other QRP groups in activities, and publishes *QRP Quarterly*, a newsletter rich in technical articles and news of QRP-related events and activities.

73 MAGAZINE AWARDS PROGRAM

Ten-Meter DX Decade Award

9 WB8LSV 10 WB9WFZ 11 W8AKS/6

DX Capitals of the World

12 WA2SRM 14 DF7QD 16 OE8MOK
13 WA2YEX 15 VK6YL 17 8P6OV

Specialty Communications DX Award

1 W2ODA (RTTY)
2 WB0QCD (SSTV)
3 WB7BFK (RTTY)
4 WB0QCD (RTTY)
5 WD9GRI (RTTY)
6 WB6CDM (RTTY)
7 N3AKO (RTTY)
8 DU1EFZ (RTTY)

District Endurance Award (Times in Minutes)

1 AJ8L (50)
2 WL7ACY (55)
3 WB6CDM/7 (12)
4 WA3PMI/7 (36)
5 WA4ZLZ (54)
6 GI4KCE (8.3)
7 WA2MCE (54)

Additional information on the extensive awards program can be had by sending a large SASE to: Doug Crittendon WB1ESN, 33 Taylor Street, Pittsfield MA 01201.

Full information on club membership, which is available to domestic and foreign amateurs at a moderate, one-time initiation fee and an even more reasonable annual renewal thereafter, can be had by sending an SASE to the secretary-treasurer, Edwin R. Lappi WD4LOO, 203 Lynn Drive, Carrboro NC 27510.

Traditional QRP frequencies are: CW—1810, 3560, 7040, 14060, 21060, 28060, 50360; phone—1810, 3985, 7285, 14385, 21385, 28885, 50385; Novice—3710, 7110, 21110, 28110.

QRP Amateur Radio Club International officers as of April 15, 1981, were as follows: Thomas W. Davis K8IF, President, 11729 Merriman Road, Livonia MI 48150; Robert L. Jenks K7ZVA, Vice President, 11714 Masonic Road, Tacoma WA 98498; Edwin R. Lappi WD4LOO, Secretary-Treasurer, 203 Lynn Drive, Carrboro NC 27510; Frederick W. Bonavita W5QJM, Publicity, Box 12072, Capital Station, Austin TX 78711; William Dickerson WA2JOC, Contest Chair, 352 Crampton Drive, Monroe MI 48161; Doug Crittenden WB1ESN, Awards Chair, 33 Taylor Street, Pittsfield MA 01201; Peter N. Spotts N1ABS, Editor, *QRP Quarterly*, 140 Warren Street, Needham MA 02192; Richard A. Crowell W4WQW, Legal Officer, 803 Oak Plaza Road, Kingston TN 37763.

QRP Amateur Radio Club International has revamped its awards program to reflect internationally recognized low-power levels and has named a new awards manager and secretary-treasurer.

"We are going to can all 100-Watt awards," said Thom Davis K8IF, president of the club which celebrates its 20th anniversary this year.

With one exception, QRP ARCI's board of directors has approved changes effective June 1, 1981, requiring awards to be based on a power *output* of not more than five Watts CW or ten Watts PEP on sideband. The organization previously offered awards with an optional power limit of up to 100 Watts input for CW or 200 Watts PEP for sideband.

The restructuring is in keeping with the club's main objective of showing how the use of limited power permits maximum enjoyment of amateur radio, minimizes interference on crowded bands, and offers operators a genuine challenge. As QRP ARCI's motto says: "Power is no substitute for skill."

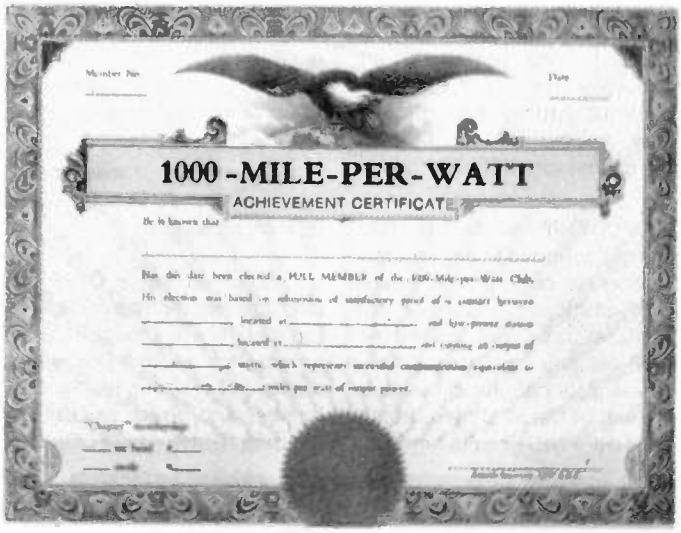
Leading QRP ARCI's awards is the popular KW/M Award, or the thousand-miles-per-Watt certificate, as it is known. It is available to any amateur transmitting from or receiving the signals of a low-power station such that the Great Circle distance between the two ends, when divided by the power output, equals or exceeds 1,000 miles per Watt. Additional certificates may be earned on different bands and with different modes.

DXCC-QRP, as its name implies, is awarded to any amateur station for confirmed contacts with stations in 100 of the ARRL's approved countries. QRP-WAS is available to any amateur for confirmed contacts in each of the 50 United States, and QRP-WAC goes to any amateur for confirmed contacts with a station in each of the six continents.

For each of the above awards, the following rules apply:

1) Power *output* may not exceed five Watts CW or ten Watts PEP on sideband.

2) Since members' QRP numbers are not made available by the club, it will accept as proof for any club award a QSO with a club member giving his/her QRP number and power level in the log data. Otherwise, a QSL card



is needed for confirmation. Copies of cards or a General Certificate Rule list are acceptable.

3) Special endorsement seals are available on awards for which power output on both ends of the contact was within the QRP limits set forth in #1 above.

4) An all-one-band or -mode (AOBM) endorsement also is available on request and if supported by log data, QSLs, or GCR list.

5) All awards are endorsed for power used and whether "one-way" or "two-way."

6) Under the General Certificate Rule, award sponsors will accept as proof of confirmed contacts and that claimed QSLs are on hand if the list is (a) signed by a radio club official, (b) signed by two amateur radio operators of General class or higher, or (c) signed by the applicant with his/her signature notarized and attesting that the QSLs are as claimed. If QSLs are sent as proof and are to be returned, they must be accompanied by sufficient postage.

The only club award to be "grandfathered" in during the restructuring of the program is the QRP-25 Award. It is issued to any amateur who works 25 QRP ARCI members, and endorsements are available for 50, 100, 200, and so on in multiples of 100. Associate members must have been running 50 Watts output or less on CW (or 100 Watts PEP on SSB) to qualify.

To apply for any of the club's awards, send copies of log data, QSLs, or a GCR list plus power and mode used by all stations together with two dollars or ten IRCs to the new awards chairman: Doug Crittenden WB1ESN, 33 Taylor Street, Pittsfield MA 01201.

QRP ARCI's secretary-treasurer, who has additional information on membership, is Edwin R. Lappi WD4LOO, 203 Lynn Drive, Carrboro NC 27510.

For additional information, the club's public relations officer is: Fred Bonavita W5QJM, PO Box 12072, Capital Station, Austin TX 78711.

LAKE SHORE ARA AWARDS

The Lake Shore Amateur Radio Association has informed us of two very unique awards being made available through their organization. Let's look at both the Lake Erie and the Pennsylvania series awards respectively.

The Lake Erie Award

This award is issued for working counties bordering the shores of Lake Erie. There are thirteen (13) counties involved in the four (4) states of New York, Pennsylvania, Ohio, and Michigan. They are Monroe and Wayne counties in Michigan, Chautauqua and Erie counties in New York, Erie county in Pennsylvania, and Ashtabula, Lake, Cuyahoga, Lorian, Erie, Sandusky, Ottawa, and Lucas counties in the state of Ohio.

Amateurs in either of the above four states must work all four states and 10 of the 13 counties to be eligible for this award. The rest of the US, and including those stations within Canada, must work 6 of the 13 counties in only 3 of the 4 represented states.

There is no starting time nor are there any endorsements for this awards program. SWL stations may also apply for this award on a heard basis.

Send no QSL cards; merely have your list of contacts verified by at least a couple amateurs and forward it with an awards fee of $1.00 in US funds or 5 IRCs. Mail your application to: David Maynard WA3EZN, 304 Barker Street, Girard PA 16417.

The Pennsylvania Award Series

The Pennsylvania Award is a series of five awards being offered by the Lake Shore Amateur Radio Association:

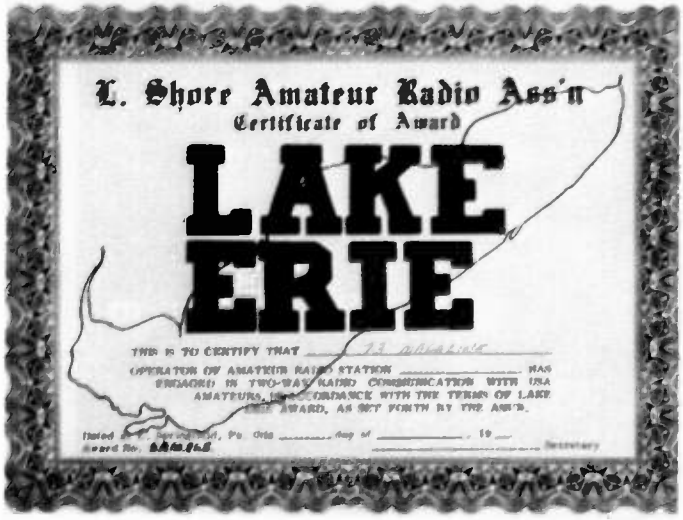
The Pennsylvania Cities Award is issued for working 10 cities in Pennsylvania. Of course the cities must be those which are the largest: Philadelphia, Pittsburgh, Erie, Scranton, Allentown, Reading, Harrisburg, Bethlehem, Altoona, and Chester. DX stations need only work 8 of the cities and may substitute Wilkes-Barre, Lancaster, York, and Johnstown.

The VHF Award requires six (6) contacts with any Pennsylvania station on six meters and above. Pennsylvania stations must work 25 stations in 15 counties. The rest of the US and Canada must work 20 stations in 10 counties, while DX stations must work at least 10 stations in 5 counties.

The Novice Award requires amateurs of the state to work a minimum of 25 other Novices in 15 counties; the balance of the US and Canada must work 20 Novices in 10 counties and DX stations must work 10 Novices in 15 counties.

The YL Award requires 25 Pennsylvania YLs be worked in 15 counties for those living in Pennsylvania. All others in the US and Canada must work 20 YLs in 10 counties, while all DX stations, including Alaska and Hawaii, must work a minimum of 10 YLs in Pennsylvania in a minimum of 5 Pennsylvania counties.

The Mobile Award requires those amateurs in Pennsylvania to work a minimum of 25 fellow Pennsylvania mobiles in 15 counties. The balance of the US



and Canada must work 20 mobile stations in 10 counties, while DX stations have to work only 10 mobile stations in 5 counties.

There are no endorsements issued for any of the five Pennsylvania series awards. There is no time limit. To qualify for the award, have your list of contacts verified by at least two amateurs and forward it to the awards manager along with an award fee for each award in the amount of $1.00 to defray cost of administering the program. Mail your applications to: David Maynard WA3EZN, 304 Barker Street, Girard PA 16417.

PEARL HARBOR STATION

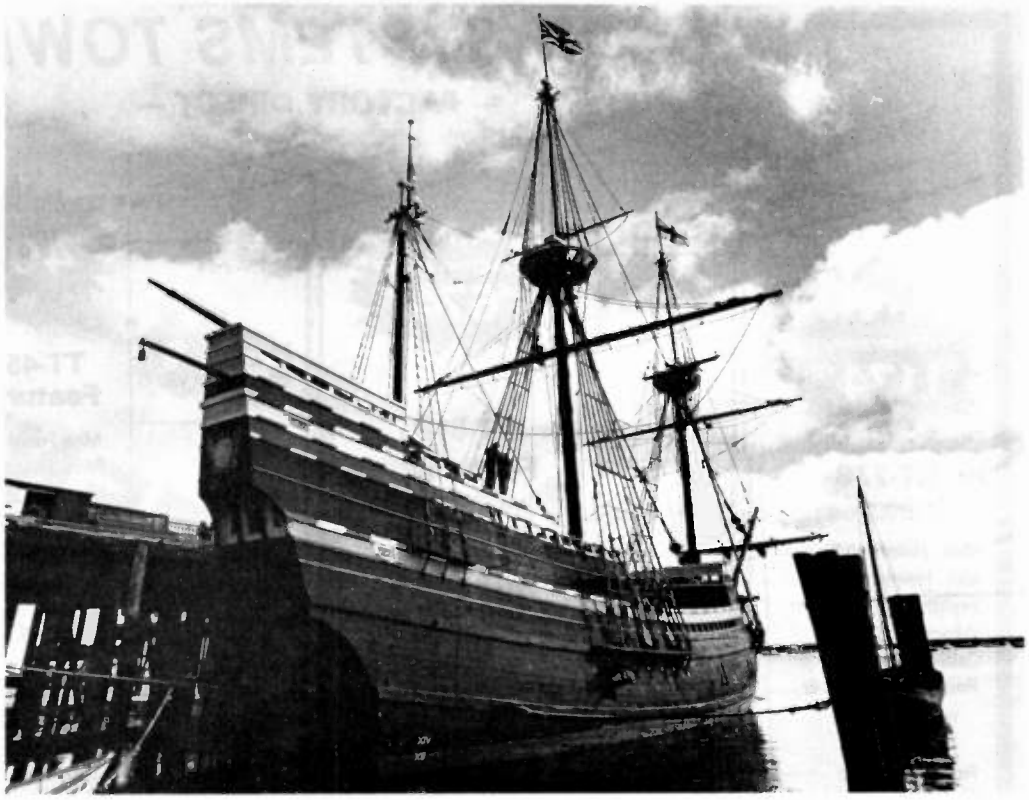
The Pearl Harbor Submarine Base Amateur Radio Station, KH6SP, will operate the weekend of 4 December 1981 in recognition of the fortieth anniversary of the Japanese attack on Pearl Harbor on 7 December 1941. Operation will be on twenty and fifteen meters SSB approximately 20 kHz inside the General phone band and on CW about 40 kHz up from the band edge. A certificate QSL will be provided for amateur contacts and an SWL certificate for SWL reports. QSL to KH6SP or KH6BD, the station custodian.

SPECIAL EVENTS STATION PLANNED AT PLIMOTH PLANTATION, THANKSGIVING DAY

A special events station from Plymouth, Massachusetts (America's Hometown) will be sponsored by the Whitman Amateur Radio Club and Plimoth Plantation on Thanksgiving Day, November 26, 1981.

An attractive certificate suitable for framing will be issued to any (foreign or domestic) amateur who makes contact with this station, which will operate from 9:00 am until 3:00 pm. Depending on weather conditions, members of the Whitman club will operate the station from a dockside location near *Mayflower II* on the Plymouth waterfront, or from an indoor site near the museum's 1627 Pilgrim Village.

Plimoth Plantation is an unusual living history museum which depicts life in 17th century Plimoth Colony. Its sites include the 1627 Pilgrim Village and Wampanoag Summer Settlement, and *Mayflower II*, a replica of the type of ship that brought the Pilgrims to the New World in 1620.The Whitman Amateur Radio Club was established in 1965. Club officers hope the Thanksgiving Day special events station will become a regular part of the community's holiday celebration.



The Mayflower II.

To receive a certificate, send proof of contact and a large (9 x 12) self-addressed stamped envelope or $1.00 to Whitman Amateur Radio Club, Box 48, Whitman MA 02382. Hours for this event will be 1400 to 2000 UTC. Frequencies to be used: 1400 to 1500 UTC, 21.260 (England only); 1500 to 1700 UTC, 7.280 ± QRM; 1700 to 2000 UTC, 21.385 ± QRM.

For additional information, contact Ed Hommel KA1CZS, Whitman Amateur Radio Club, Box 48, Whitman MA 02382 or Rosemary Carrol, Plimoth Plantation, Box 1620, Plymouth MA 02360, (617)-746-1622.

SUBMARINE EXPEDITION

The Choctaw/Muskogee Amateur Radio Clubs are planning an expedition to the submarine *USS Batfish*. Using the callsign W5FX, they will operate on November 13 from 8 to 12 pm and November 14 from 8 am to 4 pm. CW operation will take place 22 kHz above the Extra class band on 80, 40, 20, and 15 meters. Phone frequencies are 3805, 7168, 14230, and 21268 kHz. Send an SASE to Calvin G. Ladd W5FX, 109 E. Myrtle Dr., Midwest City OK 73110, for a QSL card.

RADIO VATICANA AWARD

The Radio Vaticana on the occasion of the 50th anniversary of its foundation issues an award available to licensed amateurs anywhere in the world under the following rules:

Contacts with stations in the Vatican State must be made during the period starting from October 1, 1981 on any amateur band from 315 MHz to 144 MHz and any mode (AM, SSB, CW, RTTY) including cross-band relay and mixed. This period ends on February 1, 1982.

Stations in Europe (including the USSR in the European territory) and the USA (except Alaska and Hawaii) must work (or listen to) at least 2 different stations operating from the Vatican State. At present there are only three licensed stations: HV1CN, HV2VO, and HV3SJ.

Stations outside the above-mentioned countries must work (or hear) at least one HV station.

The applicant must prove the required contact(s) by sending a photocopy of the QSLs received from the HV stations during this period.

The application must be sent before December 31, 1983. This must be addressed with the above-mentioned documents to: Radio Vaticana HV1CN, Citta Del Vaticana, Europa.

WILSON SYSTEMS TOWERS

— FACTORY DIRECT —

FACTORY DIRECT $1174.95

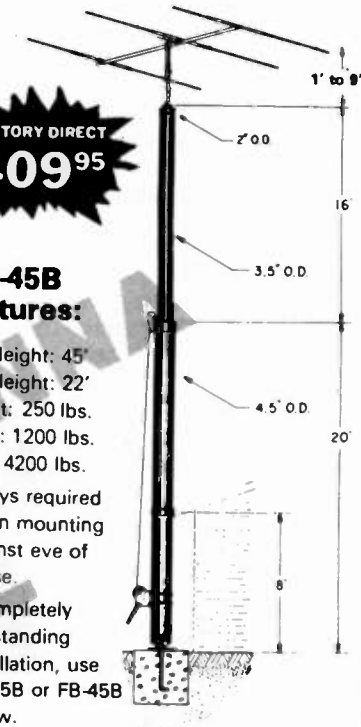
ST-77B Features:

Max. Height: 77'
Min. Height: 24'
Weight: 700 lbs.
Winch: 1500 lbs.
Cable: 6400 lbs.
Requires RB-77B & will be totally freestanding
Recommended Rotor: High Gain Roto-Brake

FACTORY DIRECT $674.95

MT-61B Features:

Max. Height: 61'
Min. Height: 23'
Weight: 450 lbs.
Winch: 1200 lbs.
Cable: 4200 lbs.
No Guys required when mounting against house.
For completely freestanding installation, use RB-61B or FB-61B below.



FACTORY DIRECT $409.95

TT-45B Features:

Max Height: 45'
Min. Height: 22'
Weight: 250 lbs.
Winch: 1200 lbs.
Cable: 4200 lbs.
No Guys required when mounting against eve of house.
For completely freestanding installation, use RB-45B or FB-45B below.

WIND LOADING			
Tower	Height	Sq. Ft.	
ST-77B	69	16	Square Footage Based on 50 MPH Wind
	77	10	
MT-61B	53	18	
	61	12	
TT-45B	37	18	
	45	12	

BASE CHART		
TOWER	WIDTH	DEPTH
TT-45B	12" x 12"	30"
FB-45B	30" x 30"	4½'
RB-45B	30" x 30"	4½'
MT-61B	18" x 18"	4'
FB-61B	3' x 3'	5½'
RB-61B	3' x 3'	5½'
ST-77B	See Below	Bases
RB-77B	3½' x 3½'	6'

Wilson Systems uses a high strength carbon steel tube manufactured especially for Wilson Systems. It is 25% stronger than conventional pipe. The tubing size used is 2" & 3½" -.095; 4½" & 6" -, 8" -.134. All tubing is cold dip galvanized. Top section is 2" O.D. for proper rotor and antenna mounting.

The TT-45B and MT-61B come complete with house bracket and hinged base plate for against-house mounting. For totally freestanding installation, use either of the tilt-over bases shown below.

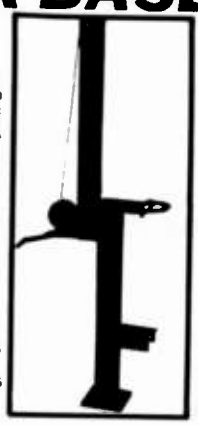
The ST-77B cannot be mounted against the house and must be used with the rotating tilt-over base RB-77B shown below.

TILT-OVER BASES FOR TOWERS

FIXED BASE

The FB Series was designed to provide an economical method of moving the tower away from the house. It will support the tower in a completely free-standing vertical position, while also having the capabilities of tilting the tower over to provide an easy access to the antenna. The rotor mounts at the top of the tower in the conventional manner, and will not rotate the complete tower.

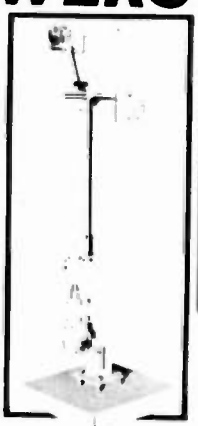
FB-45B.. 112 lbs...$209.95
FB-61B.. 169 lbs...$299.95



ROTATING BASE

The RB Series was designed for the Amateur who wants the added convenience of being able to work on the rotor from the ground position. This series of bases will give that ease plus rotate the complete tower and antenna system by the use of a heavy duty thrust bearing at the base of the tower mounting position, while still being able to tilt the tower over when desiring to make changes on the antenna system.

RB-45B.. 144 lbs...$289.95
RB-61B.. 229 lbs...$379.95
RB-77B.. 300 lbs...$569.95



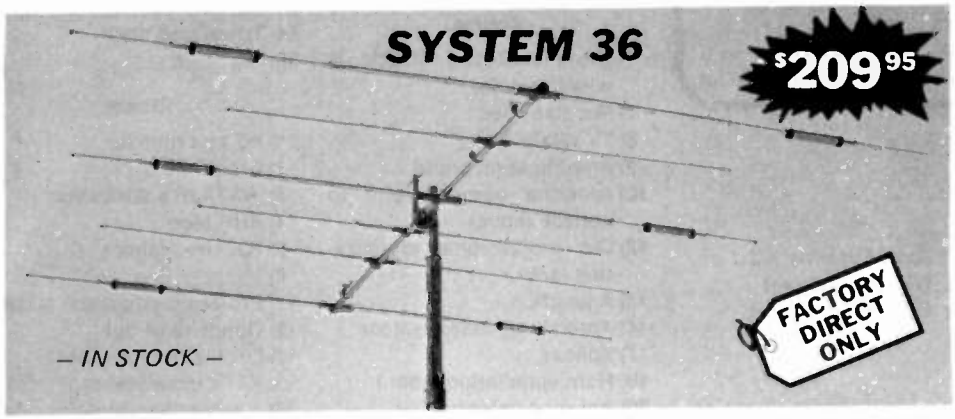
Tilting the tower over is a one-man task with the Wilson bases. (Shown above is the RB-61B. Rotor is not included.)

ORDER FACTORY DIRECT 1-800-634-6898

Prices Effective 9-1-81 thru 9-30-81
Specifications Subject to Change Without Notice

WSI WILSON SYSTEMS, INC.
4286 S. Polaris Ave., Las Vegas, Nevada 89103

WILSON SYSTEMS INC. MULTI-BAND ANTENNAS



A trap loaded antenna that performs like a monobander! That's the characteristic of this six element three band beam. Through the use of wide spacing and interlacing of elements, the following is possible: three active elements on 20, three active elements on 15 and four active elements on 10 meters. No need to run separate coax feed lines for each band, as the bandswitching is automatically made via the High-Q Wilson traps. Designed to handle the maximum legal power, the traps are capped at each end to provide a weather-proof seal against rain and dust. The special High-Q traps are the strongest available in the industry today.

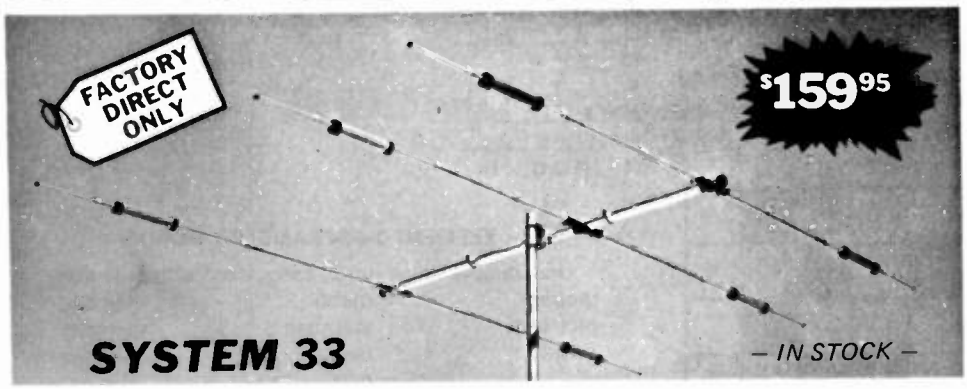
SPECIFICATIONS

Band MHz	14-21-28	Boom (O.D. x Length)	2" x 24' 2½"	Wind Loading @ 80 mph	215 lbs.
Maximum power input	Legal Limit	No. of Elements	6	Maximum wind survival	100 mph
Gain (dBd)	Up to 9 dB	Longest Element	28' 2½"	Feed method	Coaxial Balun (supplied)
VSWR @ resonance	1.3:1	Turning Radius	18'6"		
Impedance	50 ohm	Maximum mast diameter	2"	Assembled weight (approx)	53 lbs.
F/B Ratio	20 dB or better	Surface area	8.6 sq. ft.	Shipping weight (approx)	62 lbs.

NEW! **ADD 40 OR 30 METERS TO YOUR TRI-BAND WITH THE NEW 33-6 MK** **$59.95**

– IN STOCK –

Now you can have the capabilities of 40-meter or 30 meter operation on the System 36 and System 33. Using the same type high quality traps, the new addition will offer 200 HKZ of bandwidth at less than 2:1 SWR. The new 33-6 MK will fit your present SY36 or SY33, and using the same single feed line.



Capable of handling the Legal Limit, the "SYSTEM 33" is the finest compact tri-bander available to the amateur. Designed and produced by one of the world's largest antenna manufacturers, the traditional quality of workmanship and materials excells with the "SYSTEM 33". New boom-to-element mount consists of two 1/8" thick formed aluminum plates that will provide more clamping and holding strength to prevent element misalignment. Superior clamping power is obtained with the use of a rugged 1/4" thick aluminum plate for boom to mast mounting. The use of large diameter High-Q traps in the "SYSTEM 33" makes it a high performing tri-bander and at a very economical price. A complete step-by-step illustrated instruction manual guides you to easy assembly and the lightweight antenna makes installation of the "SYSTEM 33" quick and simple.

SPECIFICATIONS

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

WILSON SYSTEMS, INC.

4286 S. Polaris Ave., Las Vegas, Nevada 89103

Prices and specifications subject to change without notice

ORDER FACTORY DIRECT 1-800-634-6898

$59.95

WV-1A

4 BAND TRAP VERTICAL (10 - 40 METERS)

No bandswitching necessary with this vertical. An excellent low cost DX antenna with an electrical quarter wavelength on each band and low angle radiation. Advanced design provides low SWR and exceptionally flat response across the full width of each band.

Featured is the Wilson large diameter High-Q traps which will maintain resonant points with varying temperatures and humidity.

Easily assembled, the WV-1A is supplied with a hot dipped galvanized base mount bracket to attach to vent pipe or to a mast driven in the ground.

Note:
Radials are required for peak operation.
(See GR-1 below)

SPECIFICATIONS

- 19' total height
- Self supporting – no guys required
- Weight – 14 lbs.
- Input impedance: 50 Ω
- Powerhandling capability: Legal Limit
- Two High-Q traps with large diameter coils
- Low angle radiation
- Omnidirectional performance
- Taper swaged aluminum tubing
- Automatic bandswitching
- Mast bracket furnished
- SWR: 1.1:1 or less on all bands

GR-1

$14.95

The GR-1 is the complete ground radial kit for the WV-1A. It consists of: 150' of 7/14 stranded aluminum wire and heavy duty egg insulators, instructions. The GR-1 will increase the efficiency of the GR-1 by providing the correct counterpoise.

FUN!

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

ANTENNAS

Antennas have always been a sore spot with me. I mean, you probably think that someone who writes a monthly column for *73* has some sort of fancy array on 10, 15, and 20, and nothing less than full rhombics for 40 and 80. Not quite.

My DX antenna is a TA-33 Jr. with a reflector element that refuses to remain horizontal. I should fix it, but three families (two of the bird variety, one spider) would suddenly be rendered nestless. Foreclosing on somebody's home is not my forte.

My 40-80 meter antenna system is even funnier. Actually, it's a system in the truest sense of the word. You see, it starts in the front of my attic, runs through the house to the back attic window, across my backyard where it swings around an abandoned telephone pole, traverses the backyard once again, and terminates along the eaves of my fair abode. On the air, I call it a "doublet," since the lead-in joins this contrivance somewhere near the middle of its journey, but "unusual" may be a more apt description. As far as the radiation pattern goes, let's just say that on a good day I can actually hear stations on eastern Long Island. Once, I even got a 57 from a guy in Hicksville.

From time to time, whenever I say or write something a particular person finds objectionable, he'll threaten to "pin" my coax. "Fine business," I say, "A dead short may just improve my signal." Faced with this unexpected reaction, I'm usually left unmolested.

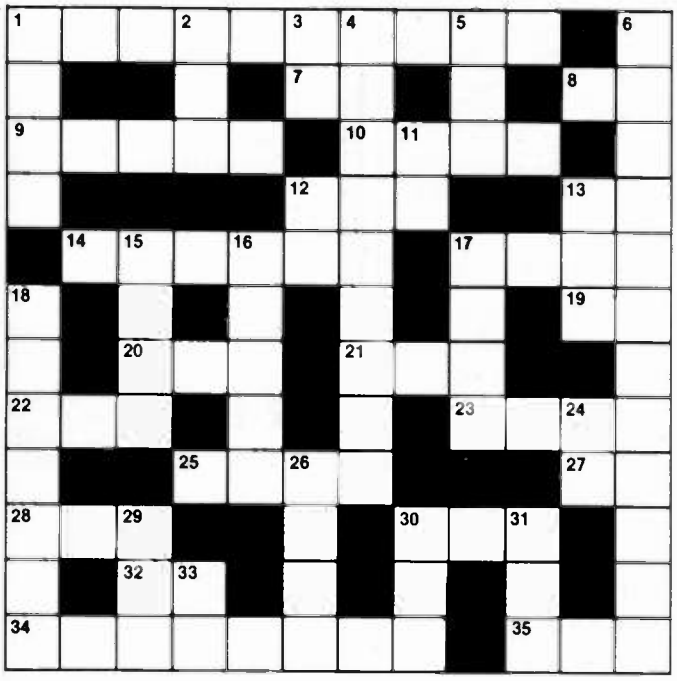


Illustration 1.

ELEMENT 1—CROSSWORD PUZZLE
(Illustration 1)

Across

1) Often confused with long-wire (2 words)
7) Russian "yes"
8) TV villain
9) Amplification plural
10) Antenna perpendicular to horizon (abbr.)
12) Old professional organization (abbr.)
13) A junction
14) Antenna cylinder system
17) Splices
19) Ham appellation (abbr.)
20) Antenna deterioration
21) Morse question mark
22) Dah's partner
23) Signal attenuation along feedline
25) Movable switch part
27) America (abbr.)
28) Some regard antennas as a work of this
30) 540-1600 kHz (abbr.)
32) 14 across measurement
34) Tower and mast
35) Big _____

Down

1) HT and mobile
2) Great noise
3) WA3AJR's sheepskin
4) SHF feed
5) Received (abbr.)
6) _____ line
11) Professional person (abbr.)
12) Opposite of out
13) Oscillator type (abbr.)
15) RTTY circuit (abbr.)
16) A preliminary treatise (abbr.)
17) Many mobile whips use a loading one
18) Antenna spokes
24) Egypt prefix
26) A ham's den
29) 160 meters: _____ band
30) Connection point
31) 80-meter rhombic, for instance
33) Differential of power (abbr.)

ELEMENT 2—ALPHABET GAME

Complete the nine words below by placing letters of the alphabet on every dash. Use each letter only once. The letter "K" is not used.

A B C D E F G H I J K L M
N O P Q R S T U V W X Y Z

1) _ A _ E _
2) _ P _ L E
3) A _ R A _
4) _ U A _
5) _ A _ _ N
6) _ E _ P
7) _ _ T C _
8) H E L _ _
9) R E _ L _ _ _ O R
10) _ R O U _ D

ELEMENT 3—SCRAMBLED WORDS

Unscramble these words associated with antennas.

dictroer
pictrosoi
rotwe
moob
loarabap
bleca
gaiy
nidmow
gainpsc
zolatipanori

ELEMENT 4—MATCHING

Match the definition to the antenna.

Column A

1) Voltage-fed Hertz antenna using a two-wire tuned feeder attached to one end of the radiator.
2) Directional antenna made up of several parallel tubes or wires. One element is a driven radiator, another a parasitic reflector, and the remaining element(s) are parasitic directors.
3) Omnidirectional antenna consisting of a metal disk attached to a metal cone.
4) Diamond-shaped, non-resonant antenna with directional characteristics. Uses a non-inductive resistor at its far end.

5) Center-fed single wire that's one-half the operating wavelength.
6) An elongated cone-like antenna, composed of parallel elements attached to cylindrical supports, center-fed.
7) Broad-spectrum antenna with element spacing and lengths that increase logarithmically from one antenna end to the other.
8) Large number of vertical radiators fixed in a plane.
9) A number of connected parallel wires arranged around a circular spreader.
10) Antenna composed of a coil wound around an element.

Column B

A) Discone
B) Sausage
C) Log indent
D) Zepp
E) Cage
F) Ferrite rod
G) Yagi or beam
H) Beverage
I) Curtain
J) Log periodic
K) Dipole

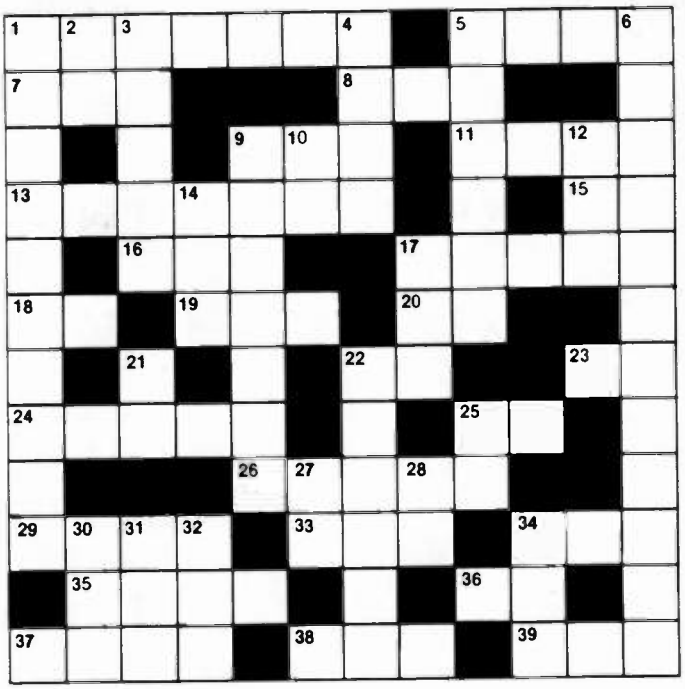


Illustration 2.

ELEMENT 5—CRYPTIC CROSSWORD
(Illustration 2)

Think our usual monthly crossword is too easy? Try this one on for size. We call it a cryptic crossword because of the clues we give you: very vague, extremely ambiguous. Think you can handle it? Well, you better have a superb background in antennas, ham radio, electronics, and life.

Across

1) 3-D antenna
2) Slashing skyhook
3) Angry old society (abbr.)
8) Alphabet: 15, 14, and 9
9) OSCAR farewell (abbr.)
11) Zilch
13) Join
15) UA assent
16) TA-33's junior
17) Antenna soar
18) Extended λ
19) Don Ameche's unit
20) Metal-oxide, reverse (abbr.)
22) SW-BC system (abbr.)
23) Barry's locale (abbr.)
24) Detection and ranging
25) Bangkok beginning
26) Pardon
29) Antenna inventor
33) Struck
34) Lotsa (abbr.)
35) The DX hunt
36) Burning trap description
37) Straight up skyhook
38) Fundamental beam substance (abbr.)
39) Here

Down

1) Radius vector-ly
2) Relating to U on CW
3) Antenna glows
4) Fail
5) Off-center antenna
6) Line direction
9) Shoes
10) Antenna position to tower
12) Hello? Hello? (abbr.)
14) Up and down baker
17) Hiram (abbr.)
21) Mast girth (abbr.)
22) Topic synonym
25) Before brid
27) Finnish exclamation
28) Wireless speech (abbr.)
30) Golden
31) Air-to-air missile (abbr.)
32) Alphabet: 10 minus 1, 13, and 13 plus 7
34) Top skip

Continued

Illustration 1A.

Illustration 2A.

THE ANSWERS

Element 1:
See Illustration 1A.

Element 2:
1—WAVES, 2—JPOLE, 3—ARRAY, 4—QUAD, 5—BALUN, 6—ZEPP, 7—MATCH, 8—HELIX, 9—REFLECTOR, 10—GROUND.

Element 3:
(Reading from left to right) director, boom, windom; isotropic, parabola, spacing; tower, cable, polarization; yagi.

Element 4:
1—D, 2—G, 3—A, 4—H, 5—K, 6—E, 7—J, 8—I, 9—B, 10—F

Element 5:
See Illustration 2A.

SCORING

Element 1:
Twenty points for the completed puzzle, or ½ point for each question correctly answered.

Element 2:
Two points for each word.

Element 3:
Two points for each word unscrambled.

Element 4:
Two points for each definition matched to the correct antenna.

Element 5:
Twenty points for the completed puzzle, or ½ point for each question correctly answered.

Do you know beams from beans?

1-20 points—You'll use a random wire 'til the day you die.
21-40 points—You actually believe that mini-beams get out as good as a monobander.
41-60 points—You'll always be safe and comfortable with your vertical.
61-80 points—You have a 40-foot tower with a tribander.
81-100+ points—"Antenna Farmer."

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

IPA CONTEST

Contest periods are:
0000 to 0300, 0700 to 1000, and 1400 to 1800 GMT on both days, November 7 and 8

The International Police Association Radio Club (IPARC) United States Section is sponsoring this year's contest. Participants are eligible to work the Sherlock Holmes Award (SHA) and the contest is open to all radio amateurs and SWLs. Use all bands on CW and SSB. No crossband or crossmode contacts are permitted. For a contact to be valid, one of the two stations must be an IPARC member. Each station can only be worked once per band.

EXCHANGE:

Non-members send RS(T) and serial number. IPA members send "IPA," two-letter state abbreviation, RS(T), and serial number. US stations will also send two-letter state abbreviation.

FREQUENCIES:

CW—3575, 7025, 14075, 21075, 28075.

SSB—3650, 3775-3800 (European DX), 7075, 14295, 21295, 28650.

SCORING:

Every completed QSO counts 2 points on 80 and 40 meters, 8 points if DX on 80 or 40 meters, and 4 points for all contacts on 20/15/10 meters. The multiplier is the total number of IPA countries and states worked per band.

For IPA members only, an IPA country and each US IPA state will be counted for multiplier and QSO only if an IPA station in that country/state has been worked. QSOs with DXCC countries or US states which are not

listed in the IPARC membership list count only 1 point and do not count as a multiplier.

ENTRIES AND AWARDS:

Each IPA member, non-member, and SWL with the highest score will receive a certificate and will be honored in the Award Chronicle of the International Poice Association Radio Club. Entries must be postmarked no later than December 31st and sent to: IPARC, Thomas D. Jenkins WA8VDC, 3327 Cloverdale W.B., Monroe MI 48161 USA.

Copies of the SHA rules, IPARC World Membership List, SHA application sheets, or contest log sheets are also available if you send an SASE to the above address.

ANTIGUA & BARBUDA INDEPENDENCE QSO PARTY

Starts: 0000 GMT November 7
Ends: 2400 GMT November 8

The members of the Antigua Amateur Radio Society are planning a QSL Party to mark Antigua and Barbuda's independence. All amateurs are invited to participate. For an attractive certificate, work four Antigua stations on any band and in any mode during the weekend. Then submit a copy of your log showing the callsign, signal report, time of contact, and band. Include a self-addressed envelope and $1.00 US to cover postage of certificate. The new operating prefix will be V2A.

FREQUENCIES:

SSB—1825, 3790-3840, 7165-7250, 14180-14300, 21150-21300, 28500-28700, 29600 FM.

CW—30 kHz above the bottom of each band.

Send all applications to: Independence QSL Party, Box 550, St. John's, Antigua, WI.

INTERNATIONAL OK DX CONTEST

Starts: 0000 GMT November 8
Ends: 2400 GMT November 8

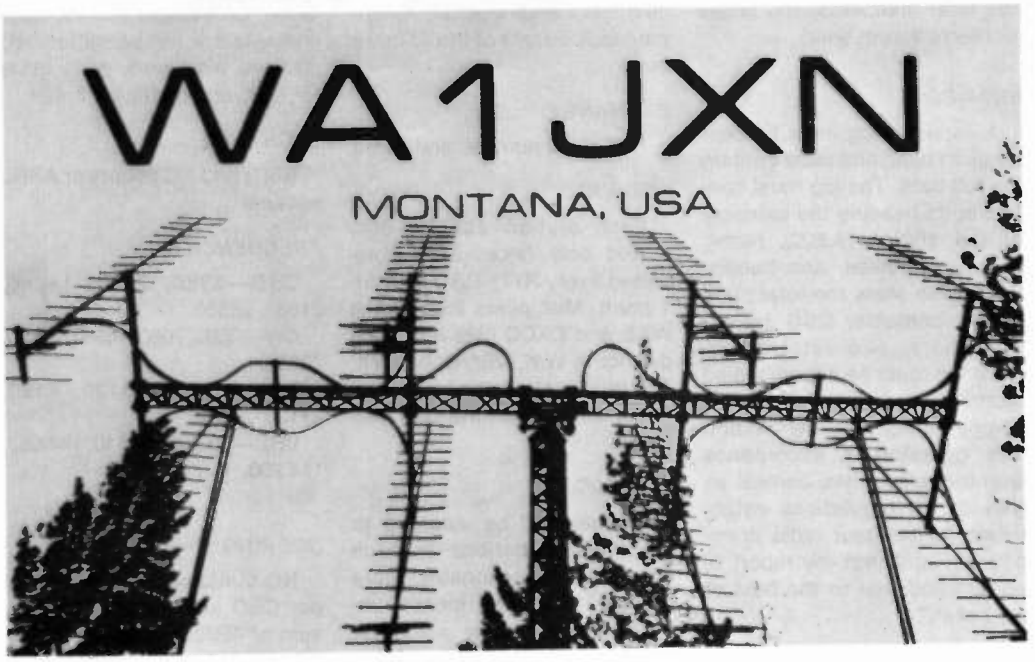
Participating stations work stations of other countries according to the official DXCC country list. Contacts between stations of the same country count only for multipliers, but have no QSO point value. Each station may be worked once on each band. Use all bands, 160 through 10 meters, on phone or CW. Crossband or crossmode contacts are not valid. Operating categories include: A—single operator, all bands; B—single operator, one band; C—multi-operator, all bands. Any station operated by a single person obtaining assistance, such as in keeping the log, monitoring other bands, tuning the transmitter, etc., is considered as a multi-operator station. Club stations may work in category C (multi-op) only.

EXCHANGE:

RS(T) and 2-digit number indicating the ITU zone. Please note the ITU zones are quite different from the ARRL zones! For a list and map of the ITU zones, send 2 IRCs to the entry address listed below.

SCORING:

Each QSO counts one point, or 3 points if with an OK station. Final score is QSO points times



WA1JXN Confirms QSO with.....
at: ..... GMT on..... 19.....
Freq: ..... Mhz. Sigs: .....
Mode: CW ☐ SSB ☐ AM ☐ FM ☐
Propagation: E.M.E. ☐ Iono Scatter ☐
Tropo ☐ E Skip ☐ Aurora ☐
Meteor Scatter ☐ ..... ☐
Preamp / Converter:
Receiver: Drake R4-B ☐ ..... ☐
Transmitter: Heath SB-100 ☐ ..... ☐
SB-500 with 4CX250 final ☐
Amplifier: ..... Watts
Antenna: 8-19 element Cushcraft Boomers fed with 1⅝" gas heliax and phased with ¾" 75 ohm CATV hardline ☐ ..... ☐
☐ PSE QSL TNX ☐ Lat: 47° 2' 54" N.
Long: 114° 15' 20" W.

Lance Collister **Tel: (406) 626-5728**
P. O. Box 243
Frenchtown, Montana
USA 59834

POST CARD

PLACE STAMP HERE

QSL OF THE MONTH: WA1JXN

This distinctive QSL card reflects WA1JXN's enthusiasm for two meters. There are eight 19-element Cushcraft Boomers fed with gas-filled heliax line. Here is how Lance got this dramatic shot: "I shot a photo of my 2-meter antenna at night with floodlights, using high-speed film. After printing it on high-contrast paper (#6), the image was reversed to make it look positive (again on high contrast paper). The result was a ready-for-printing piece of artwork.

Note the detailed information about VHF propagation modes.

If you would like to enter the contest, put your QSL *in an envelope* and mail it along with your choice of a book from *73*'s Radio Bookshop to *73 Magazine*, Pine Street, Peterborough NH 03458, Attention: QSL of the Month. Entries which do not use an envelope (the Postal Service does *occasionally* damage cards) and do not specify book choice will not be considered. Sorry.

the total number of ITU zones worked on each band.

ENTRIES:

A separate log must be kept for each band and must contain the full data. The log must contain in its heading the category of the station (A,B,C), name, callsign, address, and band(s) used. Also show the total number of contacts, QSO points, multipliers, and total score. Each log must be accompanied by the following declaration: "I hereby state that my station was operated in accordance with the rules of the contest as well as all regulations established for amateur radio in my country, and that my report is correct and true to the best of my belief."

A certificate will be awarded to the top-scoring operators in each country and each category. The "100 OK" Award may be issued to stations for contacts with 100 OK stations, and "S 6 S" Awards or endorsements for individual bands may be issued to a station for contacts with all continents. Both awards will be issued upon a written application in the log and no QSLs are required. Logs must be postmarked no later than December 31st and sent to: The Central Radio Club, PO Box 69, 113 27 Praha 1, Czechoslovakia.

DARC CORONA 10-METER RTTY CONTEST

Contest Period:
1100 to 1700 GMT November 8

This is the last of four tests during the year that were sponsored by the DARC eV to promote RTTY activity on the 10-meter band. Use the recommended portions of the 10-meter band.

EXCHANGE:

RST, QSO number, and name.

SCORING:

Each station can be contacted only once. Each completed 2-way RTTY QSO is worth 1 point. Multipliers include the WAE and DXCC lists and each district in W/K, VE/VO, and VK. The final score is the total number of QSOs times the total multiplier.

AWARDS:

Plaques will be awarded to the leading stations in each class with a reasonable score present. Operating classes include: Class A for single or multi-op, and Class B for SWLs.

ENTRIES:

Logs must contain name, call, and full address of participant. Also show class, times in GMT, exchange, and final score. SWLs apply the rules accordingly. Logs must be received within 30 days after the test. Send all entries to: Klaus K. Zielski DF7FB, PO Box 1147, D-6455 Erlensee, West Germany.

NORTH CAROLINA QSO PARTY

1700 GMT November 14 to 0200 GMT November 15
1200 GMT November 15 to 0100 GMT November 16

This year's party is again sponsored by the Alamance ARC and has been expanded to include new categories and awards. The same station can be worked on each band and mode. Crossband and repeater contacts are not permitted. NC stations may work each other for QSO and multiplier credit.

EXCHANGE:

RS(T) and NC county or ARRL section.

FREQUENCIES:

SSB—3980, 7280, 14280, 21380, 28580.

CW—3560, 7060, 14060, 21060, 28060.

Novice/Tech—3720, 7120, 21120, 28120.

VHF—50.050, 50.110, 144.050, 144.200.

SCORING:

NC stations count one point per QSO and multiply total by sum of ARRL sections (73 maximum) and NC counties (100 maximum) worked. DX contacts count only for QSO points.

Others count 2 points per NC contact and multiply total by number of NC counties worked (100 maximum).

AWARDS:

1982 US *Callbook* and certificate to overall top NC and out-of-state single-operator scorer. Certificates to top scorer in CW, SSB, mobile, VHF, and Novice/Technician categories in each ARRL section and NC county. Name of top Alamance ARC member added to perpetual trophy.

ENTRIES:

Send logs and summary sheets showing essential details and certification. Include two 18-cent stamps for results. Mailing deadline is December 12th; send to: Bob Wang KQ4M, PO Box 777, Hillsborough NC 27278.

EUROPEAN DX CONTEST—RTTY

Starts: 0000 GMT November 14
Ends: 2400 GMT November 15

Sponsored by the Deutscher Amateur Radio Club (DARC). Only 36 hours of operations out of the 48-hour period are permitted for single-operator stations. The 12 hours of non-operation may be taken in one but not more than three periods at any time during the contest. Operating classes include: single-operator, all band and multi-operator, single transmitter. Multi-operator, single-transmitter stations are only allowed to change band one time within a 15-minute period, except for making a new multiplier. Use all amateur bands from 3.5 through 28 MHz. A contest QSO can be established between all continents and also one's own continent. However, QSOs and QTC traffic with one's own country is not allowed! Each station can be worked only once per band.

EXCHANGE:

Exchange the usual six-digit number consisting of RST and progressive QSO number starting with 001.

SCORING:

Each QSO counts 1 point. Each QTC (given or received) counts 1 point. Multipliers will be counted according to the European and ARRL countries list. The multiplier on 3.5 MHz may be multiplied by 4, on 7 MHz by 3, and on 14 through 28 MHz by 2. However, contacts within the same continent only count as a multiplier of one per band (including 80 and 40 meters). The final score is the total QSO points plus QTC points multiplied by the sum total multipliers.

QTC TRAFFIC:

Additional point credit can be realized by making use of the QTC traffic feature. A QTC is a report of a confirmed QSO that has taken place earlier in the contest and later sent back to another station. The general idea is that after a number of stations have been worked, a list of these stations can be reported back during a QSO with another station. An additional 1 point credit can be claimed for each station reported.

A QTC contains the time, call, and QSO number of the station being reported, i.e., 1300/DA1AA/134. This means that at 1300 GMT you worked DA1AA and received number 134. A QSO can be reported only once and not back to the originating station. A maximum of 10 QTCs to a station is permitted. You may work the same station several times to complete this quota, but only the original contact has QSO point value. Keep a uniform list of QTCs sent. QTC 3/7 in-

CALENDAR

Nov 7-8	Antigua & Barbuda Independence QSL Party
Nov 7-8	IPA Contest
Nov 8	DARC Corona—10-Meter RTTY
Nov 8	OK DX Contest
Nov 14-15	European DX Contest—RTTY
Nov 14-16	North Carolina QSO Party
Nov 28-29	CQ Worldwide DX Contest—CW
Dec 26-31	G-QRP-Club Winter Sports
Jan 2-4	Zero District QSO Party
Jan 9	73's 40-Meter Phone Contest
Jan 10	73's 80-Meter Phone Contest
Jan 16-17	73's International 160-Meter Phone Contest
Jan 16-17	International SSTV Contest

NEWSLETTER CONTEST WINNER

The winner for the fourth month of *73 Magazine*'s Club Newsletter Contest is *Squelch Tale*, published by the Chicago FM Club. The judges were impressed by both the informational content and the newsletter's eyecatching appearance. Once a publication's staff has gathered all the club news, technical articles, and advertising, their job has only begun. Creating an appealing look is one way to encourage readers to look at each and every page of the newsletter. Even if your club has a shoestring budget, there are several inexpensive, simple ways to gain that professional look.

The simplest method of generating the first draft for a newsletter is on a typewriter. Obviously, an electric machine with a good ribbon will generate nicer copy than an inexpensive manual typewriter. You can go an extra step and "word process" the contents of your next newsletter. A word processor is a computer-based system that allows a user to organize, edit, and print out the copy in exactly the form you want. Corrections don't require messy correction fluid; you just backspace and retype the correct version. As a bonus, most word-processing systems will allow you to right justify the printout. This means that both the left and right sides of a column will line up, just like the text in this magazine. Word processors are becoming common fixtures in many offices. Perhaps a club member with a microcomputer can help you out. The club should supply its own paper and spring for a new ribbon now and then.

If your club won Field Day, you would want to tell the world—somehow typewriter-sized print wouldn't do the job very well. Headlines that have a bold, yet pleasing appearance can be made from dry transfer lettering. Art supply and stationery stores usually have several sizes and styles to choose from. Each headline and article can be prepared individually. Then the pieces are combined into one-page layouts, much as you would assemble a puzzle. This process, known as paste-up, will have a great influence on the final appearance. The time and money spent here will have a direct reflection on the end result. Your local library should have a book that discusses the details of production, or you can get some advice from the experts at a printer or copy shop.

Newsletters like *Squelch Tale* have a carefully considered layout that is consistent from issue to issue. The material is not crowded, nor is there a lot of white space. Each issue is headed by the newsletter logo; once you get a good logo you can use it again and again. Short filler items can be used to fill those corners that are left over. You can even incorporate some flashy graphics on the part of the newsletter where the address and postage go.

There are several ways that a newsletter can be reproduced. Very small organizations probably can get away with photocopying. The next step up is spirit duplicating and mimeographing. For slightly more money, you can use offset printing. You provide a clean, sharp original for each page in the newsletter. The printer uses these to make inexpensive "plates" that go on the press. The offset method gives you total control over the layout; changes can be made by pasting new material over the old. If your budget permits, offset printing will allow you to incorporate two or even three colors of ink. And, for the special occasions when only photographs will tell the story, you can get crisp black-and-white reproduction.

To produce a top-notch newsletter, the staff needs two kinds of people. Besides the individuals who gather and edit the news, the staff should have artistic types. Hopefully, your club can find a good printer to round out the group. When shopping for a copy service, look at both price and quality. Happy publishing!

dicates that this is the 3rd series of QTCs sent and that 7 QSOs are reported.

AWARDS:

Certificates to the highest scorer in each classification in each country, reasonable score provided. Continental leaders will be honored with plaques. Certificates will also be given stations with at least half the score of the continental leader or with at least 250,000 points. The minimum requirements for a certificate or a trophy are 100 QSOs or 10,000 points.

ENTRIES:

Violation of the rules or unsportsmanlike conduct or taking credit for excessive duplicate contacts will be deemed sufficient cause for disqualification. The decisions of the Contest Committee are final. The use of the log sheets of the DARC or equivalent is suggested. Send a large SASE to get the wanted number of logs and summary sheets (40 QSOs or QTCs per sheet). SWLs apply the rules accordingly. Entries should be sent no later than December 15th. North American residents may send their applications and logs to: Hartwin E. Weiss W3OG, PO Box 440, Halifax PA 17032 USA. Others may address entries to: Klaus K. Zielski DF7FB, PO Box 1147, D-6455 Erlensee, West Germany.

EUROPEAN COUNTRY LIST:

C31, CT1, CT2, DL, DM, EA, EA6, EI, F, FC, G, GC Guer, GC Jer, GD, GI, GM, GM Shetland, GW, HA, HB9, HBØ, HV, I, IS, IT, JW Bear, JW, JX, LA, LX, LZ, M1, OE, OH, OHØ, OJØ, OK, ON, OY, OZ, PA, SM, S, SV, SV Crete, SV Rhodes, SV Athos, TA1, UA1346, UA2, UB5, UC2, UN1, UO5, UP2, UQ2, UR2, UA Franz Josef Land, YO, YU, ZA, AB2, 3A, 4U1, 9H1.

HAM HELP

I would like info on 10m FM conversions (except *73* articles and K9EID's book), especially for Japanese HF rigs; 29-MHz amplifiers; access details for 10 FM repeaters and the use of CTCSS and touchtone. All letters answered.

Ash Nallawalla VK3CIT
53 Chirnside Ave.
Werribee, Vic. 3030
Australia

I need manuals and/or schematics for the following pieces of equipment: Nems Clarke, 250-1000 MHz tuner, type 2501000-1; countermeasures receiver, type 17A4, General Electronics; Servo Corporation of America VHF receiver, Model R5200-A2; and Cohu Electronics, Inc., Kintel Division electronic galvanometer, Model 204A.

Robert Sondack VE2ASL
260 Bellerive
St-Luc, Quebec
Canada J0J 2A0

I wonder if anyone would know where I can obtain a circuit diagram for an Echophone EC-1 which was a popular radio receiver in 1938 to 1943 or so. If not, could anyone supply the address of a radio historical society? Thank you.

Warren Smith KH6AQ
525 Pauku Street
Kailua, Oahu HI 96734

LOOKING WEST

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

WHAT'S UP, DOC? DEPARTMENT

I can't go into specific details at the moment, but suffice it to say that the long-awaited "clean sweep" of our amateur bands is on to rid them of all sources of willful and malicious interference. Actually, it started to get up a full head of steam last spring, mainly on the west coast, but now reports are coming in that deal with the issuance of warning letters, official citations, and show-cause orders on a rather grandiose scale nationwide. To say that the FCC is on the warpath is definitely an understatement.

Since there will probably be ongoing litigation in regard to many of the show-cause orders, I won't report on any specific case at this time. I can say that the clean-up is not being limited to repeater jammers and users of foul language. Those who interfere with HF nets and other organized amateur operations have also come under the gun of the FCC's enforcement branch. Nor do I foresee any end to these rigorous enforcement policies in the near future. Also, most amateurs I have spoken with are delighted at this turn of events. They feel that it's about time that those who claim to regulate our service show that they have the ability to make their rules stick.

But there is the other side. Some of those the FCC is clamping down on claim that the Commission has no right to regulate what they say over the air, in what way they say it, or who they say it to! In essence, their claim is one of having "the right to yell fire in a crowded theater," and in their minds it becomes your responsibility to ignore what they say. I've heard unconfirmed rumors that a number of those served are banding together, pooling financial resources, and vowing a fight on the matter to the US Supreme Court. Other rumors say that the American Civil Liberties Union has been approached for representation on the basis that the current enforcement action by the FCC violates various aspects of individual civil rights.

And here's the funniest one of all. Again, the rumor mill has it that the majority of those now in trouble with the FCC blame the ARRL for their plight. I consider this ironic in that the only thing the League has done thus far has been to form another *ad hoc* committee. If the League is responsible for the clean-up, it's news to those who are really the responsible parties. Who are they? If you have followed this column for any length of time, I think that names and callsigns like Joe Merdler N6AHU and Ray Frost WA6TEY are familiar. While the ARRL formed committees, these amateurs and others took to the world of politics. They worked through their legislators to make enforcement of the amateur rules a top priority with the FCC. It has now become quite clear that they have been successful.

The end of the fight to combat the problem is not yet in sight. As has been heard on the ham bands many times, by many of you first hand, jammers have openly stated that taking their licenses away won't keep them from jamming. And, as one expert on the subject has said, "Don't be surprised to see things get a lot worse before they get any better. It may take putting one of these jokers behind iron bars for a few years to get the point across that laws were made to be respected and not broken." I don't see things getting very much better in the near future, but we can hope. At least an important first step has been taken, but it's going to be a long time before we really see the light of day.

THE SCRRBA REPORT, PART II

Last month we began what might best be termed a mini-series about the future of UHF voluntary frequency coordination in southern California, and the problems being faced by this area's UHF coordination body, the Southern California Repeater Remote Base Association. As I said last month, this report, compiled by Gordon Schlesinger WA6LBV of the SCRRBA Technical Committee, may be primarily directed at the UHF system operators of this area, but it holds merit for any coordinator or coordination council, especially those in the position of having far more relay systems looking for homes than channel pairs available. Basically, that's the problem facing SCRRBA and many other coordination organizations nationwide.

SCRRBA is not an organization known for chasing its own tail. It is basically a very quiet organization that has historically taken a very methodical approach toward voluntary coordination. I suspect that is the reason for its longevity and its success rate. Everything is carefully researched, and this report is no exception. We continue where we left off last month.

THE VALUE OF A SOUTHERN CALIFORNIA UHF CHANNEL PAIR

A few areas of the country list only one or two UHF channels in use in an entire state. In these areas, coordination of a UHF channel pair may well be as informal as telephoning a frequency coordinator and asking: "Should I use 449.100, .200, .300, or .400?" A decision is quickly made and recorded.

In southern California, those system operators who originally obtained channel pairs for their relay stations from CARC coordinators in the 1960s and early 1970s may remember that at that time our coordination procedures were not much different. While even then there was a significant population of the 440-450 MHz portion of the band, we were not yet near 197 operational systems. At that time the spectrum appeared boundless, and coordination was an easy matter. A telephone call would accomplish the process, and there was little if any paperwork involved; several channel pairs at a time could be requested, received, and "warehoused."

A current problem in frequency coordination arises, however, because some of our system owners have not yet realized that those golden days have ended. With our current massive occupancy of the band, every channel pair is now quite valuable. Every pair is in demand. Every pair has a potential applicant ready to establish a machine upon it. The coordinated use of a UHF channel pair is no longer a casual matter to be ignored or taken for granted.

There are three different groups of mobile relay system operators involved with UHF frequency coordination: operators of presently coordinated systems, applicants for coordination for new UHF systems, and the SCRRBA Technical Committee. Every group views the situation from a different perspective, although all have (or should have) a common interest in seeing the frequency coordination process from the standpoint of each of these groups.

Some of the owners of presently coordinated systems may have the least accurate perception of the current state of our band. In a sense, this is understandable. Many of them undertook coordination some time in the past, perhaps more than 10 years ago. They established their machines, have operated and improved them over the course of the years, and some have not kept in touch with the progress in the development of the band. Consequently, in some cases their notions about band utilization are outdated. Others, by contrast, have a very fine understanding of current trends and problems.

THE APPLICANT FOR NEW FREQUENCY COORDINATION

The availability of programmable scanners means that anyone can develop a list of apparent activity on the 70-cm band. (Ed. note: This holds true for 2 meters, 6 meters with some scanners, and even 220 when a converter is used ahead of the scanner.) New scanner owners often begin keeping "researched lists" showing, as best they can determine, which channels are in use and how they are identified. This information could be used to program scanners to listen to "interesting machines," but it can also be used as a guide to which channel pairs appear to be unused. It's therefore not surprising that the Technical Committee receives requests for exact frequency pairs which are desired. However, the vast majority of these requests cannot be coordinated as requested.

The Technical Committee is

well aware of the existence of scanner-generated research lists. From time to time we receive copies of various editions. The accuracy of these lists is generally, at best, poor. Some of them are correct... as far as they go, which is not very far at all. Others are grossly inaccurate, sometimes to the point of being laughable. A few are badly outdated. All attempt to give the appearance of being "seriously professional." Such researched lists, however, are totally insufficient as bases for reasonable channel selection. Effective data, not obtainable by monitoring, are mandatory for any accurate and effective coordination action.

It must be stated that the chief function of the Technical Committee, as with any frequency coordination body, is to maintain an accurate, complete, and timely record of all UHF relay activity in southern California. The Technical Committee record was initiated by the inclusion of the old CARC UHF coordination files, which themselves were begun nearly 20 years ago. To those records have been added the details of each frequency coordination which the Technical Committee has performed, as well as the corrections, deletions, and updates which we have received.

The data base from which the Technical Committee coordinates consists not only of a chart of frequency assignments, but also the complete set of technical and operational data and histories for each relay system. Both parts are necessary for performing accurate frequency coordination; neither part by itself is sufficient.

The data base is not perfect. No tabulation of activity as diverse as UHF mobile relay in southern California can be. But it is a data base which is... and must be far, far more accurate than anything else available. It is, fundamentally, a data base upon which frequency coordination of additional systems into an existing congested environment can be performed, with a considerable degree of confidence that the new station can begin operation without creating or experiencing substantial interference.

The Technical Committee has seen some past instances of new UHF mobile relay station operators, possessing copies of researched lists (or under the counseling of someone who does), merely selecting a "free pair" for themselves and going on the air without consulting the committee. The "self-coordination" obviously looked good, at the time, to the individual who performed it, else why would that particular pair have been chosen? Nevertheless, in an environment as congested as southern California UHF is today (Ed. note: Also 2 meters and 1¼ meters), there are no longer any "free pairs." Inevitably, there is another co-channel machine somewhere else in the region, and eventually the operators of the two machines will discover each other. Problems then ensue, typically resulting in a large expenditure of time and money before a resolution is effected. With over 300 relay stations in operation, an initially small problem in one corner of the region has the potential of becoming a much larger problem affecting a large number of systems and operators throughout all of southern California. Each system owner must realize that he has a personal stake in the entire coordination system, a system which is now too complex to be forgiving of small errors or transgressions.

Each potential applicant for UHF (Ed. note: Or any) frequency coordination, possessing a researched list and tempted to bypass the usual coordination process, must ask himself: "Am I performing coordination from a data base which contains at least 320 separate entries?", and "Do I have accurate technical data for the relay stations on my list?" If the answer is "no," then the individual must realize, or be convinced, that he is operating from a position of ignorance and that his actions are a potential threat to all members of the UHF community. We can no longer tolerate self-coordination; those days are gone!

THE TECHNICAL COMMITTEE AND THE SCARCITY PROBLEM

(Ed. note: Here is the heart of any voluntary frequency coordination effort. It is the ongoing dedication of people who serve as coordinators or committee members that pulls it all together. If they fail, it's a failure for all amateurs in a given area. In SCRRBA, we see the epitome of a successful coordination body. Many of those serving in its organizational structure have done so dating back to the CARC years. Building and nurturing a successful coordination body takes time, dedication, and understanding. The lack of abdication by those who have joined with SCRRBA is strong testimony for the people and principles with which the organization was founded.)

The vast increase in the number of coordinated systems, together with the relatively constant demand for new channel assignments, has greatly increased the workload of the Committee. This increased workload is straining the Committee's ability to provide accurate and timely new coordinations and has prompted the writing of this special report.

While much of the Committee's work is done on a continuing basis, including handling incoming and outgoing correspondence, updating records, conducting band-monitoring studies, etc., all actual coordination actions are accomplished only at Committee meetings. It has been the Committee's practice to try to meet relatively often in order to keep on top of the coordination applications. However, increasing travel costs have mandated somewhat less frequent meetings. In order for the Committee to function, members must assemble at one location. (Out here, this usually means either Los Angeles or Orange County.) Members travel from as far away as San Diego and Santa Barbara to attend; this can mean as much as 5 hours of driving time for some, with *no* reimbursement of expenses. Since SCRRBA coordination is of the voluntary, amateur-sponsored kind, Committee meetings occur at night or on weekends. Every meeting entails loss of leisure time which could be spent with family or working on radio systems.

Hand in hand with the occupancy of the UHF band (Ed. note: Again remember that the band in question depends upon your own particular geographic locality... this is written in regard to southern California UHF, but in this region it could be applied to 10 meters, 2 meters, and 220. In a year or so, we will apply it to six meters as well.) has gone increased length of Technical Committee meetings. Whereas it formerly required 15 minutes to handle the average request for coordination, including selecting an appropriate frequency pair and entering the action onto the coordination data base, it now averages one hour to do the same job. While a few applications can still be handled in the previous 15-minute period, others may require in excess of 2 hours if the application is a difficult one. Consequently, Committee meetings are always marathon affairs.

SUMMARY TO DATE

In parts I and II of the SCRRBA Special Report, we have seen the problem facing the coordination body for one band in a highly populous geographic region. First we had a general overview, and now we've had direct insight to the problems of frequency coordination. Unless you have served on such a committee (and your editor spent 8 years with the Southern California Repeater Association in various functions), you have no idea what performing this seemingly simple task entails. I know what it is to give of my personal time, doing so week after week and year after year. I know firsthand of the hardships involved in being a member... an active member of such an organization.

I also know that it is impossible for such organizations to make everyone happy. The coordination process dictates that somewhere along the line some individual or group will be unhappy if for no other reason than the channel pair they long to possess is already in use by another.

Reality dictates that for a voluntary coordination body to be successful, it must be prepared to face any eventuality. For instance, with many areas of the nation already saturated with FM two-meter activity, many manufacturers seem intent on making 450 the next big VHF/UHF marketplace. There's nothing wrong with this in my book, as this is the name of the game in our free enterprise system. But even they must be accountable to the amateurs of a given area, and there are some geographic locations that do

not lend themselves to UHF transient relay mobile communication. Southern California is one of them.

Of the some 320-odd UHF relay systems now operational in Southern California, only 13 are "open" or "public access," as SCRRBA refers to them. Of these, only 6 serve Los Angeles proper. All the rest are "private" category machines that do not welcome transient operators even if the transient happens upon the proper CTCSS access. I may be wrong, but unless some drastic changes happen to the thinking of most UHF operators, changes I doubt will take place in the foreseeable future, I doubt if any major inroads will take place on 450 by the average ham in this region. The very structure of the band precludes it. The manufacturers of new equipment may and hopefully will find success in other major markets, but I would not want to bet my advertising budget on southern California. The place is just too set in its ways.

But even SCRRBA recognizes this problem, if one deems it to be a problem, and is planning on ways to cope with it. SCRRBA is perhaps the most successfu voluntary coordination body ir the nation mainly because they have an eye on that famed ex pression, "Plan Ahead." We wil conclude this three-part mini series come January, since next month we have a special Christ mas column for you. Till then.... a Happy Thanksgiving from those of us who write the late shift from Los Angeles.

LEAKY LINES

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The editors of *QST* saw fit to include in the Correspondence Section of the September issue a letter that really opens a can of worms that needs to be examined with care. The writer of the letter takes the position that the neighbors of an amateur are entitled to enjoy a vista uncluttered by antennas. He equates this right with his own right to insist that nobody play loud rock music after 1 o'clock in the morning. The comparison, aside from being both odious and foolish, is mischievous and can cause trouble. For if ever we allowed ourselves the luxury of blithely permitting such specious arguments to be injected into the general question of community zoning, we would be begging for the establishment of highly dangerous precedents that could be used over and over again by unsympathetic, hostile local government groups.

What possible analogy can be drawn between noisy public disturbances after midnight and the inherent right of the possessor of a federal license grant to exercise the privilege conferred through the issuance of the license? There is no analogy; the two are as unalike as bananas and stalks of celery!

The writer further states that he purchased his home "knowing full well that no flagpoles, clotheslines, garbage cans, *or outside antennas* were allowed." Not allowed by whom and by what sort of a covenant? If he is referring to the builder of a development who establishes such sanctions as an integral part of his plans, then he is correct. But in all other cases he is wrong. It may be proper for a community to insist upon certain limits of one sort or another, based upon sound engineering and safety, and upon avoidance of property line infringement, but it is improper for the community to condemn and outlaw all antennas generically. The term is literally a catch-basin, totally unspecific. It runs a broad gamut, embracing anything and everything from the simple dipole or whip through yagis, quads, rhombics, long wires, phased arrays of dozen of types and configurations, and some which have not even yet been devised! The sentence betrays an astonishingly naive attitude that one would never have thought would be expressed by any mature amateur.

In the first place, such disallowances have been successfully beaten down in test after test in the courts. Communities frequently attempt to sanction various uses of property by owners. If the individual is foolish and pliant enough to accept it without raising a ruckus, the town or county gets away with it. So what this man describes as "knowing full well" is merely an admission that he is willing to turn up his toes and play dead for the zoning board. He ought to have written instead: "...knowing full well that the town disapproved of antennas, but that this disapproval could not stand up if I chose to fight against it."

Now, in the matter of "laws that make others pay to prevent our hobby from being a nuisance to them," the writer is entirely balled up. For years it had been demonstrably evident that the manufacturers of TV receivers, hi-fi units, and other electronic entertainment devices willfully and deliberately omitted adequate filtering and shielding in order to make larger profits. In a vast majority of cases involving complaints of RFI and TVI to the Federal Communications Commission,the amateur stations concerned were proven to be blameless, and the devices of the complainants were shown to be at fault. Further, it can be shown that literally hundreds, if not thousands, of appliances of every sort have been made and sold which radiate interference in violation of radio regulations. Laws which compel compliance with state-of-the-art technological standards are not inappropriate in any way, for they merely force manufacturers to do what they are supposed to do in the first place.

I am not being fractious; I am just growing a bit weary of the arguments of hams who ill-advisedly want to run and hide, who feel that they would rather switch than fight, who think that it is best not to make waves. I don't know just how important his radio hobby is to this particular writer. But I do know that to hundreds of thousands of us it is very important indeed. We are not about to play the "shrinking violet" every time some local political hack or shyster waves an arbitrarily written local ordinance in our faces and threatens us with dire consequences. We are willing to fight for the rights conferred along with the license grant, a right which generally supersedes the petty, picayune statutes formulated by persons with neither any understanding of the Bill of Rights nor any inkling of the splended record of public service and innovative contributions to the art of communications run up by the amateur service.

Incidentally, I think it is somewhat interesting, if only coincidental, that the same issue of *QST* carries an editorial on the subject of RFI, as well as a report on a recent reversal on appeal where there had been a conviction on one of these malignant regulations of which I have been speaking.

This chosen avocation of ours did not arrive at its present state of popularity and growth through the docility of a pack of passive dilettantes. We have a long tradition of passionate involvement and dedication to our hobby, notwithstanding the phlegmatic indifference of a few among us, who, like the writer of that letter, not only back down in the face of challenge, but also convince themselves and attempt to convince others that it is right and proper to do so.

On the day that amateurs become willing to accept the repression of our activities without a murmur, we will be witnessing the beginning of the end of ham radio. And if we ever become resigned to the idea that we exist merely through the sufferance of others, that our operation is contingent upon tolerance from those who are prejudiced against us, then we will richly deserve to be flushed right down the drain! Among other qualities demanded of us, one that stands high is militancy. For just as in life in general, the continuance of ham radio also depends upon the exercise of the instinct for self-preservation.

The only thing in the letter with which I agree is the last paragraph, but even that is somewhat flawed because he implies that we should be reacting to pressure from the so-called anti-antenna movement through technological growth. The fact is that such growth has always come about through the natural curiosity and inventiveness of the amateur community rather than as a reaction to the pressure of outside forces. This process will continue. And the adversity posed by the activities of our foes will merely intensify and reinforce it.

In passing, I must observe that this is the very first time in a long and rewarding relationship with the hobby that I ever heard of any amateur who equated "making the community more beautiful" with the elimination of antennas! I never met a ham who failed to view a fine antenna installation as a thing of beauty.

Well, perhaps the answer is that this particular ham is not as dedicated to the hobby as most of us are. Say, listen... maybe he's a real-estate developer or the owner of a beachfront condominium building. He sure sounds like one!

Enough of this, except to reiterate my wonderment toward the impulse that caused the *QST* editors to select this particular letter out of the hundreds which must arrive every month. Perhaps it was their way of playing "devil's advocate" and they hoped to provoke dialogue on the subject. If this is so, then I politely tip my hat in their direction. For they have afforded me an opportunity to express some thoughts on it, too.

I sincerely trust that others will have detected the sour notes in this masochistic, self-flagellating cantata of capitulation to our adversaries. And I hope that there will be a flood of letters written to *QST* to belie the false contentions of the writer. They merit the condemnation of every amateur who is interested in preserving ham radio and protecting it from the sniping to which it is constantly exposed. The very notion of bowing our heads submissively and failing to fight against unfair antenna sanctions should be repugnant to every amateur. We must not allow ourselves to become second-class citizens simply because others happen to dislike us or our chosen hobby. As the old British motto puts it: Let right prevail.

DX

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SALUTE TO CW

Who needs it? The answer is: *you* and everybody else. Why? Because it separates the ham from the rest of the crowd and all those big-mouth, never-shut-up screamers and list operators. Let's have a look at a few points.

1. CW is the most reliable mode of communication. It can be copied at times when even SSB signals and other modes become unreadable. It is quite common to find that when the SSB signals are just fading out into the noise, stations switch to CW and it is like magic—signals are still readable and the difference is equivalent to 2-3 S-units. This is the reason why CW is used where there is the need to communicate at very low signal levels, such as VHF moonbounce, 160 and 80 DXing, remote area DXpeditions, etc.

2. It takes a little bit of devotion and work to master the speed. This is what separates the true-blue ham from those who are in the hobby to mess things up and deregulate it to the 27-MHz "state of the art."

3. Some are saying that CW is the old-fashioned mode, outdated and dying. Well, I think we are in for big revival. It is not dying; there are still a number of stations that can not afford SSB or more sophisticated rigs, and they have to home-brew their equipment. A CW rig is the easiest thing to build. Now with the explosion of computers, we will see more and more operators going back to CW and away from all those list undertakings. We can perhaps standardize one or two speeds on CW and let the computers talk to each other or to people. The wonderful thing is that they are compatible and could be fully automated. It also makes more sense to use CW than RTTY or ASCII, mainly for the possibility of communicating with those who have only ears. The present state of the art allows us to use fairly simple decoders and with the proper filtering and stability of today's rigs, it should be a relatively easy thing. Not to mention that keyboards make the CW machine quality perfect and easy to use.

4. Coherent CW is making its inroads and is offering another about 12 dB of signal-to-noise advantage. This offers another step of improvement. By narrowing the bandwidth on the receiver, we are making more room on the band; stations are able to get closer to each other.

5. There is a breed of operators who are operating almost exclusively on CW, away from the lists, etc. You can't help but feel much better when you tune down below the phone bands. The old ham spirit still lives there.

6. Numbers of expeditions have found that they can work the stuff much faster on CW than on phone. Sound strange? Not really. You can separate the stations much better on CW, especially when the pileups tend to get very heavy. With all those compressors adjusted for 20 dB of compression, there is more crud on the band than modulation. Sometimes they can even manage to QRM their own signals. You can quite often hear the background noise louder than the actual operator's voice.

So don't throw your key or keyer away; whenever you feel like it, give it a try. Besides, a number of countries and expeditions operate only CW. So be ready when you need that one.

One note to CW operators: Some rigs have drive control on the transmitter. It is important to set the level just below the point where there is no more increase in the transmitter power when increasing the drive level. It may seem that it does not matter, since there is no more signal going out. It makes a big difference on the signal quality; clicks and wide signals start coming out of the transmitter and give you a bad image among the fraternity. So be sensitive to that level setting and keep it clean!

Another note on the technical side: Be aware of your frequency. With the SSB rigs, good filtering and single signal reception, it is important to know if you are equivalent to USB or LSB on the filter. This is important for the receiver calibration, especially when you want to operate close to the band edge. The best thing is to use the zero-beat frequency. Some rigs use USB and some LSB for CW, so sometimes there could be over one or two kHz difference.

It is also important to know your transmitter offset on CW. Most rigs have offset around 1 or 1.4 kHz. When you operate transceive and you prefer tone around 500 Hz, when you call the stations you would be about 800 Hz or so out. If he is using a sharp CW filter, he might not hear you, especially when the bands are crowded (more important in a contest!). The best thing with the transceiver is to use RIT with the receiver and offset it in order to match the frequencies on receive and transmit. It is not uncommon to find some stations off frequency by as much as 3 kHz. Most hard-core CW operators use a separate receiver/transmitter combination, and there you can tell exactly where you are. So if you have a transceiver, it pays to find out where your signal is on transmit, and if it needs adjustment, most rigs can be adjusted by trimming the CW transmit offset capacitor.

Vince Thompson K5VT

Vince is a real delight for those hard-core CW operators.

Vince is making an extensive tour through Africa and has put a number of very rare countries on the air. He operates just about exclusively CW and the operation is first class. No wonder, he belongs to the FOC—the First Class Operators Club. He is working them fast—that means at high rates and good high-speed CW. He follows the propagation and tries to adjust his operating hours so he can satisfy just about everybody who needs him. He prefers the 15m band and can be found around 018-025 from the band edges. He usually operates split, listening from 1 to 6 kHz up. QSL cards go to his home call, K5VT.

So far, Vince has put on the air the following calls: 7P8CF, 9Q5VT, TN8VT, 9U5AV, S79WHW, S9VCT. Next on his program were supposed to be: 5V, 5U, TT8, and possibly others.

Bad tongues are saying that Vince goes to see the licensing officer who is ill. Being a doctor, he "fixes" him and the rest is a snap—a license in hand for an otherwise inaccessible rare country. Hi.

Vince is doing an excellent job and has to be congratulated for true high-quality operating and the choice of the countries he has activated.

Some Tips

How does one catch Vince and others that operate in a similar style? Here are some crude recipes:

First you tune across the band and you usually spot the big pileup. There is always a reason for that, so you can start looking for it. Most of the time, that reason is that rare DX is usually sitting a few (3-5) kHz below the bottom edge of the pileup. Then you have to start tuning very slowly and carefully to find him. Slowly, because he is usually coming back in short bursts of calls and reports, and you can very easily pass over him. If you have a rotatable antenna, it is also good to know where is he coming from so you can get enough signal for the receiver if he is weak (like VU7AN). Once you have found him and know who it is, half of the work is done. If you need him, then you have to do the other half—work him.

The most effective way of doing that is to find out his operating style or technique. Where is he listening? Is he picking the calls randomly at different frequencies, or is he going up the band or down? Try to find the stations he is working and establish the pattern. Once you know that, try to "tailgate" the last guy worked on the frequency or just slightly up or down. With a reasonable signal, this is usually the quickest way to work him. It is well worth spending the time to find out the pattern.

Or you can just pick the frequency and keep calling until he finds you. It is almost equivalent to the lottery , but it works, too.

This procedure, of course, applies to the split-frequency operation, which most DXers do use. Those that work on the same frequency get usually snowed under the never-ending pileup, and nobody can even hear them coming back to the stations.

Another important thing is to not call when someone is sending his report; be civilized and let him complete the contact. Otherwise, you will drive the DX away and nobody will get him. I have heard Vince asking the W6. . for his report and not get it, because others just kept calling him. After a few tries he gave up and quit. Proper thing to do.

What a difference in working our Japanese friends. If you ask for a stations with a "J" in the callsign, only the one that has the "J" in the suffix comes back, not the whole of Japan! What discipline and politeness! The net result is that many stations work the rare one and everybody is happy. Can you get the same result if you said: "QRZ W-something?" or "QRZ I-something?" No way, everybody all of a sudden forgets his callsign and actually tries to convince the poor DX that it is him that he has heard. The result? Big mess.

So what will the good operator do? He will throw in his callsign once or twice and wait, giving the DX a chance to come back to somebody. Try it; it works! But we all have to do it. If we try to be the last one in the pileup, then everybody wants that and the result is a never-ending screaming pileup and vanishing DX.

CQ WW DX CW Contest

This contest is a great opportunity to do some fishing for the rare ones and brush up on the rusty CW (oops, Morse code) and also observe some operating tricks and tactics by the big guns.

A number of rare expeditions are being planned and one can easily work his first 100 countries on that weekend. It is always the last weekend in November. Don't forget to send the log from the contest; sponsors always appreciate that.

* * * * *

We are looking for some pictures and stories from the expeditions or any DX stations. So please send pictures and a few lines about yourself. Many are curious to find out how you look and what are you running.

* * * * *

DX NEWS

CE0X San Felix Island. This very rare spot was to be activated by WB1GDQ, N4CNL, WB9AAD, SV1JG, W0AX, and possibly SV1IW. Apparently permission to operate has been granted and the latest info was that they should be starting around October 15th.

Juan Fernandez Island. CE0ZAC and CE0ZAD, a YL/OM team, are on the island for about three months, starting in September.

FB8WG Crozet Island. Rumored to be on around the 10th of September by a group of French operators.

HS1AMC Thailand. Apparently the bad news from there is that amateur radio activity was again suspended, so we will not hear them for a while. HS0HS operated during the CQ WW CW contest.

Belize. A J9 prefix will replace the VP1 prefix.

W6SOT/LX Luxembourg. Please QSL via KA5CCO and not via KA5CCD. Same for his operation as W6SOT/3A.

S9, Sao Tome Island. Activated by K5VT. Another operator should be stationed there very soon. If he obtains his license, he should be active for about two years.

UA1PAM Franz Josef Land. Operator Slava active around 14017 2000Z. QSL via UK3SAB.

VE1AWS/1 Sable Island. Mostly CW; QSL via W3HNK (ran out of VE managers?).

VE1BL/1 St. Paul Island. QSL via W3HNK.

K9MK/VP2A and KN5N/VP2A Antigua. All cards go via K9MK.

VP2MMR Montserrat. Operated by Dick Bash. Makes you wonder if he used his books to get his license. It sounded more like someone from the 27-MHz crowd than the amateur. Hi. QSL via KL7IHP.

VP8 South Orkneys. Stations VP8ZR, Denis, QSL via G3KTJ, VP2AJL Op. Ray QSL via Signey Island, Stanley, Falkland Island, and VP8AEV Bob. They are all on Signey Island, quite frequently on 15m around 21272.

VP9CB Bermuda. Please QSL direct or via bureau to VP9CB and not to VE3MPZ/VP9.

Andaman Islands. VU7AN showed up surprisingly. Signals were very weak on the east coast. VE3BMV Razor Beams scored that one. Operation mostly on 15m CW around 21095. QSL via VU2WTR.

VU7 Laccadives. JA group is planning to operate before the end of October.

XZ5A, XZ9A Burma. Still quite active and easy to work. They are showing up on some lists, but also operate "solo" and split on 15 and 20m. Bad news from the ARRL is that apparently those stations are not to be accepted for the DXCC. Some don't care if the ARRL gives its blessing; they simply work them and collect the cards. It seems strange that stations operated by the nationals from the country where they live are not considered "kosher." Do I have to send my license to Newington so all those that worked me can use my QSL cards for the DXCC credit? I would think if there is no doubt about the presence of the station in that country, then it should be OK. Operations by comedians that can travel by boat from NY to Antarctica in 5 hours should be questioned.

1A0KM Sovereign Order Of Malta. Apparently even after the recommendation of the ARRL DX Advisory Committee, this was not accepted as a separate country. Another Muppet show?

3C1MM Equatorial Guinea. Worked on CW early August. QSL via EA1QF.

7Q7LW Malawi. Quite active, mainly on 15m working lists and solo (much faster). QSL cards are being received and are good for DXCC.

Top Ten Most Wanted Countries

According to *The DX Bulletin* (K1TN), the list is: BY, VS9K, XZ, ZA, VU Lac., VK0, 7O, XU, FB8W, VU7 And. It looks like about two or three can be easily blown off that list before the year's end.

HAM HELP

I am looking for work in the electronics field in the Knoxville, Tennessee, area. Will be able to start February 1, 1982. My experience includes 20 years working on transmitter and receiver equipment from dc to GHz. I have an Extra class amateur license and First Class radiotelephone license with radar endorsement.

Herman F. Schnur
115 Intercept Ave.
North Charleston SC 29405

I have an R336/GRC26 Army radio receiver made in September of 1951, with a tuning range of 1.5-18 MHz.

I would like to convert this unit to an rf generator, vfo, or heterodyne exciter. I hope someone may be able to help me. Any information you can give will be greatly appreciated.

Kevin Neal
Rte. A, Box 221A
Flippin AR 72634

I am in need of help to repair a Canadian No. 19/MK III wireless HF surplus transceiver. The tuning dial is jammed. Any MK I, MK II, and MK III units for spare parts are needed. Also, any conversion info and manuals are needed. Please write and let me know what you've got. I'll reimburse printing and postage expenses. Thank you.

Jim Miyagawa WD8NRG
1529 Woodland
Portage MI 49002

I am in need of the manual and schematics for the Collins KWS-1 transmitter and associated power supply. I will gladly pay for reasonalbe reproduction and shipping costs.

John C. Lane WA8VEU
2400 Gannon Rd.
Howell MI 48843

I need a manual on the AM 1955A/GRC amplifier-converter which operates on 600-1000 MHz, as well as a manual on the RP-119/GPH signal data reproducer.

Roy W. Johne W9NNM
201 West "A" Street (4)
Iron Mountain MI 49801

I need a little help getting a manual for the Wilson T-1402SM hand-held transceiver. I would also like the sheet on the touch-tone pad and the T-15-NC drop-in charger.

I will gladly pay all copy costs and postage. I have copying facilities available.

Any help you can give will be very much appreciated as I am dreading the day the radio quits and I have to work on it.

Carl Hattan K0BZU
PSC Box 6752
Patrick AFB FL 32925

I need a schematic and any other information I can get for a Monsanto counter/timer (Model 101-B). I will pay for schematic/manual (or copy) or I can copy and return original. Thank you.

Nicholas Santillo
Box 22, RD 1
Sycamore PA 15364

Does anyone know where I can get my Standard SR-C 145B repaired?

Don Sywassink K7ZIO
4525 Paseo Arruza
Sierra Vista AZ 85635

I need a mixer coil for an HQ-170 Hammarlund receiver—top slug 455 kHz and bottom slug 3035 kHz. I am repairing the receiver for a man with M.S. and any help would be appreciated.

Jon Andrews WA2YVL
PO Box 222
Greenlawn NY 11740-0222

William Tucker W4FXE
1965 S. Ocean Dr., 15-G
Hallandale FL 33009

Cartography for Kerchunkers

— making repeater maps

JAX
6040-6640
6130-6730
6160-6760
6205-6805
6250-6850
6280-6880
7645-7045
7690-7090
7795-7195
7900-7300
7990-7390

NICEVILLE
6130-6730

PAHOKEE
4650-5250

PLANTATION
4770-5370
6190-6790
7930-7330

SANFORD
6130-6730

SEBRING
7870-7270

FT.LAUD
4510-5110
4630-5230
6310-6910
6355-6955
6430-7030
7630-7030

GAINESVILLE
6190-6790
6220-6820
6310-6910

CLERMONT
6295-6895
7780-7180

COCOA BCH
6430-7030

DAYTONA BCH
7750-7150
7840-7240

HALLANDALE
6250-6850

JUPITER
6025-6625

LAKE CITY
7750-7150

LARGO
6370-6970

MELBOURNE
6010-6610
6250-6850
6385-6985

PALATKA
7660-7060
7930-7330

ORLANDO
6040-6640
6100-6700
6130-6730
6160-6760
6220-6820
7720-7120
7825-7225
7990-7390

TAMPA
4890-5490
6160-6760
6190-6790
6235-6835
6265-6865
7630-7030
7705-7105
7750-7150
7810-7210
7840-7240
7945-7345
7975-7375

COCOA
6280-6880

CRESTVIEW
6430-7460

DISNEY WLD
7900-7300

HOLLYWOOD
6085-6685
6385-6985

KEY WEST
6340-6940

LAKE PLACID
6445-7045
7645-7045

LECANTO
6355-6955

MILTON
6100-6700

OCALA
6010-6610

PERRY
6370-6970

PENSACOLA
4510-5110
6160-6760
6250-6850
7750-7150
7930-7330

SINGER ISLD
4570-5170
7765-7165

ST.PETE
4850-5450
6310-6910
7600-7000
7660-7060
7915-7315
7960-7360

ARCADIA
7675-7075

BRADENTON
6010-6610
6220-6820

CRYSTAL RIV
7870-7270

EUSTIS
7855-7255

FT.MYERS
6190-6790
6280-6880

LAKELAND
4690-5290
4830-5430
6085-6685

LIVE OAK
6340-6940

NAPLES
6070-6670

OKEECHOBEE
7795-7195

PLANT CITY
4560-5160
4870-5470

SARASOTA
4530-5130
6130-6730

RUSKIN
7705-7105

ST.CLOUD
6190-6790

W.PALM BCH
6070-6670
6145-6745
6280-6880
7960-7360

VERO BCH
6040-6640

BELLE GLADE
4850-5450
7600-7000

BROOKSVILLE
6115-6715

DELAND
7960-7360

FERNANDINA
6010-6610

FT.PIERCE
6130-6730
7810-7210

LAKE WALES
7930-7330

LAKE WORTH
7885-7285

MARIANNA
6070-6670

N.P.RICHY
6025-6625
6070-6670

ORANGE PK
6070-6670

PANAMA CITY
6340-6940
7990-7390

POMPANO BCH
6010-6610

SAN ANTONIO
6280-6880

TICE
6115-6715

TITUSVILLE
6070-6670
6310-6910
6370-6970

WINTERHAVEN
6055-6655

BOCA RATON
6220-6820

BRANDON
7765-7165
7990-7390

DEERFLD BCH
7720-7120

DEFUNIAK SPR
7720-7120

FT.WALTON B
6190-6790
6280-6880
7600-7000

Fig. 1. Sectionalized list of repeaters.

A few years ago, on one of several trips to New Jersey to visit with our children and grandchildren, I found myself with a microphone in one hand, a repeater manual on my lap, and my dear wife, Janet, struggling with a large road map trying to pinpoint the location of Podunk Hollow where there was supposed to be a repeater on .16/.76. "There must be an easier way!" I thought.

Before making the next trip, I made up repeater maps for each state I would be passing through, by marking repeater frequencies directly on the map at their exact locations. In this manner, I could determine whether or not I was within range of the various repeaters and operate accordingly. Two-meter mobile operation then became a real pleasure.

Repeater maps can be made up in several ways using standard-size road maps. Depending on the number of repeaters at a given location, sufficient space on the map can be covered with typist's white correction fluid and, when dry, repeater frequencies can be neatly inscribed on top by hand. A black, felt-tip pen can then be used to provide an outline of the white area to greatly improve visibility. Another method is simply to use

white paper sections cut to size as paste-ons at repeater locations on which frequencies are inscribed.

I recently made up a repeater map of Florida (Fig. 2) which is being distributed by *Florida Skip*, an intrastate, non-profit monthly publication.[1] A handy 11" × 17" size, it is printed on a heavy, pale-green, 60-weight paper. (It was to be displayed in that size as a center-fold spread in *Florida Skip* on much lighter white paper.)

The map was constructed using an 11" × 17" state map put out by auto-rental firms. After a thorough study of the various repeater manuals and the latest Repeater Council listings, a request was made to all trustees to send me up-to-date information about their repeaters as to correct frequencies and location. I then typed a sectionalized list of Florida repeaters (excluding closed repeaters) on 8½" × 11" white bond paper, using a typewriter with a carbon ribbon for good reproduction clarity. (More than one sheet was required to list all the repeaters. Fig. 1 is a reproduction at 69% of its original size.)

The typewritten sheet was then photostatically reduced to 40% of its original size so that the sections could be cut out and pasted directly on the map. After a careful paste-up, a black felt-tip pen was used to outline the white areas. Because blue areas such as the ocean and lakes do not reproduce too well in black and white, the entire state as well as the larger lakes were outlined in black to provide better reproduction.

The repeater listing according to frequency also was typed on 8½" × 11" white bond paper and reduced to 40%. This list has proven to be very useful, especially with the new two-meter rigs with scanning capabilities. After the entire paste-up has been completed, the rest is up to your local printer.

This repeater map has been very enthusiastically received in Florida and probably would be much welcomed in other states. It is indeed a worthwhile project for an active two-meter repeater club. ■

Reference

1. Map available for $.25 and a business-size SASE from Andy Clark W4IYT, Editor, *Florida Skip*, PO Box 501, Miami Springs FL 33166.

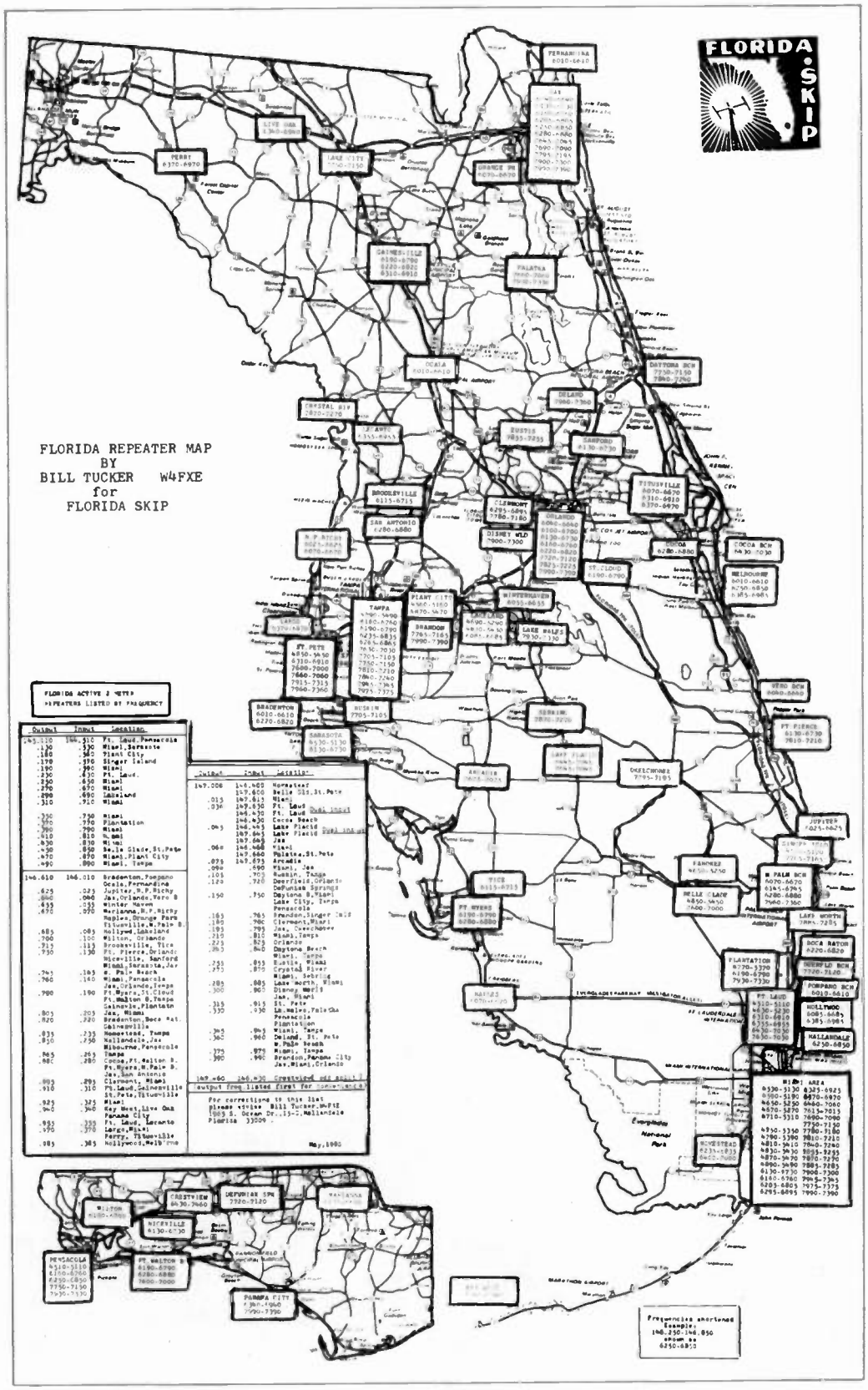


Fig. 2. Repeater map of Florida.

George M. Ewing WA8WTE
PO Box 502
Cheboygan MI 49721

Ten-Meter Lunch Hour

—ham radio for school kids

March has always been a bleak time of year for school kids in northern Michigan. Christmas vacation is long past and Easter break is still several weeks in the dim future. Once the craziness of basketball tournaments is over, there is little to do but study, stare at giant snowdrifts that half-cover the windows, and daydream of spring. Our high-school librarian, in a valiant effort to cheer up a blah faculty and student body with any sort of colorful diversion, was recruiting displays to liven up the big glass cases around the sunken main floor reading room.

I had had a ham radio display the year before that had met with quite a bit of student interest, and I resolved to try again. Along with the usual OSCAR pictures, photos of exotic DX islands, and fancy equipment, I planned to include some simple, low-cost gear that the average ninth- or tenth-grader with a part-time job and a modest budget could realistically afford. From years of experience working with teenagers, I've found that next to problems with the code, the one thing that tends to discourage young people interested in amateur radio is the perceived high cost of the equipment.

Experienced hams know that it is perfectly possible for a beginner to get on the air for little or no cash outlay, using used or borrowed gear, surplus, or even home-brew rigs (with a little friendly coaching from a more advanced builder), but the school kid just starting out doesn't realize this. He or she sees the ads in the magazines for rigs costing kilobucks—plus riceboxes, kilowatt amplifiers, beams, towers, and elaborate satellite installations. The average kid knows how much money the dealers are asking for fancy CB gear and tends to assume that ham gear, with its greater power, range, and number of "channels," must cost proportionately more.

The display case was prepared with equipment, books, photos, and magazine articles to be changed weekly and new material rotated in for a six weeks period. An attempt was made to include as much simple, home-brew, and low-cost equipment as

Students listening to another school station in Florida. The poster at the left listed license requirements and privileges.

Ned Workman, yearbook advisor and old Army radio operator, impresses everybody with high speed CW copy. Since this was taken, he has become KA8KQY.

possible. Along with the other gear, a complete Novice station was laid out, consisting of a Heathkit DX-60B, HG-10 vfo, and Lafayette HA-63 receiver.

This display hadn't been in the case for more than a few minutes before requests from students and faculty members began coming in: Why not take the gear out of the glass case and actually put it on the air, perhaps during lunch hour or after school?

I promised to take the matter under consideration and then sat down to think it over. There were some potential problems. I had tried an operating display two years before with the help of a couple of other area amateurs, but with mixed results. Because of severe antenna limitations imposed by the location in the building, we had been limited pretty much to operating with a small vertical antenna on twenty meters. A barefoot transceiver with a less than ideal antenna had left us with a dearth of contacts, especially on phone. The students had enjoyed the display, but the results were less than exciting and hardly seemed to justify the hassle of setting up and stringing long coax runs out of the way of the students who had to be able to use the library during regular school hours.

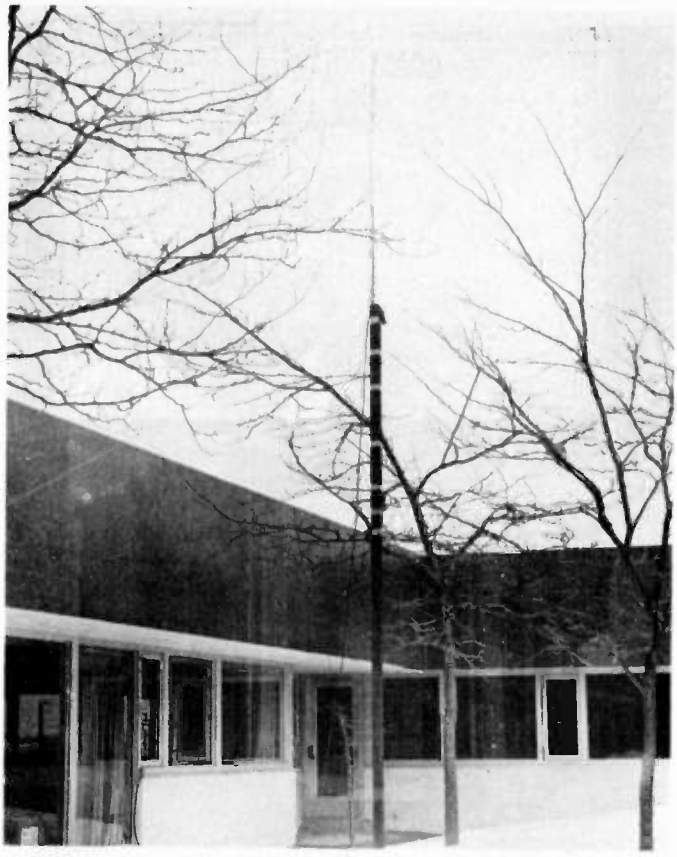
After considerable thought, I came up with what seemed to be a more practical plan. High-power SSB on the 20- or 15-meter phone bands wasn't the answer. We'd no doubt make contacts, but the whole point of showing what could be accomplished with inexpensive gear and modest power would be spoiled. Daytime in March was just about the peak of the season for 10 meters, and there was more and more low-power AM gear on the air now, thanks to all the CB conversions. An 8-foot vertical could be raised above the surrounding metal-framed buildings and should give good results. The good audio quality of AM would be easier for the students to follow, as many had had trouble with the highly compressed, filtered, and often QRM-blessed voices in the pileups on 20.

The final installation included the DX-60B and vfo, the Lafayette receiver, an swr bridge, a home-built kit

This display was changed every few days, with an effort to include as much home-brew and low-cost gear as possible. Students marked DX contacts on the world map as they were made.

frequency counter to check up on the calibration and keep us in the band, and a large hi-fi speaker so that class groups could follow the QSOs without straining their ears or having to share earphones. Outside, in the enclosed courtyard that was the only possible antenna site, we raised a makeshift 24-foot T-mast made of 1 × 4 lumber nailed together and painted

Touchy tuning, but that rare DX is still hanging in there.



The antenna. The ground in this inner courtyard was five or six feet below outside ground level.

"Now, where the heck is Victoria, Texas, anyway?"

with the school colors. An 8-foot aluminum tube was the ¼-wave vertical radiator, with three wire radials also serving as guys. With the addition of a piece of wooden dowel, the entire radiating part of the antenna was above roof level, although a three-story metal gym to the south might block some of the best DX.

Since my school preparation period overlapped with the three half-hour lunch periods, I would be able to be in the library over a 90-minute period each day between 1130 and 1300 local time, just about right for the skip to be in on ten.

The first day's operating began with a fifteen-minute dead spot, when there was nothing to be heard on the band but fluorescent lights and the arc welders in the metal shop class down the hall. But a minute or two later, there was a guy in New Mexico calling CQ mobile, his blistering 3-Watt converted CB rig booming in ten over nine; then he was drowned out by several DX stations speaking Spanish, and the fun was on.

In all, we made about two hundred contacts and spent a lot of time eavesdropping on as many more. A couple dozen of these were DX on AM, including Zagreb, Hamburg, the Canal Zone, and several from Great Britain. This is nothing compared to what a serious DX station would do in a contest, of course, but it was felt that a leisurely, rag-chewing approach would be more interesting to the students than just trading signal reports for a QSL. Big world and North American maps were kept posted on the wall and on the operating table, with callsign districts marked off with felt markers on plastic overlays. New states and all DX contacts were marked on the maps with little discs of fluorescent orange paper donated by the librarian.

The high points of student interest were a long (1-hour-plus) rag-chew with another high school student in Florida operating a school station (the W4 flatly refused to believe the nine-foot snowbanks the Michigan kids were describing) and another long visit with a G3 in Lancashire. That particular day, the school was celebrating a 1950s revival for a yearbook benefit dance, and the students were all in bobby sox and Fonzie jackets. The English ham was an old rock-and-roll fan from the 50s, and he kept the kids interested with tales of a recent Bill Haley concert, British rock concerts, and soccer riots. The yearbook advisor amazed everybody by copying high speed CW with his trusty layout pencil; he had to switch to a typewriter for copy over 35 wpm, however!

Overall, the project was a resounding success, though there were minor disappointments. The old receiver, while performing admirably on AM, was too touchy to tune SSB and CW satisfactorily, and much good DX may have been missed as a result. CW was also rather disappointing, although a few contacts on 10 were made, and we loaded up the coax and ground radials with a random-wire antenna tuner and managed to work a few Novices on 40 and 15 meters. The other disappointment was that we were unable to hear any OSCAR passes, although several attempts were made.

On the positive side, everybody's winter blahs were temporarily interrupted, and enough interest was raised so that several students expressed interest in getting a Novice ticket. The community enrichment night school decided to offer a licensing class that spring, with eight or ten people ready to sign up.

I have no doubts but that the project was a worthwhile one, and the library staff agreed—despite the noise and cables strung around the room. All the ham-related materials were checked out from the library and remained in high demand for a long time after the lunch-hour station first went on the air. ■

HAM HELP

I need a schematic and/or manual for a Central Electronics Multiphase rf analyzer, Model AM-2. I will copy and return, all postage paid.

Marvin Moss W4UXJ
Box 28601
Atlanta GA 30328

I need info on modifications, hints, kinks, and improvements which may be used on the Radio Shack Model AX-190 ham-band receiver.

John Dolan KA4OXO
PO Box 651 T.S.
Greenville TN 37743

I am in need of an assembly manual for a Mosley quad, Model MCQ-3B. In particular, I need the length of the wire elements.

William P. Smith K3LF
RD #2
Cold Spring Creamery Rd.
Doylestown PA 18901

I need schematics and manuals (both operating and maintenance) for the following equipment:
1. Alltronics Howard Model "L" teletype converter;
2. Heathkit "Twoer" ("Benton Harbor lunchbox");
3. DEI signal monitor, Model SM-7403;
4. Kleinschmidt TT76 and TT98 teletype equipment.

SSG Gary Kohtala WA7NTF
S + F Co., Box 918, USAISD
Ft. Devens MA 01433

CORRECTIONS

The TR-9000's microprocessor is *not* the 6500-based chip mentioned in the August, 1981, review. It is a NEC 650C CMOS microprocessor. This 4-bit device features 80 instructions, a 2000-byte × 8-bit read-only memory, and a 94-byte × 4-bit programmable memory. The same chip (with different ROM memory) is used in Kenwood's TR-2400 and TR-7800.

Paul Schmidt K9PS
Crane IN

Several errors crept into the September and October issues of *73*. Here they are:

- K7NZA's article, "That They Might Communicate," on pages 66-69 in the September, 1981, issue, incorrectly refers to J. C. Buckner as a J. C. Betner. Our apologies to Mr. Buckner.
- Contesters, beginners and experienced alike may want to note several corrections for "The Contest Cookbook" which appeared in the October, 1981, issue. The correct Field Day exchanges are:

CW: "K6ZM 1C EB de WB6CEP K"
Phone: "K6ZM one charlie East Bay from WB6CEP, over"

When discussing rest period strategy, author N60P defined "short contests" as those that are 20 to 30 hours long. This category should also include the mini-contests—even those as short as four hours.

- QSO party enthusiasts will be pleased to know about several new contests that can be added to Table 1 of the article "Controlled Chaos," which appeared in the October, 1981, issue. Alabama holds their event on the fourth weekend in August; out-of-state stations are required to send their state. The second weekend should be reserved for the New Mexico QSO Party. Out-of-state contestants need to relay a serial number and their state.

Changes for Table 1 include the date for the Alabama contest; it's now scheduled for the fourth weekend in August. You can plan on working South Carolina stations the second weekend in March. Finally, the Nebraska square-off has been moved to the fourth weekend of the month listed and Vermont's QSO Party is now on the second weekend of the month listed.

Tim Daniel N8RK
***73 Magazine* Staff**

✓See List of Advertisers on page 130

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.

HICKSVILLE OH
NOV 1

The Defiance County Amateur Radio Club will hold the Defiance County Hamfest and Flea Market on Sunday, November 1, 1981, from 8:00 am to 4:00 pm at the Defiance County Fairgrounds, Hicksville OH. Donations are $1.50 in advance and $2.00 at the gate. There will be free parking, overnight camping (October 31st), and trunk sales space. Doors will be open for setups at 4:00 pm on October 31st, and table space will be available. First prize is a 2m mobile. For hamfest inquiries and table reservations, contact Ed Ballard, Jr., WD8JVV, RR 1, Roland Road, Sherwood OH 43556, or phone (419)-899-4209.

SOUTH GREENSBURG PA
NOV 7

The Foothills ARC will hold its annual swap and shop on Saturday, November 7, 1981, at St. Bruno's Church in South Greensburg PA. Doors will be open from 9:00 am until 3:00 pm. Registration is $2.00 each or 3 for $5.00. All facilities are indoor. Main prize is a Kenwood TS-530S HF rig. First prize is an Icom IC-2A hand-held. Talk-in on 146.07/.67 and 146.52 simplex. For advanced table reservations, phone Chuck Hamman WB3HZM at (412)-837-9194 after 5:00 pm.

SELLERSVILLE PA
NOV 8

The R.F. Hill ARC will hold its 5th annual hamfest on November 8, 1981, in the Sellersville National Guard Armory, Sellersville PA. Doors will open at 7:00 am for sellers and 8:00 am for buyers. There will be a grand prize, door prizes, refreshments, and heat. Talk-in on .28/.88 and .52. For further information, contact R.F. Hill ARC, Box 29, Colmar PA 18915, or Chet Pierson K3TV, Box 336, RFD 1, Greenlane PA 18054.

NORTH HAVEN CT
NOV 8

The Southcentral Connecticut Amateur Radio Association will hold its second annual Electronics Flea Market on Sunday, November 8, 1981, from 10:00 am to 4:00 pm indoors at the North Haven Recreation Center, Linsley Street, North Haven CT. Admission is $1.00; children under 12 will be admitted free when accompanied by an adult. Sellers may set up at 9:00 am; spaces are $5.00. Refreshments will be served and door prizes will be awarded. Talk-in on 146.01/.61 (W1GB). For information about special arrangements for commercial exhibitors or for reservations (make checks payable to SCARA), contact the Southcentral Connecticut Amateur Radio Association, PO Box 81, North Haven CT 06473.

MASSILLON OH
NOV 8

The Massillon ARC will hold its 24th annual auction, Auctionfest '81, on Sunday, November 8, 1981, from 8:00 am to 4:00 pm at the Massillon Knights of Columbus Hall, Cherry Road, Massillon OH. Tickets are $2.50 in advance or $3.00 at the door. The flea market opens at 8:00 am and dealer tables are $3.00 per 8-foot table. The auction, beginning at 11:00 am, will include prizes of a Kenwood TS-130S, a Ten-Tec Argosy 515, and an Icom IC-2AT. Door prizes will be given away hourly. For further information or table reservations, send an SASE to Steve Nevel WD8MIJ, 1864 Massachusetts Avenue SE, Massillon OH 44646.

NEWMARKET ONT CANADA
NOV 14

The York North Amateur Radio Club will hold its fifth annual flea market on Saturday, November 14, 1981, at the Newmarket Community Centre, Newmarket, Ontario. General admission is $1.50, which includes a door prize ticket. Admission for exhibitors is $3.50, which includes a door prize ticket and one table. Additional tables are $2.00 each. The flea market will run from 0800 to 1400 EST, but the doors will be open earlier for exhibitors. Talk-in on 146.52 (VE3YNA) and 147.225/.825 (VE3YRC).

GRAND FORKS ND
NOV 14

The annual FORX ARC Hamfest and Banquet will be held on November 14, 1981, beginning at 9:00 am. The A.V.T.I. and banquet will be at the Ramada Inn. The registration fee for the hamfest is $2.00 and the banquet is $7.50. Talk-in on 146.34/146.94. Contact WB0BNR or KA0HDN, or write WB0BNR, Box 1638, Grand Forks ND 58201.

STONE MOUNTAIN GA
NOV 14-15

The Alford Memorial Radio Club, Inc., will hold its 9th annual Famvention on Saturday and Sunday, November 14-15, 1981, at the Stone Mountain Inn, Stone Mountain GA. Activities include dealer displays and large flea market area. Registration is a $5.00 donation. Talk-in on 146.16/.76 and .52. For further information, contact Carl Nichols K4ZYK, Chairman, 1657 Flicker Drive, Jonesboro GA 30236; phone (404)-478-4515.

FORT WAYNE IN
NOV 15

The Allen County Amateur Radio Technical Society, Inc., will hold the 9th annual Fort Wayne Hamfest on November 15, 1981, from 8:00 am to 4:00 pm at the Allen County Memorial Coliseum, Fort Wayne IN. Admission is $2.50 in advance or $3.00 at the door, with children 11 years old and under admitted free. There will be a large flea market, forums, and door prizes. The Coliseum charges a $1.00 parking fee. Regular tables are $6.00 each and premium tables (on arena perimeter with curtain backdrop, ac power, and personal attention) are $20.00. Talk-in on 146.28/.88. For more information or pre-registration, write Allen County Amateur Radio Technical Society, Inc., Attention: Hamfest Committee, PO Box 10342, Fort Wayne IN 46851.

OAK PARK MI
NOV 29

The Oak Park High School Electronics Club will hold their 12th annual Swap 'n Shop on Sunday, September 29, 1981, from 8:00 am to 4:00 pm at the Oak Park High School, Oak Park MI. There will be door prizes and refreshments. Admission is $1.50 in advance; $2.00 at the door. 8-foot tables are $5.00 in advance; $6.00 at the door. For reservations or more information, send an SASE to Herman Gardner, Oak Park High School, 13701 Oak Park Boulevard, Oak Park MI 48237, or phone (313)-968-2675.

FAIRBAULT MN
DEC 5

The Courage Center Handi-Ham System will hold its annual winter hamfest on Saturday, December 5, 1981, at the Eagles Club, Fairbault MN. There will be a flea market, a dinner at noon, a program, and prizes. For more information, contact Don Franz W0FIT, 1114 Frank Avenue, Albert Lea MN 56007.

HAZEL PARK MI
DEC 6

The 16th annual Hazel Park Amateur Radio Club Swap & Shop will be held on Sunday, December 6, 1981, at Hazel Park High School, Hughes Street at 9½ Mile Road, 1 mile east of I-75, Hazel Park MI. Tickets are $2.00 and tables are 75¢ per foot. Doors will open at 8:00 with the main prize drawing at 2:00 pm. There will be plenty of food and free parking, plus hourly door prizes. Grand prizes are included with the admission ticket. Talk-in on 146.52. For more information, send an SASE to Jack Field W8UPU, 1444 E. Evelyn, Hazel Park MI 48030.

W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

from page 8

strike holding our plane up for connections from the US. We'd avoided the problem in the US by driving to New York for the flight instead of starting from Boston or Manchester, New Hampshire, as we had first planned. Despite the late arrival hour, we were met at the airport by a ham/computer contingent, complete with my ham license and an HT to use with the local repeaters. W2NSD/ZS was on the air!

The next morning, I woke up and opened the curtains of the hotel room . . . to find myself in the middle of a large city, complete with high-rise buildings. It could have easily been Chicago or Philadelphia. I checked in on the 145.650 repeater and talked with a bunch of well-wishers. In minutes, I was being visited by Julius Lieberman ZS6AF, the local ham store owner and Kenwood dealer. He brought up a 2400 HT, charger, and special cube tap to fit the weird power sockets.

The day started out with an interview with the editor of *Computerweek*, followed by an interview for the local paper. Then I recorded a tape to be played over the ham network on Sunday, since I would be out of town at the time and might not be able to call in on the country-wide net. In fact, I was flying at the time of the net, so the taping was a good precaution.

In the afternoon, I visited ZS6AF's shack and managed to hook W2NSD/ZS up with W2NSD/1 in Peterborough . . . plus many more contacts around the US and through Europe. Then Sherry and I went on to dinner with a computer group, enjoying a banquet of South African seafood.

With not a lot happening over the weekend, Saturday was the best time to take off for a couple of days of new country visiting. Dave Sommerville, who runs Rand Electronics, had arranged the flight to Swaziland for us. We met our pilot and Cessna at a nearby airport and then spent an hour trying to get the plane started. That wasn't critical in Johannesburg, but what if the plane turned stubborn in Swaziland? The hope was for the battery to charge up during the flight.

It is difficult to build up a lot of confidence in a plane which takes an hour to jump-start, so perhaps we were a bit unsettled when we finally took off from Johannesburg and headed toward Mbabane, the capital of Swaziland. I had my HT in one hand talking with Dave as we left and my camera in the other taking pictures of Johannesburg from the air. I soon was so wrapped up in making contacts through the various repeaters and snapping pictures of the farm country below that I forgot about the plane problems.

When one thinks of Africa, one normally thinks in terms of dense forests, not flat farmland almost identical to our midwest. South Africa is a big country, so they probably have some forests somewhere, but in the triangle I covered during the next two days it was farmland, farms, and small towns . . . about 800 miles of this.

With 12 million blacks and only 4 million whites, I expected to see some sign of bush-type villages here and there instead of the European (and American) type of settlement. I didn't see anything like that until I crossed over into Swaziland. On the way in, I discovered the Swaziland repeater on 145.650 and contacted 3D6AX, the chap who issues licenses for the country. He told me they had my authorization waiting for me and that it was all okay for me to start signing W2NSD/3D6 as soon as my plane crossed the border. I kept a sharp eye on the flying chart and made him my first 3D6 contact as we went over the border.

Doug Goldman 3D6BG, the proprietor of the Smoky Mountain Hotel, was waiting for us when we landed. Not bad having a hotel owned by a ham . . . complete with a nice ham station on the premises. That's a lot better than carting a big suitcase full of ham gear 25,000 miles, through customs people, and paying about $5 a pound for overweight now and then. Some countries make you put up a bond on ham gear which is more than the value of the equipment, to make sure you don't accidentally leave it behind when you go.

The hotel is made up of a group of small cottages, with a central building for the bar and restaurant. Not being much of a drinker, I can't say about the bar, but the food at the restaurant was right up there with some of the finest places I've visited. Everything was superb! Doug, who built the place himself and trained all of the help, is looking for a buyer so he can travel and take it easy for a while. Running a hotel anywhere is difficult, but in a small country like this there are special problems . . . such as no people with any training at all. He had to teach the locals how to garden so he would have fruit and vegetables for the restaurant . . . and so on.

The night life in Mbabane is at one of the Holiday Inns. There are three of them, with two being right across the road from each other. Two have casinos, so we popped over there to see the action. "The Devil and Miss Jones" was playing . . . it seems that such pictures are forbidden in South Africa, as is gambling, so the South Africans come to Swaziland for their gambling and dirty movies. I dropped a couple of dollars in the slots and thought that was enough of a donation for the well-being of the country.

The next morning, Doug took us for a tour, showing us the king's palace and the compound next to it where the king lives with his 87 wives and 850 children in small native huts. I got out of the car on a hillside to take a picture of the palace and was hassled by a truck driver who stopped and wanted to know from whom I had gotten permission to take that picture. Well, it's a pretty country, but I really don't need hassles like that.

The king, by the way, has been in business for 70 years . . . the longest reigning monarch in history. He's still going strong.

With that, we headed for the airport and my flight to Lesotho. I'll go into that a bit next month, along with some pictures of the trip.

DIGITAL TRANSMISSIONS

After all that fuss to get ASCII legitimized, perhaps it is time for the more experimentally minded to get cracking on digital transmissions. The more I think about this . . . and talk about it . . . the more enthused I get. But let's move as quickly as we can to 9600 baud (murs?) and not horse around with the slow stuff.

Once we get these systems going, we'll have a corking good emergency system right there waiting for us. The idea for having emergency nets set up with the net control polling the net stations automatically, waiting for any traffic to be sent digitally, is exciting. With this system, we can interface the small pocket computers with our rigs, type in a message and its destination, and the rig will take over when polled by net control, dumping the message at 7300 words per minute . . . immediately forwarding it automatically to the addressee. We could increase our traffic-handling capabilities by a thousand times or more.

The startup for this, as I mentioned last month, can be with bulletin-board stations which can be accessed over the air. The caller would specify the transmission speed, whether it be 300, 1200, or 9600 baud. The RBB station would then send the menu and wait for the response. This system is developing rapidly via the telephone these days and could just as easily be implemented over the air. Indeed, the gang here at W2NSD/1 is working on a project to put an RBB service on . . . probably on 14.100 MHz . . . just above the RT group and below the Canadian phone band.

To recap, the idea of a RBB station is that when you call in, you get a menu. Let's say you pick item #1 from the menu, DX news. Then you would get a list of the currently active rare DX stations, their known operating frequencies and times, operator name, QSL information . . . and so on. Bulletin boards are two-way devices, so you would be

able to add to the information if you had any good DX news.

#2 might be a status report on the latest FCC news. It might list the dockets up for discussion and the dates of reply, proposed rule changes, and recent FCC rule changes which have been implemented. #3 might be a listing of hamfests and conventions, with the usual information on when, where, how much, who to contact, and so on. #4 could be a list of coming contests, with data on scoring, rules, where to send logs, and so on. #5 could be a place to list your tentative contest scores for comparison after a contest. #6 could be a list of recent certificates announced. #7 could be satellite schedules...and so it goes. At 9600 baud you can offer a lot of service for a lot of users without running out of time.

For the time being, I'd like to encourage all of the experimentation possible, complete with reports and articles in *73* on the results. Without a lot of articles, we are not going to be able to generate the enthusiasm to make this really work. By the time we've published a couple hundred articles, I think we'll start seeing some commercially-made digital gear appearing...and the beginning of a whole new kind of amateur radio.

If you have any problem getting permission from the FCC for experiments, please let me know about it. As far as I know, they've taken the lid off amateur experimenting...a very welcome relief after all these restrictive years...and we are again able to do some experimenting and pioneering.

It took us about five years to get FM and repeaters popular, starting with the *73 Magazine* push in 1969...and the publishing of hundreds of articles, a lot of books, symposiums all around the country, and so on. Perhaps in five years we will see a similar change as a result of digital communications.

HIGH SCHOOLS

As I pointed out to the people in Brazil and South Africa, the electronics technology of any country is directly proportional to the number of hams in that country. This is why Japan is getting so far ahead of us in many technical areas these days. They have over 500,000 amateurs...the great proportion of whom are active. We have a bit over 385,000 hams, of whom perhaps 50% at the most are active. So we have to sit here and choose between Japanese television sets, video recorders, ham transceivers, HTs, calculators, talking clocks, cameras... and so on.

The answer to the situation is for us to get going with more hams. I frankly view this as an emergency situation for America. The FCC can help by providing rules and a licensing situation which will best encourage the entry of new hams. The ARRL can help by getting as many clubs as possible to think in terms of ham growth. We need to get into a 33% growth pattern, not the present 3%... or even the 11% we had in the 1950s and up until the "incentive licensing" disaster.

The best approach I see to getting things going is to bite the bullet as far as our rules are concerned...and then move ahead with our ham clubs and get into every high school in the country and spread the word.

After over 40 years of hamming, and publishing for 30 of those years, I have to admit that I still don't really understand what it is about amateur radio that grabs kids of 14 and 15 years of age. I know that I was excited about the ability to talk with other people...and that working DX was kind of the ultimate thrill in this line. But I've watched thousands of kids be exposed to the same idea and come away bored. What *is* it? I've had it happen in my own shack. A nearby school sent over a batch of students in the right age group. I put on the show, with a few contacts with Europe and Asia...and nine out of the ten kids yawned and retired to another room where it was less noisy. The tenth couldn't be pried away with ice cream.

If we can ever discover what the button is that gets pushed, perhaps we can start pushing that button in all of the high schools.

Why am I stressing the 14-year-olds? Well, most of the studies of ham licenses have shown that about 50% of all newcomers to amateur radio are either 14 or 15 years old. Further, about 90% of these kids are trapped for life, going into electronics or communications later on as a result of their interest. If you read any magazines or newspapers, you know that Japan is way ahead of us in engineers and technicians...and unless we do something about it there will be no catching up. Well, Japan has been pushing ham radio in their high schools for years and it may be no accident that they are now ahead of us in electronics technology.

The Japanese ham magazines run whole sections of pictures of high school club activities. I wrote about this a few months ago and asked for some pictures from our clubs to encourage this type of development. I'm still waiting for the first picture. That tells me something.

Ham clubs can work with high schools to put on amateur radio demonstrations. They can help to set up clubs, with club members coming in to give talks and theory discussions. They can invite the students to come to club member stations to work some DX, RT, and other ham interests. With the present affluence of kids...and the relatively low cost of a ham station...there isn't a lot of demand for club stations any more. When I was a kid, an AM phone station of any power was a very expensive matter. Heck, the cheapest crummiest ham receiver sold for $30 (about $450 in 1981 dollarettes). I had a medium performance receiver and it ran me about $1,350 in today's Monopoly money. Of course, you had to build your transmitter then... there weren't enough hams to make it worthwhile to sell them commercially (we had only 40,000 hams). But even a modulation transformer for a 500-Watt rig cost about $5,000 in today's money. That's why club stations were popular then.

I'll be talking further with the FCC about this situation...and perhaps something can be done to even get a word into the White House about the need for hams as a genuine American emergency. If we do manage to get into another war, we don't want to have to set up defense contracts with Japan for our electronics equipment.

Just as a reminder...perhaps timely in the face of the "plain language rules" which essentially delete any reference to the reasons for amateur radio to exist as a service...one of the basic reasons for amateur radio, as stated in the old rules, had to do with providing a group of trained electronics people for times of emergency. When WWII came along, we had 50,000 hams and 80% of them went into the armed services. Yes, 80%. Many of these hams went right into military training schools to teach civilians the basics of radio and radar. My class at the Radio Materiel School on Treasure Island, as I have mentioned before, had virtually 100% ham instructors...and a bunch of hams in the classes. That was a super school.

Well, we don't have a war coming up...I hope...but we do have economic warfare right now and it is going strong. This is a war that we are losing. We have already fallen so far behind in our electronics troops (engineers and technicians) that even at a 33% growth rate of hams it will take us until 1990 just to catch up to Japan.

AFRICA IN PERSPECTIVE

Having visited a number of African countries...and boned up on most of the rest of them through books, talks with hams who have worked in them, or via letters from hams living in them...I think I have a good grasp of the overall situation. It is not comforting.

In a great many of the countries, you have an educational situation which has no good solution. After generations... hundreds of years...of tribal living, where the women did most of the work and the men hunted now and then, there is a strong resistance to either work or education on the part of the men.

The next problem is one of leadership. With educational levels so low, there is not a lot of communications between people and thus it is relatively easy for a small group to take over a country. Once in power, they have two main objectives...to stay in power and to get as much out of it as quickly as possible. In one country after another, I've seen aid money from other countries going into the Swiss bank accounts of the rulers and their close buddies...with little ever getting to the people. The rulers have no incentive to make long-range plans to help the country be-

cause they know they will not be around to reap the benefits.

This is not a good situation from the ham point of view because if we are going to get hams in these countries, we are going to have to start with relatively well-educated people. . . and there are very few of these. Then we are going to have to try to interest these few people in amateur radio and spending the time to get further education in electronics. . . all without any help from the government. Further, a ruling regime really doesn't want a bunch of people who are able to have private communications because that makes it too simple for them to plot to take over the country or to organize terrorist acts.

Those of you who have been reading my editorials for any time know that I'm an optimist and that I try to think in terms of solutions to problems. Well, here's one where I have no solutions. I see all but one or two countries in Africa (out of 57) going downhill. . . away from civilization. That doesn't provide much of a prospect for the development of amateur radio.

KAHANER REPORT

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JUST ONE WORD

Like that salesman in the movie "The Graduate," I just want to say one word. No, not plastics.

Deregulation.

It's in the stars for ham radio.

The FCC is on a hands-off kick, not just for amateurs, but for those in all other services: broadcast, common carrier, CB, marine, even business radio. The attitude change was inevitable, and I wish I could say it stemmed from some great karmic enlightenment by the Commission. It didn't. It reflected the FCC's only logical response to rapidly changing technology and, to a lesser extent, a citizenry tired of petty rules.

At one time, conditions forced the FCC to keep a close watch on the airwaves. Unsophisticated radio gear, splattery transmitters, and unselective receivers made everyone's life miserable. Without meaning to do so, communicators and broadcasters continually interfered with each other.

Then came the technology boom. You pulled a switch and talked. You twisted a dial and your receiver picked up only one station, eliminating those around it. Your TV sported automatic fine tuning. All that technology forced the FCC to look at things differently. Not immediately, mind you, but the Commission did finally respond.

For instance, the FCC recently ended the once necessary requirement that a First Class licensee be on hand at a radio or TV station. Unless you're a broadcast engineer who worked like crazy to get his license, you'll have to agree that the ticket really isn't necessary. You turn the station on; you turn the station off. The newer high-technology transmitters rarely go blooey anymore. No need to watch it out of your eye corners. And when major trouble occurs, you call the serviceman. His pocket beeper ferrets him out quickly, even in the deepest, darkest saloon.

The same goes for telephones. AT&T convinced the FCC that no one should be allowed to interconnect any device—such as automatic answerers or speed dialers—to their telephone lines because it would degrade the system. Only Western Electric, Bell's supplier, knew how to build equipment good enough for the sacred network, said AT&T. The FCC bought that argument for quite a while until it finally realized that others could build stuff just as technically sophisticated as Western Electric. It deregulated that part of the common carrier rules now permitting you to connect equipment to your telephone as long as it meets certain specifications.

And while the FCC got comfortable relaxing rules spurred by technology, it embarked on deregulation not necessarily caused by state-of-the-art advances. Radio broadcasters, for example, don't have to adhere anymore to rules which prescribe how much public service time they must air each week or how many commercials they send each hour. It's now up to each station.

Deregulation fever is spreading throughout amateur radio. Several years ago the FCC relaxed rules on log-keeping, mobile identifications, and a few other small items. Everyone seemed to like the changes except some old-timers and, interestingly enough, some just-weaned hams. For reasons only a PhD in sociology understands, these people feel cozy with constrictions and revel in restraints.

No matter; deregulation is in full swing, and a just-released FCC report gives us great insight into where the deregulation future lies for hams.

Now, I'm not much on government reports. Sure, some of them make fun reading, like the GAO studies that show how Congressmen pay two bucks for a haircut because their barbershops are taxpayer subsidized. But this isn't always the case. Most government reports remain dull and dry.

Not so with the FCC report titled "Deregulating Personal and Amateur Radio." It's from the Office of Plans and Policies, the closest thing the FCC has to a think tank. They form projections, raise questions, and suggest innovative, often radical answers to old, crusty problems.

Keep in mind they didn't just issue a "report." That's too banal for OPP. It's officially dubbed a "working paper."

Despite the high-brow moniker, it's written simply, presented so an FCC commissioner can understand it. Although authors Alex Felker and James Brown warn that: "The opinion expressed in this paper is the authors'. They do not necessarily reflect the policies or views of the FCC or any other organization or individual," we know who signs their checks. They're on the same floor as the FCC commissioners.

One of the main points of this 70-page report is that the FCC should eliminate minor rules partly because of new technology, partly because it would encourage new technology.

The paper said: "A number of regulations seem inconsistent with the goals of the amateur radio service. They probably no longer serve any useful purposes either because of technological advances or because they were based in the first place on overly pessimistic predictions of trouble that might arise. Although individually these regulations are not serious constraints to goal achievement, collectively their impact might be significant."

For example, the authors suggested the FCC drop restrictions on automatic repeaters. They indicated that equipment is reliable enough, and the state-of-the-art advanced enough, that any problem—such as a stuck transmitter which so terrifies the FCC—could be handled with little trouble. The present restriction, they said, prevents experimentation with spectrum-efficient techniques such as packet switching, electronic mailboxes, and other digital modes.

One reason the FCC dragged its red-taped feet on allowing hams to send ASCII was that it couldn't monitor transmissions. That argument never held water, the paper suggested, because hams are generally self-regulating, and besides, the FCC hardly listens anyway.

Unfortunately, that same concern still permeates the Commission. When the FCC met earlier this year to discuss whether hams should be allowed to use the new mode known as spread spectrum, Commissioner Abbott Washburn, at first, objected. He said that because the FCC couldn't monitor spread-spectrum transmissions, some hams might operate illegally.

Fortunately, Jim McKinney (who was then Chief of the Field Operations Bureau, now Chief of the Private Radio Bureau) quelled his fears and said hams could be trusted. Subsequently, the Commission issued a notice of inquiry; comments are welcomed and encouraged.

The report emphasized that

the Commission bears responsibility for slowing technical progress. It stated: "If there is criticism of amateurs from not being more technically advanced, it might be misdirected. Perhaps one should place some responsibility on the regulations, not the licensees. Substantially more regulatory flexibility than the service now has would be desirable."

The report also said that the FCC should relax identification requirements to allow amateurs greater opportunity in using new modes without having to sign on and off in Morse code or voice. Some other suggestions included giving Technicians expanded privileges, establishing a digital license (no Morse code needed), and permitting repeaters below 10 meters. In conclusion, the paper said: "It may be too much to ask that regulation take strong affirmative steps to develop new technologies and other new approaches for personal radio. It is not, however, too much to ask that regulation simply not stand in the way of the new."

The paper recommends that the FCC remember one word.

Deregulation.

(Copies of the working paper "Deregulating Personal and Amateur Radio" are available from the Office of Public Affairs, FCC, Room 227, 1919 M St. N.W., Washington DC 20554; (202)-254-7674.)

RTTY LOOP

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It seems as though interest in RTTY has never been higher. Maybe it's the time of year; maybe the computer revolution has something to do with it. I like to think that this column played a significant role in the introduction of RTTY to hams who might otherwise have missed out on this great mode. This month, I am going to respond to the large number of newcomers who have addressed the question of entry into RTTY, particularly using a computer or video-based terminal.

I have a letter here from Zacharias Liangas, who reads *73* at his home in Thessaloniki, Greece. He is interested in RTTY but has several questions regarding RTTY that help to illustrate some basic points.

Zacharias' first question asks for a definition of RTTY and how that differs from SSTV. I think that the confusion in your mind comes from the fact that both modes are transmitted using similar techniques. But there the similarity ends. To begin with, let's look at RTTY. Radioteletype, abbreviated RTTY, is a method of encoding data describing alphanumeric characters by defining two discrete states of a carrier frequency. Since each character is defined by a number of bits, five in the case of Murray code and eight with ASCII (which we shall discuss later), and each bit may be in one of two states—on or off—so the frequency shift is defined. The on state is termed "mark" and the off state is "space." Arbitrarily at first, and later through legislation, what these exact frequencies may be has been well defined.

Looking at audio frequency shift keying, an audio tone of 2125 Hz is normally used as the mark frequency. During the transmission of one character, the frequency is abruptly changed, in step with the pattern of bits defining that character, to the space frequency. Using the long-standing standard of an 850-Hz shift, or difference between mark and space, this would yield a 2975-Hz tone on space. These days, narrower 170-Hz shift is used; in this case, the space would be 2125 + 170 = 2295 Hz.

I realize that this is a very brief explanation of radioteletype, but the thing to keep in mind is that the carrier frequency changes state *abruptly* from mark to space and back again. This shift is in tune with a bit pattern that defines each character to be sent.

Now, SSTV stands for Slow-Scan Television, and, while it also is sent by frequency shift keying, it is an entirely different animal. A television picture is produced by a scanning beam of electrons sweeping across a cathode ray tube, covering the entire viewing surface in one-thirtieth of a second. The intensity of that beam is modulated in order to produce a picture and the faster the beam travels, the faster the modulation must vary in order to keep up, if you will, with the traveling beam. A faster beam thus requires a higher modulating frequency, and commercial TV signals approach four megahertz in bandwidth requirements.

But, if you slow the scan rate so that it takes, say, several minutes to cover the screen, then you can slow the modulating waveform down accordingly, and with it reduce the bandwidth. That is exactly what SSTV does. By sending one picture every eight minutes, rather than thirty per second, the modulating frequency is reduced to the point where it may be superimposed upon an audio carrier. The carrier is then shifted in frequency in order to encode the level of modulation, much as the RTTY signal is shifted. But here, rather than being only on or off, the frequency may vary anywhere between the mark frequency, here defining a black screen, and space, for white.

Now there are some problems. For example, if you sent an SSTV signal out and used a RTTY signal to modulate the carrier, you would be sending out a form of RTTY in SSTV's clothing. That scheme was described recently in *73* as a permissible way to send ASCII over the air before it was fully authorized. But let's avoid the exceptions and deal with the general case, OK? For the sake of this discussion, RTTY is for sending text to a teleprinter and SSTV sends pictures to a TV monitor. Fig. 1 is an attempt to show the mechanics of this transition in graphic format.

Zacharias' next question relates that several shortwave receivers have a RTTY position on their panels. He wonders what that is for and if it is usable on RTTY. Well, recall that we said that RTTY is sent with audio tones. If you put these audio tones into a well-designed sideband transmitter, what would come out over the air would be an rf carrier, shifting in frequency, exactly analogous to the shifting audio tones. This is called FSK, or frequency shift keying, and requires a beat frequency oscillator (bfo) for reception, just as receiving CW does. That is all that RTTY position means, that there is a bfo present which can supply the missing audio tones. It really says nothing about the stability of the receiver, which is vital to its use on RTTY, and assumes the availability of RTTY receiving equipment, such as a demodulator and printer.

The third question deals with a matter of confusing words, in which confusion Zacharias is not alone. He asks what the difference is or relationship between, baud and Baudot. Let me deal with the second word first. Baudot is the common name for the five-bit code we use on RTTY. This code is more properly called the Murray code, or even better, the International Telegraph Alphabet No. 2. But Baudot it has been for forty years, and we try to go with the tide.

Baud is an entirely different matter. Data transmission is measured in a speed related to bits per second. That measure, bits per second, is called "baud." In the case of standard ham-version 60-wpm RTTY, that is 45.45 baud. This derived from the length of one data pulse, 22 ms. If one pulse is 22 ms, then there are 1/.022 = 45.45 pulses per second, or baud. Simple, no?

Another newcomer, Avery Comarow W4OGK, from Great Falls, Virginia, writes of his problems with FSK vs. AFSK input to a sideband transmitter. If you look at the spectrum of SSB

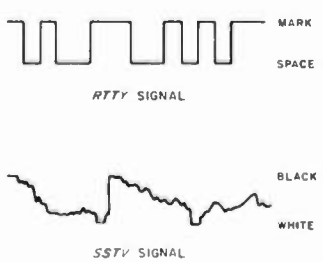


Fig. 1. RTTY vs. SSTV.

transmitters being marketed, you will quickly gain an appreciation of why AFSK is so popular. Many of these rigs either have sealed vfos or have circuits difficult to shift and still maintain stability. That makes a manufacturer of interfacing equipment nervous. So, for such a manufacturer, the most straightforward way to interface with the vast number of rigs out there is to provide a signal that any transmitter can accept—audio. They assume, and you should ensure, that any spurious emissions should be down far enough so as to be legal and not cause trouble.

My advice is that if it is not too much work to directly frequency-shift your transmitter, do it. I think the results are better, and there is less chance of difficulty. By the way, if you do use audio tones, remember to use *lower* sideband to transmit. Audio tones are normally high space, low mark. Using lower sideband reverses this relationship into the common FSK standard low space, high mark. That means that even on twenty, where upper sideband voice prevails, use lower for RTTY.

Avery asks another question which I think the readers of this column might be able to help with. He is looking for objective information on the HAL ST-6000 demodulator. Unable to find any reviews on the TU, he is unwilling to buy it without some impression of the unit. All I can say is that the ST-6000 has a good heritage, through the ST-6 line, and that, examining the manual, it looks like a good demodulator. I certainly would be interested in hearing from users of the ST-6000, pro and con.

A lot of the information covered this month is basic and entry level. The need for more up-to-date material is strong, and there is a new source for this information. Soon the *73* Bookshop section of this magazine will carry the announcement of the *New RTTY Handbook*, about to be published! Containing all kinds of circuits and data, this book covers the gamut of RTTY, from circuit diagrams of machines to computer programs for operating RTTY on the air. Watch for it!

Last December I covered some gift ideas for the RTTYer. I have received quite a few comments on that; watch next month for some more ideas here, in RTTY Loop.

NEW PRODUCTS

DAIWA ANTENNA TUNERS

Daiwa announces two manual antenna tuners for the ham that refuses to compromise on quality!

The CNW-518 is a lightweight, rugged tuner rated at 2.5 kW (PEP), 1 kW CW (50% duty). It will match unbalanced lines from 10 to 250 Ohms impedance and features 80- through 10-meter coverage including the new WARC bands. Attractive styling and planetary gearing provide operating ease and pleasure. Insertion loss is less than .5 dB.

The CNW-418 is rated at 500 Watts (PEP), 200 Watts CW, and incorporates the same features as the CNW-518 except planetary gearing.

Both manual tuners feature the unique Daiwa cross-needle meter that shows forward power, reflected power, and resultant swr at a single glance. Maximize your antenna system performance with these new Daiwa tuners! For more information, contact *MCM Communications, 858 E. Congress Park Drive, Centerville OH 45459.* Reader Service number 479.

MANHATTAN SOFTWARE'S QSO LOG

Manhattan Software's newest release, QSO LOG, will guarantee a reputation for a phenomenal memory for amateur radio operator users. When the operator hears a callsign on the air, he types it into his TRS-80, and all the details of the last contact with his fellow ham flash onto the screen. Written by a ham/computerist, the program has won high praise from hams who have tested it.

QSO LOG remembers all the details—call, name, QTH, date, time, band, RSTs, and notes on the conversation and the contact's equipment. The 16K version holds 70 QSO records and the 32K version holds 190. The program dumps to tape, loads from tape, and allows on-screen review of all QSO records, updating of contact information, editing, and deletion of entries.

Printout is available, with calls sorted by country and US call area, in notebook format for punching and retaining in a 3-ring binder. A disk version will be available in the near future, with immediate random access to QSOs in a disk file and with a much larger capacity for storing calls and QSOs. The cassette version (16K or 32K) will run on Model I or III and is available through dealers or direct from Manhattan Software.

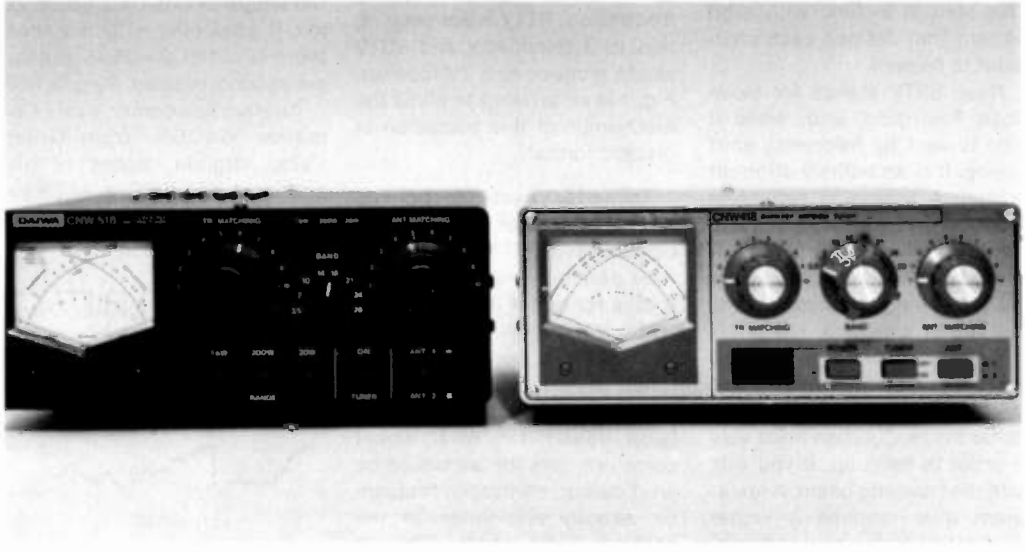
For more information, contact *Manhattan Software, PO Box 1063, Woodland Hills CA 91365.* Reader Service number 485.

SIMPLE TUNER

Simple Tuner is a RTTY tuning aid that uses an array of LEDs to indicate the presence and the frequency of audio tones. The array is organized in 3 rows and 4 columns, each column indicating a different frequency. The first column indicates 2125 Hz, the second 2295 Hz, the third 2550 Hz, and the fourth indicates 2975 Hz. The top and bottom rows are used to show when the tone is too low or too high, and the center row indicates "just right."

This ability to instantly identify 170-Hz, 425-Hz, and 850-Hz shifts, together with the ability to *see* which way to tune your receiver, makes Simple Tuner a tremendous asset to any RTTY station. With practice, you can usually tell whether the signal is "rightside up" or "upside down." Since hearing the tone is not necessary, deaf hams and those with severe hearing loss can now enjoy RTTY.

Simple Tuner is completely external to your TU and requires only audio from your receiver and a simple +5-V and ±12-V regulated power supply. (If you wish, you can use ±12-V



Two manual antenna tuners from Daiwa.

unregulated if you use Simple Tuner as a standalone unit.) The circuit board measures 5" × 7.5". Simple Tuner is designed to mount directly to the front panel of a cabinet and is compatible with the "SS-20" bus.

After a year of continuous use and having shown this unit to many hams and using their input, we are convinced that Simple Tuner represents a real breakthrough that can benefit anyone active in RTTY. For more information, contact *Inotek Engineering, PO Box 110, Spanish Fork UT 84660.* Reader Service number 478.

CURTIS 8044B KEYER CHIP

Not all Morse operators realize there are two basic types of iambic operation used in modern electronic keyers. Type A, offered by the standard Curtis 8044, does not produce a following alternate element when a squeeze is released during an element (an element is a dot or dash). Type B, employed in keyers from AEA, Ten-Tec, Nye, Heath, and others, does produce a following alternate element after squeeze release. For example, in a type A instrument, squeeze release during the dah in the letter "A" will produce just the "A". In a type B unit, the same action will produce an "R". Similarly, in an "N", squeeze release during the dit produces an "N" with type A and a "K" with type B units.

In order to provide for both user groups, Curtis Electro Devices has designed a new IC called the 8044B (8044BM if the speedmeter function is included). Priced the same as the standard 8044 (and 8044M), the new chip is pin-for-pin compatible and can be used in any existing 8044 socket (or 8043 socket with slight modifications). This is good news for operators who trained on the type B models.

For further information, contact *Curtis Electro Devices, Inc., Box 4090, Mountain View CA 94040, or call (415)-494-7223.* Reader Service number 484.

SHACK DESK FROM RICKER

Ricker Equipment, Inc., of Fort Wayne, Indiana, has introduced a new and unique operating desk for use with ham radio equipment and computers called "Shack Desk." It makes use of the space above desktop level more than any other unit on the market.

The Shack Desk is made of wood, with prefabricated uprights and lumber shelves. The shelves are edge-glued, solid lumber designed to carry ham gear weight loads, including linear amplifiers. The standard Shack Desk provides a desktop 30" deep by 36" wide, with 4 shelves above the desktop that are 12" deep and 36" wide. A second 18"-deep shelf 36" wide under the desktop level provides handy storage for reference material. All shelves are vertically adjustable on 2" centers for position, including the desktop level.

The unit is completely open construction at the sides and back for maximum air circulation. Shack Desk offers a fine solution to hams who are working under crowded conditions, making it possible to go up rather than to spread outward.

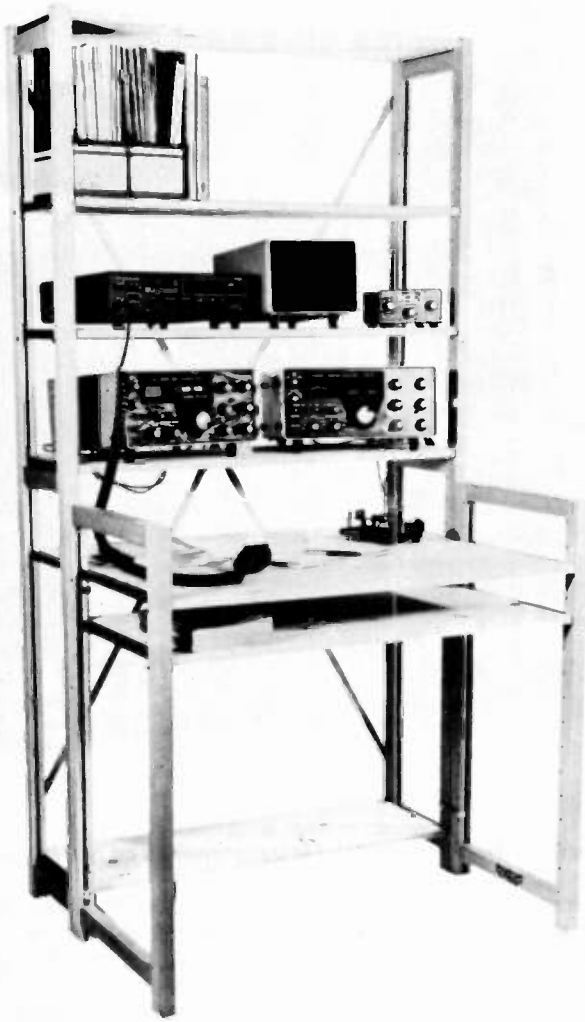
For hams with plenty of space, the unit is also available 42" wide or in double wide units of 72" or 84". An optional side shelf unit may be attached to the desk with 12"-deep shelves top to bottom. These can be used for additional equipment and/or a technical library. Hams with large equipment will appreciate the unit with deep desktop and shelves—the upper shelves are 18" deep and the desktop is 36" × 36". Shack Desk is sold unfinished with the particular finish left up to the individual user, but it is a simple job to put a finish on any unit.

For further information, contact *Ricker Equipment, Inc., PO Box 12304, Fort Wayne, IN 46863; (219)-745-0825.* Reader Service number 488.

DRAKE ESR24

The ESR24 Earth Station Receiver has been introduced by the R.L. Drake Company, Miamisburg, Ohio. This 3.7-4.2 GHz receiver is designed for satellite television reception and features digital channel display, preset and variable audio subcarrier selector, afc for stability, and full metering. For installation versatility, the downconverter module (supplied) may be mounted internally or at the antenna. Accessories for the ESR24 include a remote control, a remote tuning meter, and splash-proof housing. Attractive styling makes the ESR24 suitable for commercial or private installations.

For more information, contact *R.L. Drake Company, 540 Richard Street, Miamisburg OH 45342.* Reader Service number 482.



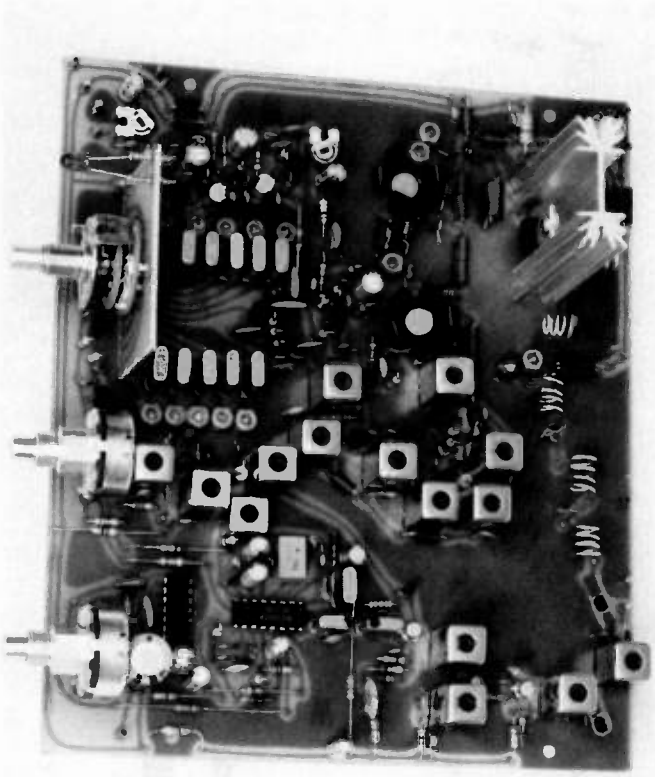
Shack Desk from Ricker Equipment, Inc.

MFJ-1200 CW COMPUTER INTERFACE

The new MFJ-1200 CW Computer Interface converts audio from your receiver to TTL or RS-232 so your computer can "understand" it. It also lets your computer key your transmitter.

When combined with a personal computer and appropriate

ESR24 from R.L. Drake.



Complete Hamtronics VHF FM transceiver all on one PC board.

software, the MFJ-1200 can give you a complete and versatile CW keyboard/reader combination.

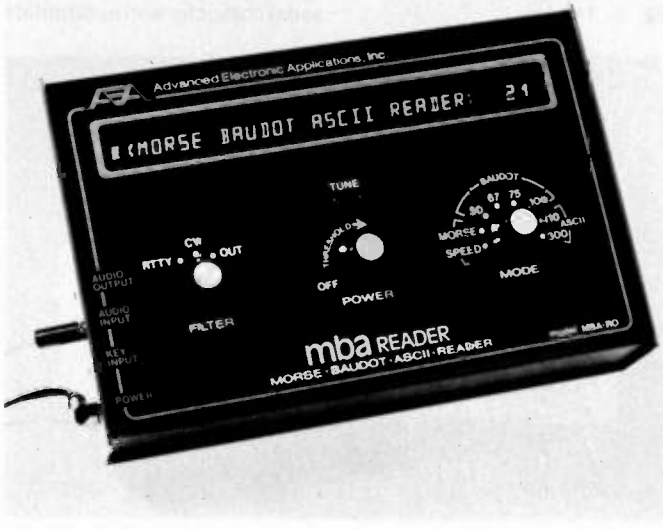
For receiving CW, the MFJ-1200 processes the received CW audio from your rig to provide a clean computer-compatible TTL or RS-232 level signal. The MFJ-1200 limits the noise on incoming CW signals, filters it to remove interfering signals, sends the desired signal through a detection stage, post filters the detected signal (this really works to clean out interference), shapes the signal, and finally converts the level of the signal to TTL or RS-232 so your computer can use it.

For transmitting CW, the MFJ-1200 takes keyboard-generated CW at TTL or RS-232 output levels from your computer and drives high-voltage keying circuits to key your tube or solid-state transmitter (−300 V, 10 mA max., +300 V, 100 mA max.).

The MFJ-1200 has 3 red LEDs to indicate tuning, transmit mode, and power on. A reverse/normal switch will invert the output level to the computer if desired. It operates on 6-9 V dc or 110 V ac with the optional MFJ-1309 ac supply.

The all aluminum cabinet is black and eggshell white and measures 6" × 1-3/4" × 3".

The MFJ-1200 is available from *MFJ Enterprises, Inc., PO Box 494, Mississippi State MS 39762.* Reader Service number 483.



New MBA-RO from AEA.

NEW HAMTRONICS VHF FM TRANSCEIVERS

Hamtronics, Inc., well known for high quality FM transmitter, receiver, and power amplifier modules, now has a complete VHF FM transceiver all on one PC board. The new model FM-5 transceiver kit is available for the 6m, 2m, and 220 MHz ham bands and may also be used in some countries on adjacent commercial bands. It operates on up to 5 channels at 10 Watts output. The receiver uses 10 poles of i-f filtering and dual gate MOSFETs for superior selectivity and crossmod rejection.

By mounting all components, including controls and heat sinks, right on the main PC board, construction is simplified and cost is reduced. Cabinets, microphones, and crystals are readily available as options.

For further information, including a 40-page catalog of all Hamtronics kits, contact *Hamtronics, Inc., 65F Moul Rd, Hilton NY 14468, or phone (716)-392-9430.* (For overseas mailing, please send $2.00 or 5 IRCs.) Reader Service number 480.

MBA™ READER ONLY

C. Mike Lamb, President of AEA, Inc., announced that his firm is introducing a reader for Morse, Baudot, and ASCII operation. Designated the MBA-RO (reader only), he said it is a state-of-the-art device using a 32-character vacuum fluorescent alphanumeric display. Lamb said the 32-character display allows for up to five words to be displayed at one time. This extended display is especially useful during high-speed copy.

The equipment features include speed capabilities of up to 99 wpm for CW copy, 60, 67, 75, and 100 wpm for Baudot, and ASCII at 110 and hand-typed 300 baud. The MBA's designer, Dr. Alan Chandler, said the MBA incorporates automatic speed tracking, ensuring no loss of copy due to rapid speed changes in signal reception. He said the MBA requires a 12 V dc external power supply, making it ideally suitable for portable, mobile, or fixed operation.

Lamb said the MBA reader is an ideal training device because it reinforces audio copy with visual copy.

Specifications are subject to change without notice or obligation. For more information, contact *AEA, Inc., PO Box 2160, Bldg O & P—2006 196th SW, Lynnwood WA 98036.* Reader Service number 481.

MMS1 MORSETALKER TALKING CODE TUTOR

Microwave Modules Ltd. has announced a new Morse code tutor, the MMS1 Morsetalker. The Morsetalker is superior to tapes because it offers instruction tailored to an individual or group's specific needs, yet it doesn't require the presence of an instructor. The Morsetalker is a significant departure from earlier tutors in that it features a voice synthesizer which provides talkback of the Morse after transmission, allowing the student to check his copy. Importantly, the Morsetalker sends completely random code groups, eliminating memorization.

Both beginner and expert are provided for with three different character group lengths—one letter, five letters, or fifty letters (in five-character bursts) before talkback. Once the group is sent, the speech synthesizer "speaks" the letters it previously sent in Morse code. For those who no longer require speech talkback, continuous Morse can be sent.

There are six learning levels—letters only: A-F, A-M, A-U, A-Z; numbers only: 0-9; letters and numbers: 0-Z. Morse can be sent at speeds between 2 and 20 wpm. At speeds below 12 wpm, the Morsetalker employs the Farnsworth method, with the characters sent at 12 wpm and lengthened spacing between letters. A high-speed conversion is available that will send at speeds between 12 and 48 wpm.

The MMS1 is housed in a durable diecast enclosure measuring 7-3/8" by 4-3/4" by 2-1/16". Circuitry includes two micropro-

cessors, two memory chips, and a handful of other ICs and semiconductors. Jacks are available for an external speaker, tape recorder, key, and power at 9 to 13.8 volts at 350 mA. For more information, contact *Spectrum International, Inc., PO Box 1084, Concord MA 01742.* Reader Service number 487.

CUBIC ASTRO C HF TRANSCEIVER

A new HF transceiver is available from Cubic Communications. Priced and designed for military and commercial use, it should nevertheless be ideal for DXpeditioners and other hams who demand a lot from their equipment.

The Astro C is fully synthesized and covers 1.8-30.0 MHz in 100-Hz steps. Frequency selection is accomplished by a VRS scanning system similar to that on the Astro 150, keypad entry, computer control, or an accessory remote control. 100 memory channels are available and will store information on frequency, mode, sideband selection, filter bandwidth, and more. Memory channels may be programmed while the radio is in normal operation without disturbing the frequency you are actually operating on. A 24-hour clock is provided, and a lithium battery will keep it and the memories alive independent of external power for 10 years.

Modes available are full or semi break-in CW, SSB, ISB, AM, RTTY, and SSTV. The solid-state finals are rated for a 100% duty cycle and produce one hundred Watts of output in SSB and CW. The receiver includes such amenities as filters for 2.4, 1.8, and .5 kHz, as well as a 6-kHz filter for AM. A tunable notch filter allows rejection of "tuner-uppers." Frequency stability is claimed to be within .0001%, but an external standard can be used for greater stability.

Wherever ham radio takes you, the Astro C should stand up to it. It weighs in at a reasonable 42 pounds and measures 7 inches high by 17 inches wide by 17 inches deep. Operating temperature range is from −30 to 65 degrees C. It will withstand shock and vibration to MIL-STD 810C. It is weatherproof to MIL-STD 108E, and even the front-panel speaker is waterproof.

The Astro C from Cubic.

Pricewise, the Astro C is out of reach for most amateurs, but Cubic is working on a more reasonably priced ham version that retains most of the Astro C's features to be available next Spring. All indications are that Cubic intends to play a prominent role in the ham market, bringing to bear the sophisticated technology used in their military and commercial equipment. For more information, contact *Cubic Communications, 305 Airport Road, Oceanside CA 92054.* Reader Service number 486.

LETTERS

from page 73

that the more things change the more they stay the same. . . and the beefs don't change either. Tsk. I say balderdash to your sad list of woes.—Wayne.

F.A.R. WINNERS

The Foundation For Amateur Radio has announced the 1981 winners of the eight scholarships which it administers:

- The John W. Gore Memorial Scholarship ($900)—Brian D. Miller KA0DGT, Englewood CO;
- The Richard G. Chichester Memorial Scholarship ($350)—Allyn R. Anderson WB7RVP, Cove OR;
- The QCWA Silent Key Memorial Scholarship ($500)—Stephen Ketler WA1FWA, West Bridgewater MA;
- The QCWA Silent Key Memorial Scholarship ($500)—Gary Myers WA2CUN, Skaneateles NY;
- The Radio Club of America Scholarship ($500)—Carl H. Puckett KA7BWC, Great Falls MT;
- The Edmund B. Redington Memorial Scholarship ($500)—Craig S. Young KA5BOU, Gretna LA;
- The Young Ladies Radio League Scholarship ($300)—Clara L. Muller KA2DYC, Amsterdam NY.

These scholarships were open to all radio amateurs holding at least an FCC General class license or equivalent. This year's applications were received from 29 states, the District of Columbia, and Canada. The Foundation is a nonprofit organization representing forty-nine clubs In Maryland, the District of Columbia, and northern Virginia. It is devoted exclusively to promoting the interest of amateur radio and to the scientific, literary, and educational pursuits that advance the purposes of the Amateur Radio Service.

Information regarding the scholarships to be awarded next year will appear in the April or May issues of the major amateur radio publications.

Hugh A. Turnbull W3ABC
College Park MD

HAM HELP

I wish to express my thanks for putting my request for a power supply and schematic for a AN/PRL9 in your Ham Help section. I was not aware of such a service and I did not request it to be done. I was surprised to get a letter from Bob Bennett, Las Cruces NM, telling me of his power supply for a AN/PRL9. He is going to send me the schematics for it.

Since I'm not a ham, such a help section is very handy to have, especially to me. Again, thanks for your Interest.

Dick Howe
Wesleyville PA

MEETING THE CHALLENGE

Referring to the TVRO challenge (page 6, September): Yes, by all means let's get deeper into this interesting part of electronics. Your July issue with the fine story and photos of the Turks & Caicos Island installation of Coops was tops. . .

Now let's see a flood of TVRO "how to" articles—and while you are at it, how about some 2300 MHz antennas and downconverter construction articles?

Wilbur T. Golson W5CD
Baton Rouge LA

We are ready. How about you?—N8RK.

KL7 SCHOLARSHIPS

The Anchorage Amateur Radio Club is proud to announce that it has established two scholarships—one each at the University of Alaska, Anchorage, and at Anchorage Community College. Each scholarship is for $500/year and will cover tuition and fees for two semesters. The scholarship at UAA is open to all applicants, with preferential consideration going to hams or those active in amateur radio. The one at ACC is likewise unrestricted, although preference will be shown for students in electronics technology.

The club has recently estab-

lished a special scholarship account, with the intent of permanently endowing the scholarship program. At this time, most of the funds come out of the general operating budget of the club. We would like to change that so the interest earned on a special account will cover scholarship costs and have moved toward that objective. While the club members are justly proud of this accomplishment, we would like to invite others to join us in this worthy cause. Any donations received will be placed in the scholarship account and the interest earned from the account will help provide college-level education to young people.

The AARC cordially invites you to join us in this effort. Other clubs might want to help us or even to establish such a scholarship of their own. Individual hams may want to contribute to their local club programs or even to the program here in Anchorage. In any case, the cost is small, but the rewards are great. Contributions may be sent to the address shown below. The club is a tax-exempt organization but cannot accept contributions that are tax deductible.

Imagine having someone in a full and rewarding career who will always remember that radio amateurs helped make that possible.

Steve Norrell KL7IYX
Member, Board of Directors, AARC
5018 Knight's Way
Anchorage AK 99504

HAM HELP

I would like to convert a Knight T-60 6-80m transmitter to sideband operation. Any information about this mod would be appreciated. Also, if anyone needs a Knight T-60 manual for his set, he can contact me.

Kevin Neal
Rte. A, Box 221A
Flippin AR 72634

I would like to purchase several 7094 transmitting amplifier tubes or receive information on where they can be purchased.

Tort Isaacson KØHQW
65 Dellbrook Ct.
O'Fallon MO 63366

I would like to get in touch with hams in Salzburg, Austria. Let me know the frequency, GMT, and date to meet you on the air. I am now waiting for my Novice license, and by the time you read this I should have my General class.

I would also like to get in touch with anyone who has made a weather radar receiver and weather satellite receiver, and anyone who has converted a 40-channel SSB CB to 15 meters.

K. C. Walker
Route 3, Box 97
Rocky Mount NC 27801 USA

Help! Help! I need a schematic for an NCX-5. Thanks.

Kay Clausen WH6AGA
73-1161 Mahilani Dr.
Kailua-Kona HI 96740

Although I am not an amateur operator yet, I would be very grateful for any information on the BC-348-Q, an Army Signal Corps receiver that was used during World War II. I am trying to get one of these going after 40 years of inactivity in a musty, wet basement, for use as a first receiver. I am particularly interested in a schematic and in operation instructions. Does anyone know whether any of this information is available? All I know is that these receivers were for sale as surplus after the war from ads in a postwar radio magazine called *Radio News*. As I said, I would appreciate any information or references from anyone familiar with this piece of equipment.

Steven Lapinskas
University of Lowell
PO Box 2029
Lowell MA 08154

I would appreciate any suggestions on how I could remove the glass lens from an automobile headlight in order to use the remaining reflective surface for solar energy experiments. For safety precautions, I broke the vacuum seal located in the back of the headlight.

Marvin Rosen N3BQA
20 W. Madison St.
Baltimore MD 21201
(301)-685-6308

Has anyone converted the "global" program for calculating the distance between your QTH and any city in the world as described in the December, 1977, *73 Magazine* (page 106) for use with the Radio Shack Pocket TRS-80? The Pocket-80 won't handle 2-letter, or letter-numeric (i.e., AB, 2A) string variables, among other things. Any ideas/help will be appreciated.

Gary Payne KE6CZ
1347 E. Dakota
Fresno CA 93704

I am looking for an CU-286/FRR-33 antenna coupler to complete an AN/FRR-33 radio receiving set. Can someone help me?

Roberto Pieraccini
Via Vittorio Veneto 66
51013 Chiesina Uzzanese
Italy

✓See List of Advertisers on page 130

OSCAR ORBITS

TUNING IN TO OSCAR 8

OSCAR 8 is the only amateur satellite available for everyday communications. Using the satellite for two-way contacts requires a 2-meter signal of about 100 W ERP. This can be achieved either by using a linear amplifier or by erecting a high-gain antenna which is movable in both azimuth and elevation. Such complexities are unnecessary, however, if you simply want to listen to OSCAR 8. In fact, listening to OSCAR 8's 10-meter downlink is a fairly simple procedure and an excellent introduction to the fun of satellite communications. The satellite operates in Mode A (10-meter downlink) on Monday, Tuesday, Thursday, and Friday. The only equipment required is a receiver capable of tuning the high end of the 10-meter band and an omnidirectional antenna or dipole for 10 meters. You will also need some idea of when the satellite is in range. The simple method outlined below will help you determine when to listen for OSCAR 8, and it requires nothing more than a pencil, paper, and a pocket calculator. The method works satisfactorily for all locations in the northern hemisphere.

WHEN AND WHERE

The first step in using the data in the chart of orbital information on this page is to divide a sheet of paper into three columns labeled "Orbit No.," "Time," and "Crossing." Select a day that OSCAR 8 is scheduled to be in Mode A, and write the corresponding orbit number from the chart in your first column. Then get the time and equatorial crossing longitude from the same row of the chart and write them in the second and third columns. You should now have one row of data on your paper, the same data found in the chart for the date you have selected. At this point, you are ready to calculate the equatorial crossing time and longitude for each orbit of the selected day. A pocket calculator will be helpful for this, but even so, the process will be time consuming. We all must make sacrifices in the name of progress!

Now, add 1 to the orbit number and write the result just below the first orbit number. Add 103 minutes (1 hour, 43 minutes) to the original time in row one and write the result in column two of the second row. Finally, add 26 degrees to the longitude in row one and write the result in column three of row two. You should now have two complete rows of data in the homemade table you are constructing. Repeat this procedure, adding 1, 103, and 26 to the most recent numbers in columns one, two, and three until the total in column two exceeds 2400 hours, indicating that you have reached the end of one day's calculations. Whenever the total in column three exceeds 360, simply subtract 360 from the number before writing it into the table. There should be 14 or 15 rows of data in your completed table.

What you have just done is to develop a table showing the orbit number, crossing time, and equatorial crossing longitude for each orbit in the selected day. In essence, you have filled in the gaps in the charts printed in the magazine, which show data for only the first orbit of the day. A new table must be created for each day you plan to listen for OSCAR 8.

We are almost ready to choose a time for listening to OSCAR 8, but you must first determine your longitude. This is easily done by consulting a road map, most of which show longitude and latitude around the perimeter. Now examine your homemade table. Scan the third column, looking for crossing longitudes which are between approximately 10 degrees west of your longitude and 35 degrees east of your longitude. You should find two or three suitable longitudes in your table. When you find them, go across to column two and circle the times corresponding to these longitudes. On the day in question, those are the best times to start listening for OSCAR 8. If you live near the equator, you will begin to hear the satellite a few minutes before the calculated time, while more northerly listeners will hear it after the calculated time.

This is a relatively crude calculation, but it should allow you to hear OSCAR 8 reliably. It is important to remember that the satellite operates on Universal Time (UTC). Thus, when we speak of Monday being a Mode A day, we are referring to Monday UTC, not Monday local time.

WHAT YOU'LL HEAR

The OSCAR 8 10-meter downlink spans the frequency range from 29.400 to 29.500 MHz. A Morse telemetry beacon on 29.400 MHz transmits continuously at 20 wpm, sending coded information about the condition of the satellite. The telemetry consists of several groups of three digits each. Listening for the telemetry beacon is a good way to be sure you are hearing OSCAR 8 and not some other amateur activity on the same frequency.

When the satellite is in range, you will hear many QSOs in progress simultaneously in the 100 kHz that comprises the communications passband. Although satellite users tend to stick to a band plan which calls for CW at one end of the passband and SSB at the other, there is considerable mixing of the modes. OSCAR contacts tend to be short, since the satellite is in range for a maximum of only 20 minutes.

If you have 435-MHz receiving capability, try listening to OSCAR 8's Mode J transponder. Its downlink is 435.100 to 435.200 MHz. Mode J is activated on Saturday, Sunday, Tuesday, and Friday (note that OSCAR 8 is in Modes A and J simultaneously on Tuesday and Friday). The Mode J telemetry beacon can be found at 435.090 MHz.

You may have noticed that Wednesday is not mentioned as either a Mode A or Mode J day. This is because Wednesday is set aside for special experiments and the satellite is not available for normal communications use, although you are welcome to listen to the day's activities.

When listening to OSCAR, you will notice that the frequency of the transmissions from the satellite is constantly changing. This is the famous Doppler shift, caused by the high relative velocity between you and the satellite (thousands of miles per hour!). You will need one hand on the tuning knob almost continuously during an OSCAR 8 pass.

OSCAR represents an exciting opportunity to learn and perfect a new communications technique, and listening will get you started. For more information about amateur satellites, write to the Amateur Satellite Corporation (AMSAT), PO Box 27, Washington DC 20044.—WB8BTH.

ORBITAL INFORMATION

OSCAR 8 ORBITAL INFORMATION FOR NOVEMBER

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
18645	1	0107:45	79.3
18659	2	0111:36	80.3
18673	3	0115:27	81.2
18687	4	0119:18	82.2
18701	5	0123:09	83.2
18715	6	0127:00	84.1
18729	7	0130:51	85.1
18743	8	0134:41	86.1
18757	9	0138:32	87.0
18771	10	0142:23	88.0
18784	11	0003:06	63.2
18798	12	0006:57	64.1
18812	13	0010:48	65.1
18826	14	0014:39	66.0
18840	15	0018:30	67.0
18854	16	0022:21	68.0
18868	17	0026:12	68.9
18882	18	0030:03	69.9
18896	19	0033:54	70.9
18910	20	0037:45	71.8
18924	21	0041:36	72.8
18938	22	0045:27	73.7
18952	23	0049:18	74.7
18966	24	0053:09	75.7
18980	25	0057:00	76.6
18994	26	0100:50	77.6
19008	27	0104:41	78.6
19022	28	0108:32	79.5
19036	29	0112:23	80.5
19050	30	0116:14	81.4

OSCAR 8 ORBITAL INFORMATION FOR DECEMBER

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
19064	1	0120:05	82.4
19078	2	0123:56	83.4
19092	3	0127:47	84.3
19106	4	0131:38	85.3
19120	5	0135:29	86.3
19134	6	0139:20	87.2
19147	7	0000:03	62.4
19161	8	0003:54	63.4
19175	9	0007:45	64.3
19189	10	0011:36	65.3
19203	11	0015:27	66.2
19217	12	0019:18	67.2
19231	13	0023:09	68.2
19245	14	0026:59	69.1
19259	15	0030:50	70.1
19273	16	0034:41	71.1
19287	17	0038:32	72.0
19301	18	0042:23	73.0
19315	19	0046:14	73.9
19329	20	0050:05	74.9
19343	21	0053:56	75.9
19357	22	0057:47	76.8
19371	23	0101:38	77.8
19385	24	0105:29	78.8
19399	25	0109:20	79.7
19413	26	0113:11	80.7
19427	27	0117:02	81.6
19441	28	0120:53	82.6
19455	29	0124:44	83.6
19469	30	0128:35	84.5
19483	31	0132:25	85.5

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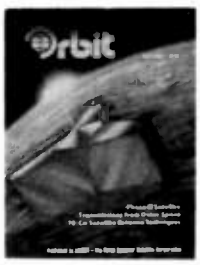

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DX Guide *from page 80*

and WAE Contests, two of the major DX events of the summer months.

The most disturbing part of *The Complete Idiot's Guide to DX,* however, is the inclusion of five pages describing the various sorts of turkeys which inhabit our DX bands. Unfortunately, any DXer finds out about these birds soon enough, and there is no reason to spend this much space airing our dirty laundry and unnecessarily discouraging those who haven't yet found out that the gobble of most turkeys is much worse than their bite. A word of warning would be sufficient; Gregg indulges in overkill in his description of "Amateuris Vulgaris."

We have been assured that the second edition of the book, which should be available shortly, tackles most of these problems.

This book doesn't have all the answers. If you're looking for tail-ending techniques or want to know split-frequency tactics, you'll have to find them elsewhere (preferably by listening to how the big guys do it). But if you want to start out in DXing as painlessly as possible and would like to know at least some of the rules before you join the game, *The Complete Idiot's Guide to DX* will be a very worthwhile investment.■

Micronta *from page 92*

you want to measure (dc volts, ac volts, dc current, or resistance—and a few offer ac current scales). Then you need to select the range within that function, and you might have five or more ranges for some functions. Furthermore, you must have the probe polarity correct for dc measurements or the meter will indicate an error, forcing you to reverse your test probes—a nuisance at best.

The new Radio Shack Micronta LCD Auto-Range Digital Multimeter offers many of the newest DMM features in an under-$100 instrument. A single four-position selector knob allows you to measure dc volts, ac volts, resistance, or dc current with a large 3½-digit floating-decimal-point LCD readout. As you make the measurement, the decimal point moves to the proper position, automatically setting the proper range. You can measure up to 1000 volts on dc, 500 volts rms on ac (accurate to about 15 kHz), dc current up to 200 milliamperes, and up to 2 megohms of resistance. If the test probes are connected "backwards" (reversed polarity), the display shows a minus sign, but the actual readings are unaffected. If you go over-range, the display goes blank except for a "1" on the left side.

A range-hold feature, usually only found on more expensive auto-ranging DMMs, allows you to freeze the decimal point location for additional reading within that range. This saves the time normally required for the meter to seek the correct range. The range-hold feature is enabled by moving the on-off switch to the range-hold position when the desired decimal-point location is displayed. This feature works for ac voltage, dc voltage, and resistance measurements. The current-reading display has only one decimal point location (100.0), and so it appears range-hold would be unnecessary. However, if you go over-range (over 199.9 mA), the decimal point disappears when you come back into range, unless you are in the range-hold condition!

A standard 9-volt battery (alkaline is recommended) powers this DMM, and about 8 milliamperes is drawn from the battery when the DMM is on. A subminiature phone jack is provided for a Radio Shack 65-731 or 273-1431 ac adapter ($4.95, 9 volts dc, subminiature phone plug with positive tip). When the adapter is plugged in, the battery is disconnected. A small "BT" on the left side of the display alerts you to a low-battery condition.

On analog meters, an overload could burn out the meter coil or bend the pointer. Also, most analog multimeters need zero adjustments, and many use mirrors behind the pointer to avoid parallax errors in reading. This DMM has effective overload and transient protection and is precalibrated, so no zero adjustments are required. A miniature 1-Amp fuse is built into the battery compartment to protect the DMM if *voltage* is applied to the probes when measuring current or resistance—a no-no!

The DMM is easy to read, since the digits are 3/8" high. There are four digits, but the first digit is either blank or a 1. Therefore, the maximum reading is 1999, making 2000 the over-range condition. On the voltage and resistance function, the display reads .000 when the unit is turned on and the probes are held together. Therefore, you can effectively read .001 volts (1 millivolt) or 1 Ohm (since the Ohms scale display is kilohms and must be mentally multiplied by 1000). When used to measure dc current, the decimal point is stationary at the 100.0 position, so the lowest current resolution is .1 milliamperes (100 microamperes) and the maximum reading is 199.9 milliamperes.

I found the Micronta Auto-Range DMM very easy to use and easy to read, provided you ignore the decimal point excursions as the DMM seeks the proper range. I was disappointed in the lowest voltage range (2 volts) having only a 1-millivolt resolution. Many recent DMMs have a .2-volt scale, allowing readings down to 100 microvolts. Also, since this DMM has only one current range (199.9 milliamperes maximum), you can't use it for measuring either low microamperes or currents higher than 2 Amps. The resistance scale is limited to 2 megohms maximum, in 1-Ohm increments.

Considering that this DMM includes an LCD readout, the auto-ranging and range-lock features, and overload protection for a comparatively low price, it's still an excellent buy for a general-purpose multimeter. For laboratory use, where high precision is required, you might find an instrument with extended lower ranges necessary.

A rugged gray plastic case, 1-1/8" × 8-7/32" × 4-1/8", houses the approximately one-pound unit. A handy feature is the carrying handle, which swivels down to form a tilt-up stand to hold the DMM at a convenient viewing angle. Test leads are included, but the battery is not. The 12-page manual is easy to follow and includes a complete schematic of the unit. Available from any Radio Shack store or participating dealers as Catalog Number 22-196. Reader Service number 476.■

Daiwa *from page 40*

The switchless, tweakless system is even more useful when pruning antennas or adjusting antenna tuners, particularly when using a solid-state transmitter. As you adjust a tuner, swr can jump way above 3:1, causing the transmitter's swr protection circuits to reduce output power dramatically. Using a typical meter, the reflected power would appear to go down, and you could be tuning for high swr rather than low unless you zero the forward meter every time you tweak the tuner. With the Daiwa meters, no matter how much the power output of your rig varies, you are always looking at an accurate measure of swr.

About the only drawback to the Daiwa meters has been their expense, but that stumbling block has now been removed. There are three compact new meters available, and they are considerably less expensive than their predecessors, which are still available. They are less expensive because they are more limited in the frequency range they cover and offer fewer power ranges. In many applications, these limitations won't make any difference. The new models are the CN520, covering 1.8-60 MHz, the CN540, covering 50-150 MHz, and the CN550, covering 144-250 MHz. Each meter offers two power ranges. 200 and 2 kW at full scale with the CN520, and 20 and 200 Watts with the other two meters. A push-button switch located on top of the meter selects the range. SO-239 antenna connectors are provided on the rear panel. The compact trio did well in the realm of basic performance. Run against a Bird wattmeter, all three meters appeared to be well within the 10% margin of accuracy the manufacturer claims. Although their cabinets are plastic, there wasn't any noticeable increase in RFI floating about the shack when one of the meters was put in-line, and we checked 80-10 meters, six meters, two meters, and 220 MHz.

Conclusions

These meters are small! In many installations the small size will be an advantage—a meter can be squeezed into tiny spaces where nothing else will fit. If your taste runs to RG-8/U or RG-213 for interconnecting equipment, take care to fix the meter in place or you'll find it disappearing over the rear edge of your table, pulled by the weight of the coax.

The cross-needle meter approach to measuring swr is clever yet straightforward and represents a noteworthy advance over the all-pervasive switch and tweak boxes currently found in most of our shacks. For more information, contact *MCM Communications, 858 Congress Park Drive, Centerville OH 45459*. Reader Service number 477. ■

P-310X *from page 52*

pedance is a nominal 50 Ohms. Gain of up to 20 dB is possible, controlled by a front-panel knob over a 15-dB range. The 1.8-54-MHz range is spanned in four discrete segments, selected by a front-panel switch: 1.8-4, 4-10, 10-23, and 23-54 MHz, respectively.

I mentioned the bi-linear feature—when you transmit, a special rf sensing circuit automatically connects the transceiver directly to the antenna, bypassing the preamp. At the end of each transmission, the unit switches back to receive with a slight delay, adjustable from 1/2 to 3 seconds by means of a panel control for various operating modes and operator preferences. This feature makes it unnecessary to be concerned with trying to hook into the transceiver's push-to-talk (PTT) or voice-controlled-transmit (VOX) line to cut the preamp in and out when switching from transmit to receive, or vice-versa. An internal four-transistor circuit takes care of the rf sensing, relay energizing, and variable-delay functions. An "off" position on the delay control not only deactivates the preamp, but also serves to bypass it for those occasions when it isn't needed. An LED on the front panel indicates when the preamp is in-line.

I've alluded to the fact that a receiving preamp may not be a necessary investment for everyone. True, most new receivers and transceivers have excellent sensitivity on all bands, at least when they are factory-new. But after a few years, tubes (if employed) may get weak, circuits go out of tune, noise figures go up—slow processes—but so slowly that one may not realize they are occurring. Hooking up the Palomar or a similar preamp to an old tube-type receiver badly in need of alignment and sitting around gathering dust can be an especially amazing experience.

Even with newer transceivers, performance may be marginal on the top two HF bands—10 and 15 meters. Design compromises are always taken in transceivers and will be further exaggerated as the three new WARC bands are designed into transceivers. The preamp should be particularly effective with those transceivers using the pi-network output of the transmitter section as the receiver's rf stage input. Many such units suffer a pronounced drop-off in sensitivity on 15 and 10, much like their older vacuum-tube brethren. The inclusion of six-meter coverage on the Palomar preamp makes it suitable for pepping up a 50-MHz transceiver as well.

I tried the preamp with a Kenwood TS-180S transceiver and an R-1000 communications receiver, which are no slouches in the sensitivity department. The preamp did not noticeably improve reception on 160, 80, or 40 meters, but did help dig down into the noise for weak-signal DX on the higher bands through 10 meters. This was especially true of the TS-180S on 10. The preamp's inherent rf selectivity was helpful on all bands in reducing signal overload from adjacent or out-of-band signals. This characteristic was very helpful when used with the R-1000, whose slow-recovery agc system occasionally gets bombed with strong signals, and the TS-180S, whose front end occasionally lets through a few spurious, image-like signals.

All things considered, the P-310X did a very creditable job in my shack; in transceive operation, the relay was quiet and positive-acting. Had I had available an old clunker transceiver or receiver on which to experiment, results probably would have been even more impressive. Nevertheless, there were a few minor points that warrant consideration by a prospective purchaser.

It's easy to mistune the unit if one isn't careful. This can result in the image or other spurious frequency ranges being boosted, to the detriment of the desired signal. Tune carefully!

There is no attenuator or

provision for use with a second antenna. The former feature would increase the unit's capability to handle cross-mod and overloading effects, while the latter would add flexibility in connecting, say, a general-coverage receiving antenna without need for an external coax switch. Interestingly, the SWL-oriented receiver preamps (models P-305 and P-308) both include these features; each has a switchable 20-dB attenuator and toggle switch used to select either of two antennas.

An extra rf output for a second receiver would be useful, to allow simple connection of, say, a general-coverage communications receiver and a transceiver to enable the preamp to perform double duty. I use both the TS-180S and R-1000 and have to use a coax switch to take care of this chore. Adding an extra output should be a simple project, as the back panel has space for an extra jack or switch.

Despite the few detractors I mentioned, the Palomar transceiver preamp is a good, dependable, and sturdy unit; it's representative of the generally high quality of the company's accessory product line. Too, the attractive aluminum front panel and vinyl-covered metal case add a good deal of "class." The 2½-pound, 8"×5"×3" P-310X is available from *Palomar Engineers, Box 455, Escondido CA 92025.* ■

IC-730 *from page 76*

however, has power to spare. An output level pot located inside the rig's bottom cover was readjusted to increase output from 110 to 130 Watts on 20 meters (as read on my Drake W4 wattmeter). By the time this report appears in print, I will have readjusted that pot for an exact 100 Watts output and be enjoying the rig's margin of safety. The rf power control mounted concentric with the mike gain directly varies output independent of mike or speech processor level. SSB operators who enjoy QRP operation can reduce power output while maintaining full audio. The 730 drives both my Drake L4B and home-brew "classic-kilowatt" amplifier (December, 1978, *73 Magazine*, pg. 226) to their usual outputs.

A large final amplifier heat sink is affixed to the 730's rear, and a twist-blade fan moves air diagonally across the sink whenever the 730 is in transmit mode. The super cooling seems like a mild overkill, as the sink has yet to become noticeably warm. The manual explains that high sink temperature will cause a thermal sensor to increase the fan's speed, and also keep it on during receive (evidently after a 20-minute transmission into a 3:1 swr!). A barely perceptible wind noise was noticed and cleared by removing the fan/sink rear cover. The cover's removal also permits more efficient cooling. Swr shutdown checks showed full output until 2.5:1. At 2.7:1 swr, the output dropped to 70 Watts, and at 3:1, output decreased to 55 Watts.

During CW operations, the transmit signal is shifted approximately 400 Hz. I compensate for that shift by turning the RIT control two divisions lower in frequency. This maneuver was initially plotted using a second receiver to monitor both sides of a QSO conducted with the 730.

A key must be plugged into the 730 in order to transmit a carrier. I bypass this requirement during mobile operation with a direct-shorted phone plug in the key jack.

Bells and Whistles

The 730's digitalized dual vfo's are fully microprocessor-controlled, and the vfo's may be operated transceive or used for split operations as desired. A single reprogrammable memory is provided for each band. The memory is also tunable, with memory release-and-recall returning operation to the originally stored frequency. One can thus operate a net and chase DX on both CW and SSB portions of a band at the same time. Pushing the rig's write button (without pushing the memory button) will sync both vfo's on one frequency when needed (such as initially hunting, spotting, and calling a DX-pedition upon their "fire-up"). Another button locks tuned frequencies to prevent accidental knob bumps from changing frequency. The tuning knob's tension/drag is also fully adjustable by a screw accessible through a hole in the rig's bottom.

The 730 also features an internal relative power wattmeter (accuracy varies 15 percent of my W4), a very effective speech processor, and an swr bridge. The controls for these units are located beneath an access cover on the rig's top left area. The front-panel meter is thus used to read S-units, alc, rf output, and swr. The "everything-in-one-box" arrangement can't be beat!

Up/down band scanning is possible via an optional microphone. Since I've yet to locate a "scanning mike," I dug into the 730's manual and schematic for details. I had the rig scanning within 10 minutes! The ability to lean back and tune the rig remotely is great, and I'm now planning a keyboard system for entering frequencies directly into the 730's microprocessor.

On the Air

The 730 received its initial checkout during the 1981 Radiosport Contest, and it performed like a DX champ on both CW and SSB. The barefoot rig performed comparably to my TS-120. Switching on the 730's speech compressor added "7 league boots"—and called for reducing rf drive to my amplifier. The increased duty cycle was quite noticeable on the wattmeter, on the amplifier tube plates, and on pileup-cracking ability.

W4CEC and I recently exchanged rigs for a day to evaluate signals. The 730's transmitted signal is quite clean, with ever-so-slightly more high frequency audio response than a TS-820 or 120 (only apparent through direct comparison and knowing the other person's voice). The speech processor adds punch while producing a barely perceptible change in transmitted audio response.

Mobiling with the 730 is sheer pleasure. The quiet receiver and the noise blanker give me the impression I'm in a different auto (my previous rig showed S7 ignition noise; the 730 shows S2 ignition noise).

Conclusion

The Icom 730 is quite a rig for the money. Its numerous features and state-of-the-art technology reinforce my opinion that a new rig is one of today's best dollar values. Icom offers a fairly extensive line of accessories, including matching power supply, external speaker, linear amplifier, and a mobile antenna. For more information, contact *Icom Corporation, 3331 Towerwood Drive, Suite 307, Dallas TX 75234.* ■

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I am Mrs. Ruth Fleischer, wife of former sergeant Martin Fleischer, formerly stationed at Gunter Field, Montgomery, Alabama, serial #32316245, Squadron C-1, 2131 A.A.F. Base Unit.

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We are searching for any personnel stationed at Gunter Field, Montgomery, Alabama, between 1942-1945, so that we may discuss the possible recollection of this accident. They may contact me at the address and telephone number below at my expense.

Perhaps in this endeavor to help Martin, we may be able to help the other GIs he rescued and who were also injured. If you need any documentation that I have for verification of these facts, please communicate with me.

Mrs. Ruth Fleischer
2701 East Utopia Road #110
Phoenix AZ 85024
(602)-867-8092

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Glenn Churchill KA2IOI
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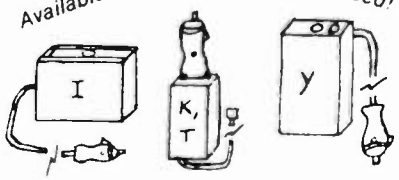

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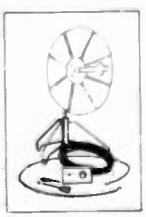

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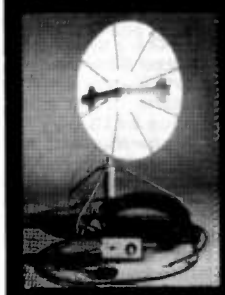

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R-388/URR - 0.5-30.5 Mhz in 30 bands; rackmount. Mil-Collins 51J3; 10½x19x13", 55 lbs. Used, checked: ... **$400.** Manual, partial repro: ... **$10.**

HAMMARLUND SP-600JX - 0.54-54 Mhz AM-CW in seven bands; rackmount. 10½x19x17", 85 lbs. Used, checked: **$285** Manual, partial repro: **$10.**

R-648/ARR-41 - 190-550 Khz and 2-25 Mhz AM-CW in 25 bands; mechanical digital tuning. Requires 24 VDC 4 amps; 7½x16x13¼", 35 lbs. Used, checked: **$205.** Manual, partial repro: ... **$15.**

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✓See List of Advertisers on page 130

Synthesized Hand-Held Scanner!

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The Ultimate Synthesized Scanner!

Allow 30-60 days for delivery after receipt of order due to the high demand for this product.

List price $599.95/CE price **$419.00**

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Bands: 30-50, 118-136 AM, 144-174, 421-512 MHz.

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Bearcat® 300

List price $549.95/CE price $339.00

7-Band, 50 Channel • Service Search • No-crystal scanner • AM Aircraft and Public Service bands. • Priority Channel • AC/DC

Bands: 32-50, 118-136 AM, 144-174, 421-512 MHz.

The *Bearcat* 300 is the most advanced automatic scanning radio that has ever been offered to the public. The *Bearcat* 300 uses a bright green fluorescent digital display, so it's ideal for mobile applications. The *Bearcat* 300 now has these added features: Service Search, Display Intensity Control, Hold Search and Resume Search keys, Separate Band keys to permit lock-in/lock-out of any band for more efficient service search.

NEW! Bearcat® 350

Bearcat® 250

List price $429.95/CE price $269.00

6-Band, 50 Channel • Crystalless • Searches Stores • Recalls • Digital clock • AC/DC Priority Channel • Delay • Count Feature

Frequency range 32-50, 146-174, 420-512 MHz.

The *Bearcat* 250 performs any scanning function you could possibly want. With push button ease you can program up to 50 channels for automatic monitoring. Push another button and search for new frequencies. There are no crystals to limit what you want to hear. A special search feature of the *Bearcat* 250 actually stores 64 frequencies and recalls them, one at a time. Overseas customers should order the *Bearcat* **250FB** at $379.00 each. This model has 220 V AC/12 V DC power supply and 66-88 MHz low band coverage.

NEW! Bearcat® 20/20

List price $449.95/CE price $279.00

7-Band, 40 Channel • Crystalless • Searches AM Aircraft and Public Service bands • AC/DC Priority Channel • Direct Channel Access • Delay

Frequency range 32-50, 118-136 AM, 144-174, 420-512 MHz.

The *Bearcat* 20/20 automatic scanning radio replaces the *Bearcat* 220 and monitors 40 frequencies from 7 bands, including aircraft. A two-position switch, located on the front panel, allows monitoring of 20 channels at a time.

Bearcat® 210XL

List price $349.95/CE price $219.00

6-Band, 18 Channel • 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!

Bearcat® 160

List price $299.95/CE price $184.00

5-Band, 16 Channel • AC only • Priority Dual Scan Speeds • Direct Channel Access

Frequency range: 32-50, 144-174, 440-512 MHz.

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The first no-crystal programmable handheld scanner.

Allow 60-120 days for delivery after receipt of order due to the high demand for this product.

List price $449.95/CE price $299.00

8-Band, 16 Channel • Liquid Crystal Display Search • Limit • Hold • Lockout • AC/DC

Frequency range: 30-50, 138-174, 406-512 MHz.

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The *Bearcat* 100 produces audio power output of 300 milliwatts, is track-tuned and has selectivity of better than 50 dB down and sensitivity of 0.6 microvolts on VHF and 1.0 microvolts on UHF. Power consumption is kept extremely low by using a liquid crystal display and exclusive low power integrated circuits.

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4-Band, 8 Crystal Channels • Lockout • AC only

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Frequency range: 33-47, 152-164, 450-508 MHz.

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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.

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	LF-B6/CFU455H	455KHz +- 1KHz	5.80
	LF-C18	455KHz	10.00
Tokin	CF455A/BFU455K	455KHz +- 2KHz	4.80
Matsushira	EFC-L455K	455KHz	7.00

ROTRON MUFFIN FANS Model Mark 4/MU2A1
These fans are new factory boxed 115vac at 14watts 50/60cps. Impedance Protected-F
CFM is 88 at 50cps and 105 at 60cps. $ 7.99

SPECTRA PHYSICS INC. Model 088 HeNe Laser Tubes.
Power output 1.6mw. Beam Dia. .75mm. Beam Dir. 2.7mr. 8Kv starting voltage
68K ohm 1watt ballast 1000vdc +-100vdc 3.7ma. TUBES ARE NEW $59.99

"AMPLIFIERS"

AVANTEK LOW NOISE AMPLIFIERS

Models	UTC2-102M	AP-20-T	AL-45-0-1	AK-1000M
Frequency Range	30 to 200MC	200 to 400MC	450 to 800MC	500 to 1000MC
Noise Figure	1.5dB	6.5dB	7dB	2.5dB
Voltage	+15vdc	+24vdc	-6vdc @ +12vdc	+12vdc @ -12vdc
Gain	29dB	30dB	30dB	25dB
Power Output	1dB Gain +7dBm	1dB Gain +20dBm	1dB Gain -5dBm	1dB Gain +8dBm
Price	$49.99	$49.99	$49.99	$69.99

Mini Circuits Double Balanced Mixers

Model RAY-3

Very High Level (+23dBm LO) 70KHz to 200MHz LO,RF,DC to 200MHz IF
Conversion Loss,dB One Octave From Band Edge 6Typ./7.5Max. Total Range 6.5Typ./8Max. Isolation,dB Lower Band Edge To One Decade Higher (LO-RF/LO-IF) 55Typ./45Min. Mid. Range (LO-RF/LO-IF) 40Typ./30Min. Upper Band Edge To One Octave Lower (LO-RF/LO-IF) 30Typ./25Min.
Price $24.99

Model TSM-3

Standard Level (+7dBm LO) .1MHz to 400MHz LO,RF,DC to 400MHz IF
Conversion Loss,dB One Octave From Band Edge 5.3Typ./7.5Max. Total Range 6.5Typ./8.5Max. Isolation,dB Lower Band Edge To One Decade Higher (LO-RF/LO-IF) 60Typ./50Min. Mid. Range (LO-RF/LO-IF) 50Typ./35Min. Upper Band Edge To One Octave Lower (LO-RF/LO-IF) 35TYP./25Min.
Price $11.99

Hewlett Packard Linear Power Microwave RF Transistor HXTR5401/35831E

Collector Base Brakedown Voltage at Ic=100ua	35volts min.
Collector Emitter Brakedown Voltage at Ic=500ua	30volts min.
Collector Cutoff Current at Vcb=15v	100ua max.
Forward Current Transfer Ratio at Vce=15v,Ic=15ma	15min,40typ,125max
Transducer Power Gain at Vce=18v,Ice=60ma,F=2GHz.	3dBmin,4dBtyp
Maximum Available Gain at Vce=18v,Ic=60ma,F=1GHz/F=2GHz	14dB typ,8dB typ
Price $29.99	

Motorola RF Power Amplifier Modules

Model	MHW612A	MHW613A	MHW710	MHW720
Frequency Range	146 to 147MHz	150 to 174MHz	400 to 512MHz	400 to 470MHz
Voltage	12.5vdc	12.5vdc	12.5vdc	12.5vdc
Output Power	20watts	30watts	13watts	20watts
Minimum Gain	20dB	20dB	19.4dB	21dB
Harmonics	-30dB	-30dB	40dB	40dB
RF Input Power	400mw	500mw	250mw	250mw
Price	$57.50	$59.80	$57.50	$69.00

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"TRANSISTORS"

WATKINS JOHNSON WJ-M62 3.7 to 4.2GHz Communication Band Double Balanced Mixer $100.00

SSB Conversion Loss	4.9dB Typ. 6dB Max.	fR 3.7 to 4.2GHz	
	5.5dB Typ. 6.5dB Max.	fI DC to 1125MHz	fL fR
		fI 880MHz	fL fR
SSB Noise Fiqure		fR 3.7 to 4.2GHz	
	4.9dB Typ. 6dB Max.	fI 30 to 1125MHz	fL fR
	5.5dB Typ. 6.5dB Max.	fI 880MHz	fL fR
Isolation			
fL at R	30dB Min. 40dB Typ.	fL 2.8 to 5.35GHz	
fL at I	25dB Min. 30dB Typ.	fL 4.5 to 5.35GHz	
	20dB Min. 30dB Typ.	fL 3.6 to 4.5GHz	
	15dB Min. 25dB Typ.	fL 2.8 to 3.6GHz	
Conversion Compression	1dB Max.	fR Level +2dBm	
Flatness	.2dB Peak to Peak Over any 40MHz Segment of fR=3.7 to 4.2GHz		
Third Order Input Intercept	+11dBm	fR1=4GHz fR2=4.01GHz Both at -5dBm	fL=4.5GHz @ +13dBm
Group Time Delay	.5ns Typ. .75ns Max.	fR3.7 to 4.2GHz	fL 3480MHz
VSWR	L-Port 1.25:1 Typ.	2.0:1	fL 2.8 to 5.35GHz
	R-Port 1.25:1 Typ.	2.0:1	fR 3.7 to 4.2GHz fL fR
	1.4 :1 Typ.	2.0:1	fR 3.7 to 4.2GHz fL fR
	I-Port 1.5 :1 Typ.	2.0:1	fI=100MHz
	1.3 :1 Typ.	2.0:1	fI=500MHz
	1.8 :1 Typ.	2.5:1	fI=1125MHz

SGS/ATES RF Transistors			Motorola RF Transistor	
Type.	BFQ85	BFW92	MRF901	2N6603
Collector Base V	20v	25v	25v	25v
Collector Emitter V	15v	15v	15v	15v
Emitter Base V	3v	2.5v	3v	3v
Collector Current	40ma	25ma	30ma	30ma
Power Dissipation	200mw	190mw	375mw	400mw
HFE	40min. 200max.	20min. 150max.	30min. 200max.	30min. 200max.
FT	4GHZ min. 5GHz max.	1.6GHz Typ.	4.5GHz typ.	2GHz min.
Noise Fiqure	1GHz 3dB Max.	500MHz 4dB Typ.	1GHz 2dB Typ.	2GHz 2.9dB Typ.
Price	$1.50	$1.50	$2.00	$10.00

National Semiconductor Variable Voltage Regulator Sale !!!!!!!!!

LM317K	LM350K	LM723G/L	LM7805/06/08/12/15/18/24
1.2 to 37vdc	1.2 to 33vdc	2 to 37vdc	5, 6, 8,12,15,18,24vdc
1.5Amps	3Amps	150ma.	1Amp
TO-3	TO-3	TO-100/TO-116	TO-220/TO-3
$4.50	$5.75	$1.00 $1.25	$1.17 $2.00

P & B Solid State Relays Type ECT1DB72

5VDC Turn On 120VAC Contact 7Amps
20Amps on 10"x10"x.062" Alum.Heatsink with
Silicon Grease $5.00

*May Be Other Brand Equivalent

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"MIXERS"

WATKINS JOHNSON WJ-M6 Double Balanced Mixer

LO and RF 0.2 to 300MHz	IF DC to 300MHz	$21.00
Conversion Loss (SSB)	6.5dB Max. 1 to 50MHz 8.5dB Max. .2 to 300MHz	WITH DATA SHEET
Noise Figure (SSB)	same as above	
Conversion Compression	8.5dB Max. 50 to 300MHz .3dB Typ.	

NEC (NIPPON ELECTRIC CO. LTD. NE57835/2SC2150 Microwave Transistor

NF Min F=2GHz	dB 2.4 Typ.	MAG F=2GHz	dB 12 Typ.	$5.30
F=3GHz	dB 3.4 Typ.	F=3GHz	dB 9 Typ.	
F=4GHz	dB 4.3 Typ.	F=4GHz	dB 6.5 Typ.	

Ft Gain Bandwidth Product at Vce=8v, Ic=10ma. GHz 4 Min. 6 Typ.
Vcbo 25v Vceo 11v Vebo 3v Ic 50ma. Pt. 250mw

UNELCO RF Power and Linear Amplifier Capacitors

These are the famous capacitors used by all the RF Power and Linear Amplifier manufacutures and described in the Motorola RF Data Book.

10pf	22pf	30pf	40pf	100pf	250pf	1 to 10pcs. .60¢ each
13pf	25pf	32pf	43pf	120pf	820pf	11 to 50pcs. .50¢ each
14pf	27pf	33pf	62pf	180pf		51 to 100pcs. .40¢ each
20pf	27.5pf	34pf	80pf	200pf		

NIPPON ELECTRIC COMPANY TUNNEL DIODES

		MODEL 1S2199	1S2200 $7.50
Peak Pt. Current ma.	Ip	9min. 10Typ. 11max.	9min. 10Typ. 11max.
Valley Pt. Current ma.	Iv	1.2Typ. 1.5max.	1.2Typ. 1.5max.
Peak Pt. Voltage mv.	Vp	95Typ. 120max.	75Typ. 90max.
Projected Peak Pt. Voltage mv.	Vpp Vf=Ip	480min. 550Typ. 630max.	440min. 520Typ. 600max.
Series Res. Ohms	rS	2.5Typ. 4max.	2Typ. 3max.
Terminal Cap. pf.	Ct	1.7Typ. 2max.	5Typ. 8max.
Valley Pt. Voltage mv.	VV	370Typ.	350Typ.

FAIRCHILD / DUMONT Oscilloscope Probes Model 4290B

Input Impedance 10 meg., Input Capacity 6.5 to 12pf., Division Ration (Volts/Div Factor) 10:1, Cable Length 4Ft. , Frequency Range Over 100MHz.
These Probes will work on all Tektronix, Hewlett Packard, and other Oscilloscopes.

PRICE $45.00

MOTOROLA RF DATA BOOK

List all Motorola RF Transistors / RF Power Amplifiers, Varactor Diodes and much much more.

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"SOCKETS AND CHIMNEYS"

EIMAC TUBE SOCKETS AND CHIMNEYS

SK110	Socket	$ POR	SK626	Chimney	$ 7.70
SK406	Chimney	35.00	SK630	Socket	45.00
SK416	Chimney	22.00	SK636B	Chimney	26.40
SK500	Socket	330.00	SK640	Socket	27.50
SK506	Chimney	47.00	SK646	Chimney	55.00
SK600	Socket	39.50	SK711A	Socket	192.50
SK602	Socket	56.00	SK740	Socket	66.00
SK606	Chimney	8.80	SK770	Socket	66.00
SK607	Socket	43.00	SK800A	Socket	150.00
SK610	Socket	44.00	SK806	Chimney	30.80
SK620	Socket	45.00	SK900	Socket	253.00
SK620A	Socket	50.50	SK906	Chimney	44.00

JOHNSON TUBE SOCKETS

124-115-2/SK620A	Socket	$ 30.00	124-113	Bypass Cap.	$ 10.00
124-116/SK630A	Socket	40.00	122-0275-001	Socket (For 4-250A,4-400A,3-400Z, 3-500Z)	10.00 2/$15.00

CHIP CAPACITORS

.8pf	10pf	100pf*	430pf
1pf	12pf	110pf	470pf
1.1pf	15pf	120pf	510pf
1.4pf	18pf	130pf	560pf
1.5pf	20pf	150pf	620pf
1.8pf	22pf	160pf	680pf
2.2pf	24pf	180pf	820pf
2.7pf	27pf	200pf	1000pf/.001uf*
3.3pf	33pf	220pf*	1800pf/.0018uf
3.6pf	39pf	240pf	2700pf/.0027uf
3.9pf	47pf	270pf	10,000pf/.01uf
4.7pf	51pf	300pf	12,000pf/.012uf
5.6pf	56pf	330pf	15,000pf/.015uf
6.8pf	68pf	360pf	18,000pf/.018uf
8.2pf	82pf	390pf	

PRICES: 1 to 10 - .99¢ 101 to 1000 .60¢
11 to 50 - .90¢ 1001 & UP .35¢
51 to 100 - .80¢

* IS A SPECIAL PRICE: 10 for $7.50
100 for $65.00
1000 for $350.00

WATKINS JOHNSON WJ-V907: Voltage Controlled Microwave Oscillator $110.00

Frequency range 3.6 to 4.2GHz, Power ouput, Min. 10dBm typical, 8dBm Guaranteed. Spurious output suppression Harmonic (nf_O), min. 20dB typical, In-Band Non-Harmonic, min. 60dB typical, Residual FM, pk to pk, Max. 5KHz, pushing factor, Max. 8KHz/V, Pulling figure (1.5:1 VSWR), Max. 60MHz, Tuning voltage range +1 to +15volts, Tuning current, Max. -0.1mA, modulation sensitivity range, Max. 120 to 30MHz/V, Input capacitance, Max. 100pf, Oscillator Bias +15 +-0.05 volts @ 55mA, Max.

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"TUBES"

TUBES	PRICE
2E26	$ 4.69
2K28	100.00
3B28	5.00
3-500Z	102.00
3-1000Z/8164	300.00
3CX1000A/8283	200.00
3X2500A3	200.00
4-65A/8165	45.00
4-125A/4D21	58.00
4-250A/5D22	68.00
4-400A/8438	71.00
4-400C/6775	80.00
4-1000A/8166	300.00
4CS250R	69.00
4X150A/7034	30.00
4X150D/7035	40.00
4X150G	50.00
4X250B	30.00
4CX250B/7203	45.00
4CX250F/7204	45.00
4CX250FG/8621	55.00
4CX250K/8245	100.00
4CX250R/7580W	69.00
4CX300A	99.00
4CX350A/8321	100.00
4CX350FJ/8904	100.00
4X500A	100.00
4CX600J	300.00
4CX1000A/8168	300.00
4CX1500B/8660	300.00
4CX3000A/8169	300.00
4CX5000A/8170	400.00
4CX10000D/8171	500.00
4CX15000A/8281	700.00
4E27/A/5-123A/B	40.00
4PR60A	100.00
4PR60B/8252	175.00
KT88	15.00
DX362	35.00
DX415	35.00
572B/T160L	44.00
811	10.00
811A	13.00
812A	15.00
813	38.00
4624	100.00
4665	350.00
5551A	100.00
5563A	77.00
5675	15.00

TUBES	PRICE
5721	$200.00
5768	85.00
5836	100.00
5837	100.00
5861/EC55	110.00
5876A	15.00
5881/6L6	5.00
5894/A	45.00
5894B	55.00
6080	10.00
6083/AX9909	89.00
6098/6AK6	14.00
6115/A	100.00
6146	6.00
6146A	6.50
6146B/8298A	7.50
6146W	14.00
6159	11.00
6161	70.00
6291	125.00
6293	20.00
6360	4.00
6524	53.00
6550	7.00
6562/6794A	25.00
6693	110.00
6816	58.00
6832	22.00
6883/8032A/8552	7.00
6884	46.00
6897	110.00
6900	35.00
6907	55.00
6939	15.00
7094	75.00
7117	17.00
7211	60.00
7289/3CX100A5	34.00
7360	11.00
7377	67.00
7486	75.00
7650	250.00
7843	58.00
7868	4.00
7984	12.00
8072	55.00
8121	50.00
8122	85.00
8236	30.00
8295/PL172	300.00

TUBES	PRICE
8462	$100.00
8505A	73.50
8533W	92.00
8560A	55.00
8560AS	57.00
8608	34.00
8624	67.20
8637	38.00
8647	123.00
8737/5894B	55.10
8807	1000.00
8873	260.00
8874	260.00
8875	260.00
8877	533.00
8908	12.00
8916	1500.00
8930/X651Z	45.00
8950	10.00
6BK4C	5.00
6DQ5	4.00
6FW5	5.00
6GE5	5.00
6GJ5	5.00
6HS5	5.00
6JB5/6HE5	5.00
6JB6A	5.00
6JM6	5.00
6JN6	5.00
6JS6B	5.00
6JT6A	5.00
6KD6	5.00
6K66/EL505	5.50
6KM6	5.00
6KN6	5.00
6LF6	6.00
6LQ6	6.00
6LU8	5.00
6LX6	5.00
6ME6	5.00
12JB6A	6.00

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"MICROWAVE COMPONENTS"

MICROWAVE COMPONENTS

AIL	70A	Noise Source	$100.00
AIL	7010	Noise Source .2 to 2.6GHz	100.00
AIL	07050	Noise Source	100.00
AIL	07051	Noise Source 7.05 to 10GHz	150.00
AIL	07091	Noise Source 12.4 to 18GHz	200.00
ARRA	KU520A	Variable Attenuator	100.00
ARRA	2416-20	Variable Attenuator 0-20dB .5 to 1GHz 10w	50.00
ARRA	3614-60X	Variable Attenuator 0-60dB 1 to 2GHz 10w	50.00
ARRA	4684-20C	Variable Attenuator 0-20dB 3 to 4GHz 10w	75.00
ARRA	6684-20F	Variable Attenuator 0-20dB 7 to 11GHz	75.00
Alfred	1151	Sampler Attenuator 1 to 2GHz 0 to 50dB	200.00
Alfred	1152	Sampler Attenuator 2 to 4GHz 0 to 50dB	200.00
Alfred	1153	Sampler Attenuator 4 to 8GHz 0 to 50dB	200.00
Americon	2000-6254	Adapter X to SMA 8.2 to 12.4GHz	75.00
Americon	2020-6600	Directional Coupler .5 to 1GHz 6dB	75.00
Boonton	41-4B	Power Detector	75.00
Coaxial Dynamics	3023	Directional Power Detector 60wfwd/15wrev/225-400mc	50.00
Coaxial Dynamics	3025	Directional Power Detector 60wfwd/15wrev/116-150mc	50.00
FXR/Microlab	CW-A21	Coupler	35.00
FXR/Microlab	XP-A39	Crystal Detector	35.00
FXR/Microlab	S164A	Variable Attenuator 0-50dB 2.6 to 3.95GHz	450.00
FXR/Microlab	N414A	Frequency Meter 3.95 to 11GHz	450.00
FXR/Microlab	601A07	Adapter	35.00
FXR/Microlab	G601B	Adapter	35.00
General Microwave	M402A-3	Power Detector	100.00
General Microwave	M710-20	Directional Coupler 2 to 4GHz 20dB	75.00
General Microwave	4276-2	100:1 Divider 1MC to 250MC	35.00
Hewlett Packard	G281A	Adapter G to N 3.95 to 5.85Gc	50.00
Hewlett Packard	H281A	Adapter H to N 7.05 to 10Gc	35.00
Hewlett Packard	X281A	Adapter X to N 8.2 to 12.4Gc	35.00
Hewlett Packard	MX292B	Adapter 10 to 15Gc	75.00
Hewlett Packard	NK292A	Adapter 15 to 22Gc	75.00
Hewlett Packard	345B	Noise Source IF 30/60Mc	200.00
Hewlett Packard	G347A	Noise Source 3.95 to 5.85Gc	250.00
Hewlett Packard	H347A	Noise Source 7.05 to 10Gc	250.00
Hewlett Packard	S347A	Noise Source 2.6 to 3.95Gc	325.00
Hewlett Packard	X347A	Noise Source 8.2 to 12.4Gc	250.00
Hewlett Packard	349A	Noise Source 100Mc to 4Gc	300.00
Hewlett Packard	355C	Variable Attenuator .5w DC to 1Gc	150.00
Hewlett Packard	360D	Low Pass Filter 4100Mc	50.00
Hewlett Packard	G382A	Variable Attenuator 0 to 50dB 3.95 to 5.85Gc	500.00
Hewlett Packard	J382A	Variable Attenuator 0 to 50dB 5.85 to 8.2Gc	500.00
Hewlett Packard	P382A	Variable Attenuator 0 to 50dB 12.4 to 18Gc	350.00
Hewlett Packard	X382A	Variable Attenuator 0 to 50dB 8.2 to 12.4Gc	325.00
Hewlett Packard	411A-210	N Tee For 411A	35.00
Hewlett Packard	H421A	Crystal Detector 7.05 to 10Gc	50.00
Hewlett Packard	H421A	Crystal Detector 7.05 to 10Gc Matched Pair	200.00
Hewlett Packard	H424A	Crystal Detector 7.05 to 10Gc Matched Pair	400.00
Hewlett Packard	477B	Thermistor Mount For 430 Series 10Mc to 10Gc	75.00
Hewlett Packard	G485A	Barretter Mount 1.95 to 5.85Gc	65.00
Hewlwtt Packard	J485B	Detector Mount 5.85 to 8.2Gc	85.00
Hewlett Packard	J486A	Thermistor Mount 5.85 to 8.2Gc	180.00
Hewlett Packard	H487B	Thermistor Mount 7.05 to 10Gc	50.00
Hewlett Packard	K487C	Thermistor Mount 18 to 26Gc	135.00
Hewlett Packard	P487B	Thermistor Mount 12.4 to 18Gc	155.00
Hewlett Packard	X487A	Thermistor Mount 8.2 to 12.4Gc	65.00
Hewlett Packard	X487B	Thermistor Mount 8.2 to 12.4Gc	85.00
Hewlett Packard	G532A	Frequency Meter 3.95 to 5.85Gc	300.00
Hewlett Packard	H532A	Frequency Meter 7.05 to 10Gc	500.00
Hewlett Packard	J532A	Frequency Meter 5.3 to 8.2Gc	400.00
Hewlett Packard	M532A	Frequency Meter 10 to 15Gc	500.00
Hewlett Packard	P532A	Frequency Meter 12.4 to 18Gc	400.00
Hewlett Packard	X532A	Frequency Meter 8.2 to 12.4Gc	350.00
Hewlett Packard	536A	Frequency Meter .94 to 4.2Gc	600.00
Hewlett Packard	G752D	Directional Coupler 20dB 3.95 to 5.85Gc	200.00
Hewlett Packard	X752A	Directional Coupler 3dB 8.2 to 12.4Gc	200.00
Hewlett Packard	X752C	Directional Coupler 10dB 8.2 to 12.4Gc	200.00
Hewlett Packard	X752D	Directional Coupler 20dB 8.2 to 12.4Gc	200.00
Hewlett Packard	766D	Dual Directional Coupler .94 to 1.975Gc 20dB	50.00
Hewlett Packard	767D	Dual Directional Coupler 1.9 to 4Gc 20dB	50.00
Hewlett Packard	787D	Directional Detector 1.9 to 4.1Gc	200.00
Hewlett Packard	G910B	Termination 3.95 to 5.85Gc	75.00
Hewlett Packard	X914B	Moving Load 8.2 to 12.4Gc	100.00
Hewlett Packard	2830A	Sensor Oscillator	50.00
Hewlett Packard	3503	Microwave Switch 500mc to 12.4Gc SPST	100.00
Hewlett Packard	8431A	Bandpass Filter 2 to 4Gc	200.00
Hewlett Packard	8436A	Bandpass Filter 8 to 12.4Gc	200.00
Hewlett Packard	9471A	RF Detector	75.00
Hewlett Packard	8472A	Crystal Detector .01 to 18Gc	100.00
Hewlett Packard	8732A	Pin Modulator 1.8 to 4.5Gc 80dB	400.00
Hewlett Packard	8733A	Pin Modulator 3.7 to 8.3Gc 35dB	350.00
Hewlett Packard	10100B	Termination 50 ohms	25.00
Hewlett Packard	10855A	Preamp. 2 to 1300Mc	200.00
Hewlett Packard	11660A	Tracking Generator Shunt	50.00
Hewlett Packard	11693A	Limiter	300.00
Hewlett Packard	13510	Transistor Test Jig	150.00
Hewlett Packard	33001C	Pin Absorptive Modulator	200.00
Hewlett Packard	33102A	Microwave Switch 100Mc to 18GHz	100.00
Hewlett Packard	C79-33602A	Microwave Switch DC to 18Gc SPDT	75.00
Hewlett Packard	39098A	Microwave Switch	100.00
Kay	30-0/4320	0 to 101dB Variable Attenuator DC to 1Gc	100.00
Kay	NM781	Noise Source	250.00
Kay	7921A	Noise Source 10 to 900Mc	200.00
Kay	7921A1	Noise Source 10 to 1000Mc	250.00
Lectronic	503A	Tube Mtg./Attenuator and 2K25	50.00
MDL	90LW26-1	X Band Load	50.00
MECA	715-1S2	Directional Coupler 4 to 8Gc 20db (Narda 3044B20)	100.00
Merrimac	AU-26A/	8D1162 Variable Attenuator	75.00
Microtech	214972	Microwave Switch	50.00
Military	AT-68/UPM	Horn Antenna 8.5 to 9.6Gc	25.00
Military	UG-528/U	6dB Attenuator	35.00
Narda	708	Variable Attenuator 0 to 40dB	100.00
Narda	792FM	Variable Attenuator 2 to 2.5Gc 0 to 17dB min. 2.5 to 12.4Gc 0 to 20dB min.	250.00
Narda	2301-20	Directional Coupler 2 to 4Gc 20dB	100.00
Narda	2301-30	Directional Coupler 2 to 4Gc 30dB	100.00
Narda	2366	Variable Directional Coupler 1.2 to 1.4Gc 7 to 12dB	90.00
Narda	2863		
Narda	2864		
Narda	2979	BiDirectional Coupler 4 to 8Gc 20dB	100.00
Narda	3002-10	Directional Coupler .95 to 2Gc 10dB	100.00
Narda	3002-20	Directional Coupler .95 to 2Gc 20dB	100.00
Narda	3003-10	Directional Coupler 2 to 4Gc 10dB	100.00
Narda	3003-30	Directional Coupler 2 to 4Gc 30dB	100.00
Narda	3004-10	Directional Coupler 4 to 10Gc 10dB	

"TEST EQUIPMENT"

TEST EQUIPMENT

Boonton	202J	AM FM Signal Generator 195 to 270MHz	450.00
Boonton	202J/207H	AM FM Signal Generator and Univerter 100KHz to 55Mc and 195 to 270Mc	600.00
CMC	931	Heterodyne Converter 200 to 1200Mc	200.00
Chushman	MCM5	Monitor	750.00
Alfred	8000/7051	Sweep Network Analyzer 100KHz to 40Gc	800.00
Meguro	MSG-2282A	Standard Signal Generator For CB	250.00
Gertsch	FM3	Frequency Meter 20 to 1000Mc	150.00
Systron Donner	1037/1291A	Frequency Meter 0 to 50Mc with Plug In to 500Mc	500.00
Singer	SPA3/25A	Spectrum Analyzer 1Kc to 25Mc and a G-6 Campanion Sweep Generator 0 to 15Mc and PS-19 Power Supply	1500.00
Measurements	65B	Standard Signal Generator 75Hz to 35Mc	250.00
Measurements	140	Standard Devfiation Meter 25 to 1000Mc	200.00
Polarad	MSG-2	Signal Generator 2150 to 4600Mc	500.00
E.H.	574	Microwave Swept Oscillator 8 to 12.4Gc	750.00
Monsanto	1107	Time Interval Plug In	50.00
Military	TS-1011/	UPM84 Spectrum Analyzer 10Mc to 40Gc with 1Each Filter F335/F336/F337/F338/F341/1Each Attenuator CN411/CN410/CN409 and 1Each Adapter UG1239/UG1240/UG1241/UG1242	1800.00
General Radio	805C	Standard Signal Generator 16Kc to 50Mc	300.00
Hewlett Packard	230A	Power Amplifier 10 to 500Mc 4.5watts	400.00
Hewlett Packard	230B	Power Amplifier 10 to 500Mc 4.5watts	800.00
Hewlett Packard	240A	Sweep Generator 4.5 to 120Mc	400.00
Hewlett Packard	410C	VTVM to 700MHz	400.00
Hewlett Packard	415D	SWR Meter	250.00
Hewlett Packard	431B	Power Meter 10Mc to 40Gc	150.00
Hewlett Packard	606A	Signal Generator 50KHz to 65Mc	800.00
Hewlett Packard	608D	Signal Generator 10 to 420Mc	400.00
Hewlett Packard	608C	Signal Generator 10 to 480Mc	500.00
Hewlett Packard	608E	Signal Generator 10 to 480Mc	1500.00
Hewlett Packard	608F	Signal Generator 10 to 455Mc	1500.00
Hewlett Packard	612A	Signal Generator 450 to 1230Mc	500.00
Hewlett Packard	614A	Signal Generator 900 to 2100Mc	500.00
Hewlett Packard	616A	Signal Generator 1.8 to 4.2Gc	400.00
Hewlett Packard	616B	Signal Generator 1.8 to 4.2Gc	500.00
Hewlett Packard	618A	Signal Generator 3.8 to 7.6Gc	400.00
Hewlett Packard	618B	Signal Generator 3.8 to 7.6Gc	500.00
Hewlett Packard	620A	Signal Generator 7 to 11Gc	400.00
Hewlett Packard	623B	Test Set 5925 to 7750Mc	500.00
Hewlett Packard	626A	Signal Generator 10 to 15Gc	2000.00
Hewlett Packard	628A	Signal Generator 15 to 21Gc	2500.00
Hewlett Packard	940A	Frequency Doubler 26.5 to 40Gc	1000.00
Hewlett Packard	3550A	Portable Test Set	1000.00
Hewlett Packard	5245L	Frequency Counter 0 to 50Mc	1000.00
Hewlett Packard	5251A	Plug In For above 20 to 100Mc	100.00
Hewlett Packard	5252A	Plug In For above 100 to 350Mc	200.00
Hewlett Packard	5253B	Plug In For above 50 to 500Mc	350.00
Hewlett Packard	5254B	Plug In For above 200Mc to 3Gc	750.00
Hewlett Packard	5260A	Frequency Divider to 12.4Gc For above	1000.00
Hewlett Packard	5262A	Plug In For above Time Interval	100.00
Hewlett Packard	5327B	DVM and Frequency Meter to 550Mc	1500.00
Hewlett Packard	DY5636	H Band Generator/Test Set 7.1 to 8.5Gc	1000.00
Tektronix	491	Spectrum Analyzer Solid State 10Mc to 40Gc.	7000.00
Micro Tel	MSR903	Microwave Receiver to 40Gc Digital Readout	9000.00
Tektronix	190B	Signal Generator 350KHz to 50Mc	150.00
Telonic	2003	Sweep/Signal Generator Systems 3305 5 to 1500Mc Autoplex.2/3323 1 to 2000Mc Variable Marker,3340 RF/Output Attenuator 50 ohms,3350 RF Detector,3360A Rate Modulation,3370Display Prcoessing.	1000.00
Telonic	2003	Sweep/Signal Generator Systems 3303 5 to 500Mc Sweep,3323 1 to 2000Mc Variable Marker,3343 RF/Output 50 ohms,3340 RF Output/Attenuator 50 ohms,3350 RF Detector,3360A Rate Modulation,3370 Display Processing.	750.00

MICROWAVE COMPONENTS

Narda	3004-20	Directional Coupler 4 to 10Gc 20dB	100.00
Narda	3032	Hybrid .95 to 2Gc 3dB	150.00
Narda	3033	Hybrid 2 to 4Gc 3dB	150.00
Narda	3039-20	Directional Coupler 125 to 250Mc 20dB	150.00
Narda	3040-20	Directional Coupler 240 to 500Mc 20dB	125.00
Narda	3043-20	Directional Coupler 2 to 4Gc 20dB	100.00
Narda	3044-20	Directional Coupler 4 to 8Gc 20dB	100.00
Narda	3044B20	Directional Coupler 3.7 to 8.3Gc 20dB	150.00
Narda	3045C30	Directional Coupler 7 to 12.4Gc 30dB	125.00
Narda	4035	Hybrid 3dB	150.00
Narda	22006/	3043-20 Directional Coupler 1.7 to 4Gc 20dB	100.00
Narda	22007/	3043-30 Directional Coupler 1.7 to 4Gc 30dB	100.00
Narda	22011/	3003-10 Directional Coupler 2 to 4Gc 10dB	100.00
Narda	22012/	3003-30 Directional Coupler 2 to 4Gc 30dB	100.00
Narda	22377	Adapter X to N 8.2 to 12.4Gc	35.00
Narda	22538/	4014-10 Directional Coupler 3.85 to 8Gc 10dB	75.00
Narda	22539/	4015C10 Directional Coupler 7.4 to 12Gc 10dB	85.00
Narda	22540A/	4013C10 Directional Coupler 2 to 4Gc 10dB	75.00
Narda	22574	Directional Coupler 2 to 4Gc 10dB	100.00
Narda	22689	Directional Coupler 15.8 to 17.3Gc	125.00
Narda	22876/	4014C6 Directional Coupler 3.85 to 8Gc 6dB	100.00
Narda	23105/	4015C30 Directional Coupler 7 to 12.4Gc 30dB	100.00
Norsal	14064-30	Directional Coupler 6 to 10Gc 30dB	75.00
PRD	C101	Variable Attenuator 5.85 to 8.2Gc 0 to 60dB	350.00
PRD	U101	Variable Attenuator 12.4 to 18Gc 0 to 60dB	300.00
PRD	205A	Slotted Line with Probe 4 to 10Gc	100.00
PRD	585A	Frequency Meter 8.2 to 10Gc	125.00
PRD	K3414	90° Twist 18 to 26.5Gc	50.00
PRD	5815	Wavemeter 7 to 10.6Gc	75.00
PRD	N6001	Crystal Switch	50.00
PRD	X6284	Thermistor Mount 8.2 to 12.4Gc	125.00
Quantatron	S100	Rodustub Tuner	50.00
RLC	A-2610C	Variable Attenuator	50.00
Radar Design	01536	Directional Coupler	75.00
Sage	752-3	Coupler	25.00
Sage	2503	Mixer	25.00
Sage	7753-3	Directional Coupler 4 to 6Gc 3dB	50.00
Sperry Microline	12G1	Frequency Meter 5.84 to 8.2Gc	200.00
Stoddart	9051$	10dB Attenuator	35.00
Systron Donner	0BE319A	Tunable Detector 18 to 26.5Gc	200.00
Tektronix	S1	Sampling Head	Call
Tektronix	S2	Sampling Head	Call
Tektronix	S50	Pulse Generator Head	Call
Tektronix	B170A	170 ohm Variable Attenuator	50.00
Telonic	TBP417-34-5CD2	Bandpass Filter	15.00
Texscan	SVF250-500-1AA	Tunable Bandpass Filter 250 to 500Mc	250.00
Transco	919C70100	SPDT Switch	25.00
Waveline	601	Adapter X to TNC 8.2 to 12.4Gc	35.00
Waveline	9009-10	Directional Coupler 4 to 10Gc 10dB	100.00
Wavetek	5070	0 to 70dB Variable Attenuator	75.00
Weinschel Eng.	2692	+30 to 60dB Vairable Attenuator	50.00

Microwave Equipment

Manufacture	Model	Description	Price
PRD	219/3302/ 3302L/1106A	20 to 1000MHz Standing Wave Detector and Matched Load	$250.00
Hewlett Packard	805A	Slotted Line 500MHz to 4GHz	200.00
Hewlett Packard	805C	Slotted Line 500MHz to 4GHz	400.00
Hewlett Packard	809B with	806B Slotted Line 3 to 12GHz/G810B Slotted Line 3.95 to 5.85GHz/J810B Slotted Line 5.85 to 8.2GHz/X810B Slotted Line 8.2 to 12.4GHz/P810B Slotted Line 12.4 to 18GHz/ X281A & H281A Adapter/HX292B Tapered Transition/444A Probe 2.6 to 18GHz/and a 447B Probe/H810B Slotted Line 7.05 to 10.5	900.00
Hewlett Packard	809B with	806B Slotted Line 3 to 12GHz/H810B Slotted Line 7.05 to 10.5GHz/X810B Slotted Line 8.2 to 12.4GHz/HX292B Tapered Transition H to X/H281A & X281A/with Probe.	550.00

✓48

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INTEGRATED CIRCUITS

7400 TTL

Part	Price
7400N	.39
7401N	.39
7402N	.39
7403N	.39
7404N	.41
7405N	.41
7406N	.43
7407N	.43
7408N	.41
7409N	.43
7410N	.39
7411N	.39
7413N	.49
7414N	.67
7416N	.43
7417N	.43
7420N	.39
7423N	.44
7425N	.43
7426N	.41
7427N	.41
7430N	.39
7432N	.41
7437N	.41
7438N	.41
7440N	.39
7441AN	1.16
7442N	.69
7443N	.81
7444N	.81
7445N	.93
7446N	1.03
7447N	1.03
7448N	1.03
7450N	.39
7451N	.39
7453N	.39
7454N	.39
7460N	.40
7470N	.62
7472N	.62
7473N	.50
7474N	.49
7475N	.67
7476N	.49
7482N	.63
7483N	.75
7485N	.48
7486N	3.08
7490N	.57
7491N	.69
7492N	.58
7493N	.67
7495N	.64
7496N	.74
74107N	.48
74109N	.49
74121N	.55
74123N	.99
74125N	.64
74126N	.64
74130N	.54
74132N	.70
74141N	1.16
74145N	.89
74147N	1.70
74148N	1.38
74150N	1.36
74151N	.64
74153N	.61
74154N	1.29
74155N	.67
74156N	.67
74157N	.64
74159N	1.75
74160N	.62
74161N	.69
74162N	.81
74163N	.69
74164N	.88
74165N	.97
74166N	.92
74170N	1.94
74173N	1.22
74174N	.89
74175N	.89
74176N	.94
74177N	.94
74180N	.69
74181N	1.98
74182N	1.01
74184N	3.66
74185N	3.66
74190N	1.01
74191N	.94
74192N	1.05
74193N	.89
74194N	.89
74195N	.69
74196N	.80
74197N	.80
74198N	1.74
74199N	1.74
74251N	1.10
74365N	.75
74366N	.75
74367N	.75
74368N	.75
8093N	.64
8094N	.64
8095N	.75
8096N	.75
8097N	.75
8098N	.75
9334N	2.41

74LS00 TTL

Part	Price
74LS00N	.39
74LS01N	.39
74LS02N	.39
74LS03N	.39
74LS04N	.41
74LS05N	.41
74LS08N	.41
74LS09N	.43
74LS10N	.39
74LS11N	.40
74LS12N	.39
74LS13N	.60
74LS14N	.64
74LS15N	.40
74LS20N	.39
74LS21N	.40
74LS22N	.39
74LS26N	.43
74LS27N	.41
74LS30N	.39
74LS32N	.43
74LS37N	.43
74LS38N	.43
74LS40N	.40
74LS42N	.67
74LS47N	1.08
74LS48N	1.08
74LS49N	1.03
74LS51N	.39
74LS54N	.39
74LS55N	.39
74LS73N	.47
74LS74N	.49
74LS75N	.66
74LS76N	.51
74LS78N	.49
74LS83AI	.98
74LS85N	.98
74LS86N	.50
74LS90N	.68
74LS92N	.69
74LS93N	.69
74LS95N	.89
74LS107N	.49
74LS109N	.49
74LS112N	.49
74LS113N	.52
74LS114N	.52
74LS122N	.73
74LS123N	.67
74LS125N	.86
74LS126N	.86
74LS132N	.84
74LS136N	.49
74LS138N	.88
74LS139N	.88
74LS151N	.88
74LS153N	.84
74LS154N	1.40
74LS155N	.88
74LS156N	.88
74LS157N	.88
74LS158N	.88
74LS160N	.93
74LS161N	.89
74LS162N	.89
74LS163N	.89
74LS164N	.89
74LS166N	1.48
74LS168N	1.89
74LS170N	1.64
74LS173N	.84
74LS174N	.70
74LS175N	.70
74LS190N	1.08
74LS191N	1.09
74LS192N	1.01
74LS193N	1.01
74LS194N	1.80
74LS195A	.83
74LS196N	1.39
74LS197N	.94
74LS221N	1.07
74LS240N	1.97
74LS241N	1.97
74LS242N	1.77
74LS243N	1.77
74LS244N	1.40
74LS247N	1.39
74LS248N	1.39
74LS249N	1.39
74LS251N	.74
74LS253N	.73
74LS257N	.74
74LS258N	.74
74LS261N	2.23
74LS266N	.50
74LS279N	.60
74LS283N	.89
74LS290N	.87
74LS293N	1.29
74LS295N	1.29
74LS298N	1.29
74LS324N	1.49
74LS353N	1.49
74LS365N	.82
74LS366N	.82
74LS367N	.82
74LS368N	.82
74LS373N	1.53
74LS374N	1.53
74LS386N	.64
74LS390N	1.89
74LS670N	2.11
81LS95N	1.73
81LS96N	1.73
81LS97N	1.73
81LS98N	1.73

74S00 TTL

Part	Price
74S00N	.50
74S02N	.60
74S03N	.60
74S04N	.53
74S05N	.53
74S08N	.50
74S09N	.60
74S10N	.60
74S11N	.50
74S15N	.50
74S20N	.60
74S22N	.50
74S30N	.60
74S32N	.66
74S40N	.50
74S51N	.60
74S64N	.50
74S65N	.50
74S74N	.67
74S86N	.67
74S112N	.69
74S113N	.67
74S114N	.72
74S133N	.86
74S134N	.64
74S135N	.89
74S136N	1.00
74S138N	.88
74S139N	.96
74S140N	.67
74S151N	1.19
74S153N	1.18
74S157N	1.19
74S158N	1.19
74S160N	2.84
74S161N	3.84
74S162N	3.64
74S163N	3.64
74S174N	1.18
74S175N	1.16
74S181N	6.33
74S182N	2.08
74S188N	2.71
74S194N	2.08
74S195N	2.08
74S196N	2.30
74S197N	2.30
74S200N	7.67
74S206N	7.87
74S240N	2.81
74S241N	2.81
74S242N	3.38
74S243N	3.38
74S244N	3.41
74S251N	1.22
74S253N	1.22
74S257N	1.22
74S258N	1.22
74S280N	2.30
74S283N	3.52
74S287N	2.88
74S288N	3.31
74S289N	4.27
74S373N	3.08
74S374N	3.08
74S387N	2.88
74S470N	4.89
74S571N	4.98
74S572N	4.46
74S573N	8.46
74S940N	3.41
74S941N	3.41

74C00 CMOS

Part	Price
74C00N	.40
74C02N	.40
74C04N	.36
74C08N	.40
74C10N	.40
74C14N	.67
74C20N	.40
74C30N	.40
74C32N	.49
74C42N	.98
74C48N	1.23
74C73N	.61
74C74N	.69
74C76N	.82
74C83N	1.48
74C85N	1.48
74C86N	.36
74C89N	4.94
74C90N	1.12
74C93N	1.12
74C95N	1.37
74C107N	.81
74C150N	3.63
74C151N	2.38
74C154N	3.03
74C157N	2.38
74C160N	1.03
74C161N	1.03
74C162N	1.03
74C163N	1.00
74C164N	1.16
74C165N	1.16
74C173N	.96
74C174N	.94
74C175N	.98
74C192N	1.03
74C193N	1.03
74C195N	1.03
74C200N	6.30
74C221N	1.41
74C240N	1.78
74C373N	2.27
74C374N	2.27
74C901N	.52
74C902N	.52
74C903N	.52
74C904N	.52
74C905N	.52
74C906N	.52
74C907N	.52
74C908N	1.21
74C909N	2.24
74C910N	6.12
74C914N	.98
74C922N	3.83
74C923N	3.83
74C925N	6.98
74C926N	6.67
74C927N	6.87
74C928N	6.87
74C932N	1.14
74C941N	1.80
80C95N	.53
80C96N	.53
80C97N	.67
80C98N	.53
88C29N	1.89
88C30N	1.39

4000 CMOS

Part	Price
4000	.36
4001B	.38
4002B	.38
4006	1.08
4007	.36
4008B	1.08
4009	.47
4010	.67
4011B	.37
4012B	.39
4013B	.40
4014B	.92
4015B	.92
4016B	.46
4017B	.67
4018B	.92
4019B	.67
4020B	.87
4021B	.87
4022B	.94
4023B	.36
4024B	.78
4025B	.36
4027B	.56
4028B	.80
4029B	.96
4030	.45
4031B	1.36
4034B	2.09
4035B	1.07
4040B	.88
4041	.85
4042B	.89
4043B	.87
4044B	.87
4046B	1.01
4047B	.67
4049	.45
4050	.47
4050B	.47
4051B	.84
4052B	.96
4053B	.89
4060B	1.08
4066B	.46
4069	.36
4070B	.36
4071B	.38
4073B	.38
4075B	.36
4076B	.96
4081B	.37
4082B	.38
4089B	1.08
4093B	.84
4099B	1.30
40100B	.67
40160B	1.03
40161B	1.03
40162B	1.03
40163B	1.09
40174B	.84
40175B	.89
40182B	1.03
40193B	1.03
40195B	1.03
4503B	.48
4510B	1.01
4511B	1.12
4512	1.01
4514B	1.89
4516B	1.09
4518B	1.07
4519B	1.07
4520B	.48
4520B	.94
4522B	1.16
4526B	1.19
4527B	1.31
4528B	1.16
4529B	1.39
4541B	1.20
4543B	1.21
4584B	.67
4723B	1.34
4774B	1.34

Micro

Part	Price
DP8212N	1.67
DP8216N	1.42
DP8224N	1.69
DP8226N	1.42
DP8228N	2.30
DP8238N	2.30
DP8300N	.80
DP8303N	3.20
DP8304BN	3.20
DP8307N	3.20
DP8308N	3.30
DP8310N	5.33
DP8311N	5.33
INS8080N	16.49
INS8073N	33.93
INS8080AN	4.69
INS8154N	16.89
INS8251N	6.89
INS8253N	12.27
INS8254N	10.93
INS8256N	6.70
INS8258N	9.24
ISP-8F-382	32.79
MSM5832	6.38

Memory

Part	Price
82S10PC	3.13
1702	6.40
MM2102AN-4L	1.79
MM2114N	2.00
MM2114N-3L	3.70
MM2114N-L	3.20
MM2147N	6.69
MM2708Q	6.69
MM2716Q	7.89
4116N	2.80
MM5257N	5.20
MM5280N-085	2.31
5280N	2.40

A/D & D/A

Part	Price
ADC0800PCN	5.55
ADC0804LCN	5.72
ADC0808CCN	6.14
ADC0816CCN	22.40
ADC0817CCN	13.30
ADC3511CCN	7.60
ADC3711CCN	7.80
ADD3501CCN	8.38
ADD3701CCN	8.38
DAC0800LCN	2.70
DAC0808LCN	2.37
DAC0832LCN	2.80
DAC1020LCN	11.32
DAC1022LCN	7.87

Interface

Part	Price
MC1488N	.90
MC1488AN	.90
MC1489N	.80
75450N	.72
75451N	.69
75452N	.69
75453N	.59
75454N	.59
75491N	.89
75492N	.89
75493N	1.04
75494N	1.04

Linear

Part	Price
LF347N	2.19
LF351N	.67
LF353N	1.13
LF356N	1.40
LF357N	1.40
LF411CN	.98
LF412CN	1.64
LF411CN	.89
LF444CN	2.50
LF13741N	.67
LM301AN	.50
LM307N	.62
LM308N	.75
LM311N	.75
LM317K	4.64
LM317LZ	.93
LM317MP	1.37
LM317T	1.08
LM319N	2.12
LM320MP-5	1.08
LM320MP-8	1.08
LM320MP-9	1.08
LM320MP-6	1.89
LM320MP-12	1.08
LM320MP-15	1.08
LM320MP-24	1.08
LM322N	1.64
LM323K	7.64
LM324N	.76
LM325N	2.41
LM326N	3.41
LM327N	3.41
LM331N	4.30
LM334Z	1.51
LM336Z	1.79
LM336Z 2.5	2.79
LM336Z 5.0	2.39
LM337K	6.88
LM337T	2.44
LM338K	6.78
LM339N	.77
LM340KC-5	2.01
LM340T-5	1.14
LM340T-12	1.14
LM340T-15	1.14
LM341P-5	.98
LM341P-8	.98
LM341P-12	[illegible]

Linear

Part	Price
LM341P-15	[illegible]
LM341P-18	.99
LM341P-24	.89
LM348N	1.11
LM349N	1.09
LM350K	7.76
LM350T	4.74
LM358N	.86
LM376N	.80
LM377N	1.49
LM378N	2.44
LM379S	3.79
LM380N-8	1.16
LM381N	1.91
LM382N	1.41
LM383AT	3.83
LM386N-1	.86
LM387N	.80
LM392N	.67
LM395T	2.54
LM555CN	.65
LM556CN	1.04
LM565CN	1.30
LM566CN	2.17
LM567CN	1.30
LM709CN	.79
LM723CN	.69
LM733CN	1.10
LM741CN	.66
LM747CN	.79
LM748CN	.69
LM1310N	1.69
MC1458N	1.10
LM1458N	.62
LM1488N	1.18
LM1800N	1.21
LM1801N	1.79
LM1812N	6.12
LM1830N	1.66
LM1889N	2.40
LM2111N	1.64
LM2907N	2.88
LM2917N-8	2.32
LM2901N	2.08
LM2917N-8	2.07
LM3046N	.39
LM3080N	.79
LM3086N	1.70
LM3301N	[illegible]

Linear

Part	Price
LM3524N	4.46
LM3900N	.66
LM3905N	1.46
LM3909N	.89
LM3911N	1.02
LM3914N	3.25
LM3915N	3.25
LM3916N	3.25
LM7805CK	2.01
LM7805CT	1.74
LM7812CT	1.24
LM7815CT	1.24
LM78L05ACZ	.41
LM78L08ACZ	.41
LM78L12ACZ	.41
LM78L15ACZ	.41
LM78L18ACZ	.41
LM78L24ACZ	.41
LM7905CT	1.27
LM7908CT	1.27
LM7908CT	1.27
LM7912CT	1.27
LM7915CT	1.27
LM7918CT	1.27
LM7924CT	1.27
LM13600N	2.04

TEXAS INSTRUMENTS I.C. SOCKETS

SOLDER TAIL DIP SOCKETS

- Low profile
- Face grip design for maximum retention force
- Redundant contact points
- YOUR CHOICE — TIN OR GOLD*
  (*Minimum of 50 microinches gold inlay on gold sockets)
- TEXAS INSTRUMENTS QUALITY

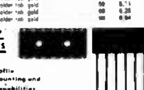
TIN INLAY SOLDER TAIL — Min. 200 Microinches Tin

Part No	Description	1	10	100
C8508	8 pin solder tab tin	.13	1.16	9.45
C8514	14 pin solder tab tin	.22	2.03	16.58
C8516	16 pin solder tab tin	.26	2.33	18.05
C8518	18 pin solder tab tin	.29	2.60	21.29
C8520	20 pin solder tab tin	.32	2.92	23.85
C8522	22 pin solder tab tin	.35	3.19	26.18
C8524	24 pin solder tab tin	.38	2.49	28.88
C8528	28 pin solder tab tin	.44	4.05	33.09
C8540	40 pin solder tab tin	.63	5.78	47.26

GOLD INLAY SOLDER TAIL — Min. 30 Microinches Gold

Part No	Description	1	10	100
C9508	8 pin solder tab gold	.29	2.67	21.83
C9514	14 pin solder tab gold	.34	3.11	25.43
C9516	16 pin solder tab gold	.38	3.56	29.25
C9518	18 pin solder tab gold	.44	4.02	32.88
C9520	20 pin solder tab gold	.49	4.46	36.48
C9522	22 pin solder tab gold	.54	4.53	40.05
C9524	24 pin solder tab gold	.59	5.11	43.85
C9528	28 pin solder tab gold	.69	6.25	51.06
C9540	40 pin solder tab gold	.98	8.94	73.12

WIRE WRAP DIP SOCKETS



- Standard profile
- Universal mounting and packaging capabilities
- Contacts accommodate .015" through .021" rectangular or round dual in line leads
- Wire wrap posts hold to true position of .015" providing a true position of .020" on boards for efficient automatic wire wrapping
- YOUR CHOICE — TIN OR GOLD*
  (*Minimum 10 microinch gold inlay on gold sockets)
- TEXAS INSTRUMENTS QUALITY

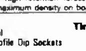
TIN PLATED WIRE WRAP — Min. 100 Microinches Tin

Part No	Description	1	10	100
C8108	8 pin wire wrap tin	.38	3.38	30.00
C8114	14 pin wire wrap tin	.50	4.50	40.00
C8116	16 pin wire wrap tin	.57	5.11	46.00
C8118	18 pin wire wrap tin	.69	6.23	56.40
C8120	20 pin wire wrap tin	.76	6.84	60.80
C8122	22 pin wire wrap tin	.83	7.46	66.20
C8124	24 pin wire wrap tin	.81	8.17	72.60
C8128	28 pin wire wrap tin	1.04	9.36	83.20
C8140	40 pin wire wrap tin	1.42	12.79	113.60

GOLD INLAY WIRE WRAP — Min. 10 Microinches Gold

Part No	Description	1	10	100
C9108	8 pin wire wrap gold	.59	4.60	43.20
C9114	14 pin wire wrap gold	.79	6.89	61.43
C9116	16 pin wire wrap gold	.89	7.70	69.30
C9118	18 pin wire wrap gold	.99	8.25	83.25
C9120	20 pin wire wrap gold	1.18	10.20	91.80
C9122	22 pin wire wrap gold	1.34	11.15	100.20
C9124	24 pin wire wrap gold	1.38	12.20	110.70
C9128	28 pin wire wrap gold	1.59	14.08	126.45
C9140	40 pin wire wrap gold	2.29	18.45	176.05

Solder Tail Single Beam Dip Sockets



Body — 94 V-O polyester with Copper Alloy contacts. Accommodates standard IC leads up to .014" thick and .025" wide. Contact is designed and oriented to the insulator to grasp the broad "face" of the IC lead, allowing for low insertion and high retention forces. Socket is designed to achieve maximum density on boards.

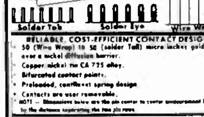
TIN — Tin Plated Solder Tail Single Beam Low Profile Dip Sockets — Tin Plated 200 Microinch Min. -40° to +75°C

Pins	Part No.	1	10	100
8	C8808	.10	.88	8.00
14	C8814	.17	1.53	14.00
16	C8816	.20	1.79	16.00
18	C8818	.22	1.89	18.00
20	C8820	.25	2.21	20.00
22	C8822	.27	2.43	22.00
24	C8824	.30	2.66	24.00
28	C8828	.35	3.11	28.00
40	C8840	.49	4.41	40.00

GOLD — Gold Inlay Solder Tail Single Beam Low Profile Sockets — Gold Plated 50 Microinch Min. -65° to +125°C

Pins	Part No.	1	10	100
8	C9808	.26	2.49	22.00
14	C9814	.32	2.81	25.00
16	C9816	.37	3.26	29.00
18	C9818	.42	3.72	33.00
20	C9820	.47	4.18	37.00
22	C9822	.50	4.50	40.00
24	C9824	.54	4.84	43.00
28	C9828	.63	5.63	50.00
40	C9840	.80	8.10	72.00

TEXAS INSTRUMENTS GOLD EDGEBOARD CONNECTORS



RELIABLE, COST-EFFICIENT CONTACT DESIGN

- 50 (Wire Wrap) to 50 (Solder Tail) micro inches gold inlay over a nickel diffusion barrier.
- Copper nickel tin CA 725 alloy.
- Bifurcated contact points.
- Preloaded, cantilevered spring design.
- Contacts are user removable.

NOTE — Dimensions below are the pin center to center measurement followed by the distance separating the two pin rows.

H4 SERIES .100"x.200" EDGEBOARD CONNECTORS

Positions/Contacts	Part No. Wire Wrap	1	10	100	Part No. Solder Tail	1	10	100
10/20	C6-10	2.27	20.40	167.00	C5-10	2.10	11.30	156.00
15/30	C6-15	2.55	73.40	191.00	C5-15	2.37	21.70	178.00
17/34	C6-17	2.73	25.00	205.00	C5-17	2.32	23.70	189.00
18/36	C6-18	2.88	26.40	216.00	C5-18	2.41	23.90	196.00
20/40	C6-20	3.09	28.30	232.00	C5-20	2.76	25.30	207.00
22/44	C6-22	3.36	30.80	252.00	C5-22	2.97	27.20	223.00
25/50	C6-25	3.75	34.40	281.00	C5-25	3.27	30.00	245.00
28/56	C6-28	3.99	36.60	299.00	C5-28	3.54	32.50	266.00
30/60	C6-30	4.14	38.00	311.00	C5-30	3.75	34.40	281.00
31/62	C6-31	4.32	39.60	324.00	C5-31	3.84	35.20	288.00
35/70	C6-35	4.89	44.80	367.00	C5-35	4.20	38.50	315.00
36/72	C6-36	4.95	45.40	371.00	C5-36	4.32	39.60	324.00
40/80	C6-40	5.49	50.30	412.00	C5-40	4.71	43.20	353.00
43/86	C6-43	5.91	54.20	443.00	C5-43	4.98	45.70	374.00
49/98	C6-49	6.72	61.40	504.00	C5-49	5.58	51.20	419.00
50/100	C6-50	6.81	62.40	511.00	C5-50	5.64	51.70	423.00

For polarizing keys order P/N C811 64-2 10 ea 7.50 100

H4 SERIES .125"x.250" EDGEBOARD CONNECTORS

Positions/Contacts	Part No. Wire Wrap	1	10	100	Part No. Solder Tail	1	10	100
10/20	C4-10	2.37	21.70	178.00	C3-10	2.13	19.50	160.00
15/30	C4-15	2.73	25.00	205.00	C3-15	2.46	22.60	185.00
18/36	C4-18	2.97	27.20	223.00	C3-18	2.67	24.50	200.00
20/40	C4-20	3.24	29.70	243.00	C3-20	2.85	26.10	214.00
22/44	C4-22	3.48	31.90	261.00	C3-22	3.00	27.50	225.00
25/50	C4-25	3.90	35.80	293.00	C3-25	3.39	31.10	254.00
28/56	C4-28	4.11	37.70	308.00	C3-28	3.69	33.80	277.00
30/60	C4-30	4.29	39.30	322.00	C3-30	3.81	34.90	286.00
31/62	C4-31	4.44	40.70	333.00	C3-31	4.05	37.10	304.00
35/70	C4-35	5.01	45.90	376.00	C3-35	4.50	41.30	338.00
36/72	C4-36	5.10	46.80	383.00	C3-36	4.56	41.80	342.00
40/80	C4-40	5.64	51.70	423.00	C3-40	5.04	46.20	378.00
44/88	C4-44	6.09	55.80	457.00	C3-44	5.49	50.30	412.00
50/100	C4-50	6.90	63.30	518.00	C3-50	6.18	56.70	464.00

For polarizing keys order P/N C811 64-2 10 ea 7.50 100

H6 SERIES .156"x.200" EDGEBOARD CONNECTORS

Positions/Contacts	Part No. Solder Tail	1	10	100	Part No.	1	10	100
10/20	C1-10	2.49	22.80	187.00	C2-10	4.08	37.40	306.00
12/24	C1-12	2.64	24.20	198.00	C2-12	4.37	39.60	324.00
15/30	C1-15	2.94	27.00	221.00	C2-15	4.71	43.20	353.00
18/36	C1-18	3.18	29.20	239.00	C2-18	4.98	45.70	374.00
22/44	C1-22	3.54	32.50	266.00	C2-22	5.49	50.30	412.00
25/50	C1-25	3.84	35.20	288.00	C2-25	5.91	54.20	443.00
28/56	C1-28	4.29	39.30	322.00	C2-28	6.36	58.30	477.00

For polarizing keys order P/N C811 64-1 10 ea 7.50 100

ELECTRONIC HARDWARE KIT

CAT. NO. 1600 KIT **$14.95**

5% CARBON FILM RESISTORS

½ WATT RESISTOR ASSORTMENTS

RS125 Set of 5 each of the 73 standard 5% ¼ watt carbon film resistors in the series 1.0, 1.2, 1.5, 1.8, 2.2, 2.7 etc. through 1.0 megohm (365 total pcs.) **$9.90**

RS225 Set of 5 each of the 72 standard 5% ¼ watt carbon film resistors in the series 1.1, 1.3, 1.6, 2.0, 2.4 etc. through 910 kilohm (360 total pcs.) **$9.90**

½ WATT RESISTORS ASSORTMENTS

RS150 Set of 5 each of the 73 standard 5% ½ watt carbon film resistors in the series 1.0, 1.2, 1.5, 1.8, 2.2, 2.7 etc. through 1.0 megohm (365 total pcs.) **$9.90**

RS250 Set of 5 each of the 72 standard 5% ½ watt carbon film resistors in the series 1.1, 1.3, 1.6, 2.0, 2.4 etc. through 910 kilohm (360 total pcs.) **$9.90**

E.F. JOHNSON ALUMINUM SPACERS

Round Tubular — Round Threaded — Hex Threaded

MOLEX I.C. SOCKET PINS

9.10/M — 42.00/5M — 300.00/50M

TIME-TEMPERATURE PROGRAMMABLE MODULE

USER PROGRAMMABLE FOR:

- 12 or 24 Hour Display
- F and or C as well as virtually any number of temperature sensors
- Fixed or flashing colon format
- 50 60 Hz line frequency operation

MA 1026 by National Semiconductor

Instruction Included with all orders

Cat No	Description	Cost
2MA1026M-ND	MA1026 Clock Module (Assembled and tested)	$19.95
2MA1026P ND	Digi-Key Switching Panel Kit for MA1026M (includes P.C. Board, switches, hardware, two temperature sensors, two potentiometers)	11.95
2MA1026T ND	Special transformer for MA1026M	2.95
MA1026B	Alarm buzzer for MA1026M	3.00
2MA1026K ND	Includes MA1026M P, T, and B	34.95
MA1026X	3.58 Megahertz Crystal	2.95
MA1026C	Conventional Switch Set for applications where MA1026P is not used includes one 501PB and ten 502PB switches	3.95
2MA1026R-ND	Includes MA1026M, MA1026C, MA1026T, two temperature sensors and two potentiometer	29.95

For each additional sensor unit the following are suggested:

LM334	Temperature transducer for MA1026M Module	1.33
K0A32	300 ohm potentiometer for LM334 transducer	.27
502PB	Normally open switch	.45

THE "PROGRAMMABLE" CLOCK MODULES

USER PROGRAMMABLE FOR:

- 12 or 24 hour display
- 50 60 Hz line frequency operation
- fixed or flashing colon

MA1023 0.7" HIGH DIGITS

Cat No	Description	Cost
2MA1023M ND	MA1023 Clock Module Only (Assembled and tested)	$9.95
2MA1023P ND	Digi-Key Switching Panel Kit for MA1023 (Includes P.C. Board, Switches, Hardware and Components)	4.95
2MA1023T-ND	Special Transformers for MA1023	2.95
MA1023B	Alarm Buzzer for MA1023	3.00
2MA1023K ND	Includes MA1023M, P, T, & B.	19.95
MA1023C	Conventional switch set for applications where MA1023P is not used, includes one 501PB and 502PB	3.10
2MA1023R ND	Clock Module, Conventional Switches, Transformer	14.95

MA1020 0.84" HIGH DIGITS

Cat No	Description	Cost
2MA1020M ND	MA1020 Clock Module (Assembled and tested)	$13.95
2MA1020P ND	Digi-key Switching Panel Kit for MA1020 (Includes P.C. Board, Switches, Hardware, Components)	7.95
2MA1020T ND	Special Transformer for MA1020M	3.35
MA1020B	Alarm Buzzer for MA1020M	3.00
2MA1020K ND	Includes MA1020M, P, T, & B.	26.95
MA1020C	Conventional switch set for applications where MA1020P is not used. Includes one 501PB and six 502PB and a 3M ohm resistor, trimmer, battery snaps	3.30
2MA1020R ND	Includes MA1020M, MA1020C & MA1020T	19.95

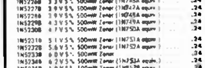
SILICON TRANSISTORS

	1	10	100	1000
2N3055	1.44	12.00	108.00	980.00
2N3904	.20	1.79	16.25	146.25
2N3906	.20	1.79	16.25	146.25
2N4124	.21	1.93	17.50	157.50
2N4126	.22	2.01	18.25	164.25
2N4401	.21	1.93	17.50	157.50
2N4403	.21	1.93	17.50	157.50
2N4410	.30	2.70	24.38	219.38
2N5087	.24	2.20	20.00	180.00
2N5089	.24	2.20	20.00	180.00
2N5210	.27	2.48	22.50	202.50
2N5457	.54	4.86	43.88	394.88
92PU01A	.38	3.47	30.88	277.88
92PU10	.38	3.47	30.88	277.88
92PU45A	.41	3.69	33.32	299.82
92PU51A	.38	3.42	30.88	277.88
MJ2955	1.47	13.48	122.50	1102.25
MJE172	.74	6.66	60.13	541.13
MJE182	.72	6.48	58.50	526.50
MJE3439	.56	4.80	40.00	360.00
MJE344	.68	6.12	55.25	497.25
MJE370	.89	8.01	72.32	650.82
MJE371	1.10	9.90	89.38	804.38
MJE520	.86	7.74	69.88	628.88
MJE521	.86	7.74	69.88	628.88
MJE703	1.13	10.17	91.82	826.31
MJE712	.74	6.66	60.13	541.13
MJE722	.74	6.66	60.13	541.13
MJE803	1.01	9.09	82.07	738.57
MPF102	.54	4.95	45.00	405.00
MPS2222A	.21	1.93	17.50	157.50
MPS2369A	.24	2.20	20.00	180.00
MPS2907A	.24	2.20	20.00	180.00
MPS3397	.23	2.07	18.75	169.00
MPS3393	.21	1.93	17.50	157.50
MPS3394	.24	2.20	20.00	180.00
MPS3395	.24	2.20	20.00	180.00
MPS3563	.21	1.93	17.50	157.50
MPS3565	.21	1.93	17.50	157.50
MPS3638A	.21	1.93	17.50	157.50
MPS3641	.21	1.93	17.50	152.50
MPS3643	.21	1.93	17.50	157.50
MPS918	.22	1.98	17.88	160.88
MPS930	.21	1.93	17.50	157.50
MPSA13	.27	2.48	22.50	202.50
TIP112	.98	8.40	70.00	630.00
TIP117	1.12	10.08	91.00	819.00
TIP120	1.17	10.73	97.50	877.50
TIP122	1.54	13.20	110.00	990.00
TIP127	1.54	13.20	110.00	990.00
TIP132	2.32	20.88	188.50	1696.50
TIP135	2.32	20.88	188.50	1696.50
TIP29C	.81	6.90	57.50	517.50
TIP30C	.81	6.90	57.50	517.50
TIP31C	.98	8.40	70.00	630.00
TIP32C	1.07	8.70	72.50	652.50
TIP61C	.81	6.90	57.50	517.50
TIP62C	.81	6.90	57.50	517.50

ITT RECTIFIERS

Cat No	Description	Pkg	10	100	1000	10,000
1N4001	1 Amp 50 PIV Silicon Rectifier	DO-41	[illegible]	[illegible]	[illegible]	[illegible]
1N4002	1 Amp 100 PIV Silicon Rectifier	DO-41	[illegible]	[illegible]	[illegible]	[illegible]
1N4003	1 Amp 200 PIV Silicon Rectifier	DO-41	[illegible]	[illegible]	[illegible]	576.00
1N4004	1 Amp 400 PIV Silicon Rectifier	DO-41	[illegible]	[illegible]	66.00	612.00
1N4005	1 Amp 600 PIV Silicon Rectifier	DO-41	1.00	[illegible]	74.00	[illegible]
1N4006	1 Amp 800 PIV Silicon Rectifier	DO-41	1.00	[illegible]	[illegible]	720.00
1N4007	1 Amp 1000 PIV Silicon Rectifier	DO-41	1.00	[illegible]	[illegible]	[illegible]
1N4148	Ultra Fast Switching Diode (1N914 equiv.)	DO-41	[illegible]	[illegible]	33.00	276.00

ITT SILICON ZENER DIODES



Catalog Number	Description	Unit Price	10
1N5226B	3.3 V 5% 500mW Zener (1N746A equiv.)	.24	1.80
1N5227B	3.9 V 5% 500mW Zener (1N747A equiv.)	.24	1.80
1N5228B	3.9 V 5% 500mW Zener (1N748A equiv.)	.24	1.80
1N5229B	4.3 V 5% 500mW Zener (1N749A equiv.)	.24	1.80
1N5230B	4.7 V 5% 500mW Zener (1N750A equiv.)	.24	1.80
1N5231B	5.1 V 5% 500mW Zener (1N751A equiv.)	.24	1.80
1N5232B	5.6 V 5% 500mW Zener (1N752A equiv.)	.24	1.80
1N5233B	6.0 V 5% 500mW Zener	.24	1.80
1N5234B	6.2 V 5% 500mW Zener (1N753A equiv.)	.24	1.80
1N5235B	6.8 V 5% 500mW Zener (1N957B equiv.)	.24	1.80
1N5236B	7.5 V 5% 500mW Zener (1N958B equiv.)	.24	1.80
1N5237B	8.2 V 5% 500mW Zener (1N959B equiv.)	.24	1.80
1N5238B	8.7 V 5% 500mW Zener	.24	1.80
1N5239B	9.1 V 5% 500mW Zener (1N960B equiv.)	.24	1.80
1N5240B	10 V 5% 500mW Zener (1N961B equiv.)	.24	1.80
1N5241B	11 V 5% 500mW Zener (1N962B equiv.)	.24	1.80
1N5242B	12 V 5% 500mW Zener (1N963B equiv.)	.24	1.80
1N5243B	13 V 5% 500mW Zener (1N964B equiv.)	.24	1.80
1N5244B	14 V 5% 500mW Zener	.24	1.80
1N5245B	15 V 5% 500mW Zener (1N965B equiv.)	.24	1.80
1N5246B	16 V 5% 500mW Zener (1N966B equiv.)	.24	1.80
1N5247B	17 V 5% 500mW Zener	.24	1.80
1N5248B	18 V 5% 500mW Zener (1N967B equiv.)	.24	1.80
1N5249B	19 V 5% 500mW Zener	.24	1.80
1N5250B	20 V 5% 500mW Zener (1N968B equiv.)	.24	1.80
1N5251B	22 V 5% 500mW Zener (1N969B equiv.)	.24	1.80
1N5252B	24 V 5% 500mW Zener (1N970B equiv.)	.24	1.80
1N5253B	25 V 5% 500mW Zener	.24	1.80
1N5254B	27 V 5% 500mW Zener (1N971B equiv.)	.24	1.80
1N5255B	28 V 5% 500mW Zener	.24	1.80
1N5256B	30 V 5% 500mW Zener (1N972B equiv.)	.24	1.80
1N5257B	33 V 5% 500mW Zener (1N973B equiv.)	.24	1.80

Call or Write for your Free DIGI-KEY Catalog

NEW MA1032 Clock

Digital LCD Clock Module

- Operates from a single 1.5V Battery
- 0.5" LCD Display

Instructions Included In All Orders

Catalog No.	Description	Cost
2MA1032M-ND	LCD Clock Module only	$24.95
MA1032C	Switch for MA1032M	$2.85
2MA1032R-ND	MA1032M, MA1032C, & AA battery holder	$28.20

DIGITAL CLOCK BEZEL

THE J.M.J. DIGITAL DISPLAY BEZEL

WITH RED FILTER
Part No. 400

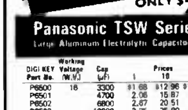
UNIVERSAL SIZE
HANDLES MOST REQUIREMENTS

Be Sure to Order the Proper Adapter for Your Digital Clock

Part	Description	Price
400	Digital Display #1281 with Red Filter	$4.95
420	Mounting Adapters for MA1001, MA1002, etc.	.69
421	Mounting Adapters for MA1010, MA1020, MA1026	.69
422	Universal PC Board Mounting Adapters	.69
423	Mounting Adapter for MA1023	.69

DIGI-CLOCK KIT

- 12 VDC — Ideal for Car, Van or Boat!



- Trouble free, No delay!
- 270° Swivel Mount
- Inlaid Walnut Chrome Trim Bezel
- Ideal for Car, Van or Boat!
- 3-5/8"x2-3/16" Tall x 2 1/4" Deep
- Quick and Easy to Install

Part No. 25001K-ND
ONLY $24.95

Panasonic TSW Series

Large Aluminum Electrolytic Capacitors

DIGI-KEY Part No.	Working Voltage (W.V.)	Cap (µF)	1	10	100
P6500	16	3300	$1.68	$12.98	$116.60
P6501		4700	2.06	15.87	142.86
P6502		6800	2.67	20.51	184.80
P6503		10000	3.36	25.80	232.90
P6504		15000	4.77	36.72	330.55
P6505	25	2200	1.72	13.26	119.40
P6506		3300	2.11	16.22	145.95
P6507		4700	2.66	20.36	183.20
P6508		6800	3.48	26.80	241.20
P6509		10000	4.49	34.56	311.20
P6510		15000	6.78	44.43	399.90
P6511	35	1000	1.43	11.00	99.10
P6512		2200	1.93	14.87	133.80
P6513		3300	2.60	20.01	180.10
P6514		4700	3.33	25.66	230.10
P6515		6800	4.28	32.93	296.40
P6516		10000	5.48	42.17	379.50
P6517	50	1000	1.75	13.46	121.10
P6518		2200	2.89	20.67	185.95
P6519		3300	3.70	28.46	256.00
P6520		4700	4.82	37.07	333.65
P6521		6800	5.87	45.12	406.10
P6522	100	470	2.02	15.53	139.75
P6523		1000	3.40	26.15	253.30
P6524		2200	5.46	41.98	377.80
P6525	200	220	2.56	19.83	176.66
P6526		330	3.52	27.07	243.80
P6527		470	4.49	34.54	310.85
P6528	250	150	2.58	19.86	178.75
P6529		220	4.13	31.78	286.05
P6530		330	5.84	44.89	404.00
P6531		470	7.62	58.62	527.56

PANASONIC K SERIES CAPACITORS

New Panasonic K series are miniature, low cost aluminum electrolytic capacitors. Their size and performance characteristics make them viable alternatives to tantalums in many applications.

CAPACITANCE TOLERANCE: 20%
D.C. LEAKAGE CURRENT, MAX. I 0.01 C V OR 3uA
ALL K-SERIES CAPACITORS WE CARRY ARE RADIAL

DIGI-KEY PART NO.	CAPACITANCE uF	WORKING VOLTAGE DC	1	10 PAK
P800	22	6.3	.24	2.03
P801	33		.25	2.13
P802	47		.24	2.18
P803	100		.30	2.56
P804	22	10	.22	2.13
P805	33		.26	2.23
P806	47		.28	2.37
P807	10	16	.22	2.07
P808	22		.27	2.28
P809	33		.29	2.45
P810	47		.32	2.72
P811	3.3	35	.24	2.03
P812	4.7		.24	2.03
P813	10		.22	2.13
P814	22		.29	2.45
P815	33		.33	2.76
P816	3.3	35	.24	2.03
P817	4.7		.25	2.07
P818	10		.26	2.22
P819	22		.32	2.73
P820	.1	50	.24	2.72
P821	.22		.24	2.03
P822	.33		.24	2.03
P823	.47		.24	2.03
P824	1.0		.24	2.03
P825	2.2		.24	2.03
P826	3.3		.23	2.07
P827	4.7		.22	2.13
P828	10		.28	2.38

Panasonic KL-Series Capacitors

Ultra Miniature Aluminum Electrolytic Capacitors
The KL Series is a tantalum sub for many app.

DIGI-KEY Part No.	Rating WV	µF	1	10	100	1,000
P850	6.3	22	.27	2.29	19.06	171.56
P851	16	10	.27	2.29	19.06	171.56
P852	25	4.7	.27	2.29	19.06	171.56
P853	25	3.3	.27	2.29	19.06	171.56
P854	50	2.2	.27	2.29	19.06	171.56
P855	50	1.0	.27	2.29	19.06	171.56
P856	50	.47	.27	2.29	19.06	171.56
P857	50	.33	.27	2.29	19.06	171.56
P858	50	.22	.27	2.29	19.06	171.56
P859	50	.1	.27	2.29	19.06	171.56

PLESSEY "MINI BOX"

Metallized Poly Cap Kit

140 CAPACITORS

Price includes convenient divided plastic box with bin guide for easy storage and quick access.

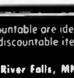
CAT. NO. 3050P-Kit
ONLY $35.95

ASSORTMENT OF 14 POPULAR "MINI-BOX" CAPACITORS

PANASONIC ELECTROLYTIC KIT

150 CAPACITORS

Price includes convenient divided plastic box with bin guide for easy storage and quick access.



Cat. No. P6200-Kit
ONLY $35.95

ASSORTMENT OF 15 POPULAR CAPACITORS

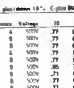
PANASONIC ELECTROLYTIC CAPACITORS

Value uF	WV D.C.	Axial 1	Axial 10	Axial 100	Radial 1	Radial 10	Radial 100
22	/6.3	.18	1.54	12.83	—	—	—
33	/6.3	.20	1.68	14.04	.14	1.12	9.31
47	/6.3	.21	1.74	14.48	.14	1.16	9.59
100	/6.3	.22	1.83	15.22	.16	1.33	11.05
220	/6.3	.28	2.34	19.53	.21	1.78	14.80
330	/6.3	.29	2.46	20.48	.23	1.92	15.95
470	/6.3	.33	2.78	23.15	.23	1.97	16.34
1000	/6.3	.49	4.20	35.00	.36	3.08	25.62
2200	/6.3	.60	5.13	42.75	.54	4.56	37.95
3300	/6.3	.81	6.94	57.83	.75	6.38	53.10
4700	/6.3	1.04	8.89	74.07	.93	7.95	66.20
6800	/6.3	1.27	10.87	90.58	1.13	9.68	80.62
10000	/6.3	1.54	13.17	109.77	1.54	13.13	109.40
22	/10	.18	1.54	12.83	.13	1.08	8.94
33	/10	.21	1.74	14.48	.14	1.16	9.59
47	/10	.21	1.77	14.78	.14	1.19	9.90
100	/10	.24	2.00	16.65	.17	1.39	11.58
220	/10	.29	2.46	20.48	.23	1.92	15.95
330	/10	.33	2.78	23.15	.24	2.06	17.10
470	/10	.44	3.72	30.97	.35	2.97	24.69
1000	/10	.55	4.63	38.62	.41	3.42	28.45
2200	/10	.78	6.63	55.28	.70	5.93	49.42
3300	/10	.99	8.45	70.38	.90	7.71	64.22
4700	/10	1.28	10.94	91.18	1.13	9.68	80.62
6800	/10	1.55	13.26	110.52	1.54	13.20	109.40
10000	/10	1.99	17.00	141.63	—	—	—
10	/16	.18	1.54	12.83	.13	1.08	8.94
22	/16	.21	1.74	14.48	.14	1.15	9.52
33	/16	.21	1.77	14.77	.14	1.19	9.90
47	/16	.24	2.00	16.65	.16	1.36	11.31
100	/16	.28	2.34	19.53	.21	1.78	14.80
220	/16	.33	2.78	23.15	.24	2.06	17.10
330	/16	.44	3.72	30.97	.35	2.97	24.69
470	/16	.50	4.22	35.14	.38	3.19	26.58
1000	/16	.60	5.09	42.45	.50	4.21	35.08
2200	/16	.92	7.85	65.39	.87	7.46	62.10
3300	/16	1.16	9.91	82.62	1.17	10.01	83.48
4700	/16	1.57	13.40	111.68	1.57	13.43	111.87
6800	/16	1.99	17.00	141.63	—	—	—
2.2	/25	.18	1.54	12.83	—	—	—
3.3	/25	.18	1.54	12.83	.13	1.08	8.94
4.7	/25	.18	1.54	12.83	.13	1.08	8.94
10	/25	.18	1.54	12.83	.14	1.15	9.52
22	/25	.22	1.83	15.22	.15	1.22	10.17
33	/25	.24	2.00	16.65	.17	1.38	11.50
47	/25	.28	2.34	19.53	.21	1.73	14.42
100	/25	.33	2.78	23.15	.23	1.90	15.77
220	/25	.44	3.75	31.24	.40	3.42	28.45
330	/25	.50	4.26	35.47	.52	4.45	37.08
470	/25	.58	4.95	41.24	.64	5.42	45.13
1000	/25	.84	7.18	59.84	.83	7.06	58.78
2200	/25	1.16	9.91	82.62	1.17	10.02	83.47
3300	/25	1.61	13.77	114.77	1.66	14.17	118.03
4700	/25	1.99	17.00	141.63	—	—	—
2.2	/35	.18	1.54	12.83	—	—	—
3.3	/35	.18	1.54	12.83	.13	1.11	9.20
4.7	/35	.18	1.54	12.83	.13	1.11	9.20
10	/35	.21	1.77	14.78	.14	1.19	9.90
22	/35	.24	2.00	16.65	.19	1.60	13.30
33	/35	.28	2.34	19.53	.21	1.78	14.80
47	/35	.33	2.78	23.15	.23	1.90	15.77
100	/35	.43	3.65	30.40	.24	2.06	17.10
220	/35	.51	4.34	36.17	.40	3.42	28.45
330	/35	.57	4.85	40.40	.52	4.45	37.08
470	/35	.65	5.51	45.89	.64	5.42	45.13
1000	/35	.98	8.38	69.80	.92	7.84	65.32
2200	/35	1.61	13.77	114.71	1.66	14.17	118.03
3300	/35	1.99	17.00	141.63	—	—	—
4700	/35	2.61	22.31	185.88	—	—	—
0.47	/50	.18	1.54	12.83	.13	1.08	8.94
1	/50	.18	1.54	12.83	.13	1.08	8.94
1	/50	.18	1.54	12.83	.13	1.08	8.94
2.2	/50	.18	1.54	12.83	.13	1.08	8.94
3.3	/50	.18	1.54	12.83	.14	1.15	9.52
4.7	/50	.21	1.77	14.77	.14	1.18	9.78
10	/50	.24	2.00	16.65	.16	1.35	11.20
22	/50	.28	2.34	19.53	.22	1.83	15.19
33	/50	.32	2.69	27.43	.23	1.90	15.77
47	/50	.36	3.04	25.33	.24	2.05	17.03
100	/50	.45	3.78	31.54	.36	3.08	25.62
220	/50	.61	5.18	43.15	.52	4.45	37.08
330	/50	.76	6.50	54.14	.83	7.06	58.78
470	/50	.92	7.87	65.55	.92	7.84	65.32
1000	/50	1.25	10.71	89.27	1.31	11.16	92.93
2200	/50	1.99	17.00	141.63	—	—	—
0.47	/63	.18	1.54	12.83	.13	1.12	9.32
1	/63	.18	1.54	12.83	.13	1.12	9.32
2.2	/63	.18	1.54	12.83	.14	1.15	9.52
3.3	/63	.21	1.77	14.77	.15	1.25	10.35
4.7	/63	.24	2.00	16.65	.16	1.34	11.13
10	/63	.28	2.34	19.53	.18	1.50	12.43
22	/63	.33	2.78	23.15	.24	2.02	16.79
33	/63	.37	3.12	26.04	.27	2.24	18.60
47	/63	.53	4.51	37.62	.38	3.18	26.45
100	/63	.56	4.76	39.64	.50	4.24	35.27
220	/63	.76	6.50	54.14	.78	6.61	55.02
330	/63	.92	7.87	65.55	.92	7.84	65.32
470	/63	1.05	8.94	74.52	.99	8.43	70.19
1000	/63	1.64	13.99	116.55	1.66	14.17	118.03
2200	/63	2.61	22.31	185.89	—	—	—
0.47	/100	.18	1.54	12.83	.14	1.19	9.90
1	/100	.18	1.54	12.83	.14	1.19	9.90
2.2	/100	.22	1.83	15.22	.15	1.25	10.35
3.3	/100	.24	2.00	16.65	.17	1.38	11.50
4.7	/100	.28	2.34	19.53	.17	1.41	11.70
10	/100	.33	2.78	23.15	.22	1.83	15.19
22	/100	.43	3.65	30.40	.27	2.27	18.90
33	/100	.45	3.85	32.12	.34	2.88	24.00
47	/100	.54	4.62	38.49	.41	3.50	29.14
100	/100	.74	6.29	52.43	.57	4.83	40.22
220	/100	1.09	9.26	77.18	.96	8.22	68.47
330	/100	1.30	11.10	92.53	1.25	10.70	89.13
470	/100	1.81	15.46	128.80	1.78	15.25	127.04
1000	/100	3.16	27.09	225.77	—	—	—

PANASONIC DISC CAPACITORS

NEW! KIT — 310 DISC CAPACITORS

Prices includes convenient divided plastic box with bin guide for easy storage and quick access.



CAT. NO. DH-KIT
ONLY $24.95

ASSORTMENT OF 18 POPULAR VALUES PANASONIC QUALITY
(Tolerance: A — plus/minus 5%, B — plus/minus 10%, C — plus 80%/minus 20%)

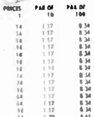
Part Number	Capacitance	Tolerance	Voltage	10	100	1000
DH100	10PF	B	500V	.77	6.80	48.70
DH150	15PF	B	500V	.77	6.80	48.70
DH220	22PF	B	500V	.77	6.80	48.70
DH330	33PF	B	500V	.77	6.80	48.70
DH470	47PF	B	500V	.77	6.50	48.70
DH680	68PF	B	500V	.85	7.20	54.25
DH101	100PF	B	500V	.71	6.10	54.25
DH151	150PF	B	500V	.77	6.10	54.25
DH221	220PF	B	500V	.71	6.10	54.25
DH331	330PF	B	500V	.71	6.10	54.25
DH471	470PF	B	500V	.85	7.20	53.80
DH681	680PF	B	500V	.85	7.20	53.80
DH102	.001UFD	C	50V	.72	6.20	46.15
DH152	.0015UFD	C	50V	.72	6.20	46.15
DH222	.0022UFD	C	50V	.72	6.20	46.15
DH332	.0033UFD	C	50V	.72	6.20	46.15
DH472	.0047UFD	C	50V	.72	6.30	46.15
DH682	.0068UFD	C	50V	.76	6.80	49.65
DE103	.01UFD	C	25V	.98	4.80	38.25
DE223	.022UFD	C	25V	.88	5.90	44.35
DE333	.033UFD	C	25V	.88	7.10	53.10
DE473	.047UFD	C	25V	.80	7.70	67.80
DE104	.1UFD	C	25V	1.80	15.40	115.35

PANASONIC POLYESTER CAPACITORS

100 VDC plus/minus 10% TOLERANCE

NEW! KIT — 150 POLYESTER CAPACITORS

Price includes convenient divided plastic box with bin guide for easy storage and quick access.



CAT. NO M-KIT
ONLY $34.95

ASSORTMENT OF 15 POPULAR VALUES PANASONIC QUALITY

PART NO	CAP (MFD)	PRICES 1	PAK OF 10	PAK OF 100	PAK OF 1000
M1102	.001	.14	1.17	8.34	75.04
M1122	.0012	.14	1.17	8.34	75.04
M1152	.0015	.14	1.17	8.34	75.04
M1182	.0018	.14	1.17	8.34	75.04
M1222	.0022	.14	1.17	8.34	75.04
M1272	.0027	.14	1.17	8.34	75.04
M1332	.0033	.14	1.17	8.34	75.04
M1392	.0039	.14	1.17	8.34	75.04
M1472	.0047	.14	1.17	8.34	75.04
M1562	.0056	.14	1.17	8.34	75.04
M1682	.0068	.14	1.17	8.34	75.04
M1822	.0082	.14	1.17	8.34	75.04
M1103	.01	.14	1.17	8.34	75.04
M1123	.012	.14	1.22	8.65	77.85
M1153	.015	.14	1.22	8.65	77.85
M1183	.018	.15	1.24	8.80	79.20
M1223	.022	.15	1.26	8.94	80.44
M1273	.027	.15	1.26	8.94	80.44
M1333	.033	.15	1.28	9.10	81.88
M1393	.039	.16	1.32	9.40	84.60
M1473	.047	.16	1.35	9.60	86.18
M1563	.056	.17	1.46	10.38	93.38
M1683	.068	.18	1.51	10.74	96.64
M1823	.082	.18	1.55	11.01	99.57
M1104	.1	.19	1.58	11.20	101.48
M1124	.12	.21	1.80	12.85	115.65
M1154	.15	.23	2.01	14.30	128.70
M1184	.18	.26	2.26	16.09	144.79
M1224	.22	.28	2.38	16.98	152.78
M1274	.27	.32	2.72	19.40	174.60
M1334	.33	.34	2.96	21.12	190.02
M1394	.39	.39	3.35	23.88	214.88
M1474	.47	.41	3.50	25.57	230.02

PANASONIC METALLIZED POLYESTER CAPACITORS

NEW! KIT — 170 METALIZED POLYESTER CAPACITORS

Price includes convenient divided plastic box with bin guide for easy storage and quick access.

CAT NO E-KIT
ONLY $54.95

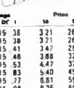
ASSORTMENT OF 15 POPULAR VALUES PANASONIC QUALITY

DIGI-KEY Part No.	Working Voltage	µF	Pak Of 1	Pak Of 10	Pak Of 100	Pak Of 1,000
E1104	100	.1	.23	1.99	16.53	148.73
E1124	100	.12	.25	2.12	17.63	158.73
E1154	100	.15	.27	2.28	18.95	170.55
E1184	100	.18	.29	2.49	20.73	186.53
E1224	100	.22	.32	2.68	22.27	200.37
E1274	100	.27	.34	2.91	24.25	218.25
E1334	100	.33	.37	3.18	26.45	238.05
E1394	100	.39	.41	3.44	28.65	257.85
E1474	100	.47	.43	3.68	30.65	275.85
E1564	100	.56	.47	4.02	33.45	301.05
E1684	100	.68	.52	4.44	36.93	332.35
E1824	100	.82	.58	4.94	41.13	370.13
E1105	100	1.0	.63	5.35	44.52	400.62
E1125	100	1.2	.68	5.82	48.50	436.50
E1155	100	1.5	.86	7.32	60.87	548.87
E1185	100	1.8	1.01	8.64	71.99	647.89
E1225	100	2.2	1.04	8.85	73.70	663.08
E1275	100	2.7	1.04	8.85	73.70	663.08
E1335	100	3.3	1.35	11.50	95.85	862.54
E1395	100	3.9	1.35	11.50	95.85	862.54
E1475	100	4.7	1.75	14.95	124.55	1120.73
E1565	100	5.6	1.95	16.65	138.70	1248.08
E1685	100	6.8	2.35	20.14	167.85	1510.43
E1825	100	8.2	2.86	24.45	203.70	1833.30
E1106	100	10.0	3.23	27.69	230.75	2076.41
E2103	250	.01	.19	1.64	13.68	123.08
E2123	250	.012	.19	1.64	13.68	123.08
E2153	250	.015	.19	1.64	13.68	123.08
E2183	250	.018	.19	1.64	13.68	123.08
E2223	250	.022	.19	1.64	13.68	123.08
E2273	250	.027	.19	1.64	13.68	123.08
E2333	250	.033	.19	1.64	13.68	123.08
E2393	250	.039	.19	1.64	13.68	123.08
E2473	250	.047	.19	1.64	13.68	123.08
E2563	250	.056	.22	1.85	15.43	138.83
E2683	250	.068	.22	1.85	15.43	138.83
E2823	250	.082	.22	1.85	15.43	138.83
E2104	250	.10	.23	1.84	18.13	145.13
E2124	250	.12	.25	2.12	17.63	158.83
E2154	250	.15	.27	2.28	18.95	170.55
E2184	250	.18	.29	2.48	20.73	186.53
E2224	250	.22	.32	2.68	22.28	200.48
E2274	250	.27	.34	2.91	24.25	218.25
E2334	250	.33	.37	3.18	26.47	238.17
E2394	250	.39	.41	3.44	28.65	257.85
E2474	250	.47	.43	3.68	30.65	275.85
E2564	250	.56	.47	4.02	33.45	301.05
E2684	250	.68	.52	4.43	36.93	332.33
E2824	250	.82	.58	4.94	41.13	370.13
E2105	250	1.0	.63	5.35	44.52	400.62
E2125	250	1.2	.68	5.82	48.50	436.50
E2155	250	1.5	.86	7.32	60.97	548.87
E2185	250	1.8	1.01	8.64	72.00	648.00
E2225	250	2.2	1.03	8.85	73.68	663.08
E4103	400	.01	.34	2.93	24.40	219.15
E4123	400	.012	.34	2.93	24.40	219.15
E4153	400	.015	.34	2.93	24.40	219.15
E4183	400	.018	.34	2.93	24.40	219.15
E4223	400	.022	.34	2.93	24.40	219.15
E4273	400	.027	.34	2.93	24.40	219.15
E4333	400	.033	.34	2.93	24.40	219.15
E4393	400	.039	.34	2.93	24.40	219.75
E4473	400	.047	.34	2.93	24.40	219.15
E4563	400	.056	.34	2.93	24.40	219.15
E4683	400	.068	.34	2.93	24.40	219.15
E4823	400	.082	.44	3.78	31.28	281.48
E4104	400	.10	.45	3.83	31.92	287.21
E4124	400	.12	.47	4.04	33.80	302.40
E4154	400	.15	.49	4.18	34.80	313.20
E4184	400	.18	.55	4.88	38.98	350.78
E4224	400	.22	.57	4.89	40.73	366.53
E4274	400	.27	.69	5.85	48.73	438.53
E4334	400	.33	.75	6.38	53.15	478.35
E4394	400	.39	.82	7.02	58.48	526.28
E4474	400	.47	.91	7.78	64.80	583.20
E4564	400	.56	1.07	9.14	76.12	685.00
E4684	400	.68	1.21	10.37	86.42	777.75
E4824	400	.82	1.29	11.03	91.90	826.99
E4105	400	1.0	1.35	11.50	95.83	862.43
E4125	400	1.2	1.47	12.60	105.00	945.00
E4155	400	1.5	1.59	13.56	112.98	1016.80
E4185	400	1.8	1.88	16.10	134.13	1207.15
E4225	400	2.2	2.15	18.34	152.85	[illegible]

PANASONIC RESIN DIPPED TANTALUM CAPACITORS

NEW! KIT — 100 TANTALUM CAPACITORS

Prices includes convenient divided plastic box with bin guide for easy storage and quick access.



CAT. NO F-KIT
ONLY $79.95

ASSORTMENT OF 15 POPULAR VALUES PANASONIC QUALITY

Digi-Key Part No.	CAP µF	Voltage Volt DC	1	10	100	1000
P2000	3.3	3.15	.38	3.21	26.70	240.30
P2001	6.8	3.15	.38	3.21	26.70	240.30
P2002	10	3.15	.41	3.47	28.85	259.65
P2003	15	3.15	.46	3.88	32.32	290.81
P2004	22	3.15	.53	4.47	37.23	335.02
P2005	33	3.15	.63	5.40	45.00	405.00
P2006	47	3.15	.77	6.61	55.05	495.45
P2007	68	3.15	.98	8.35	69.54	625.83
P2008	100	3.15	1.29	11.04	91.97	827.77
P2009	150	3.15	3.73	31.93	266.04	2394.34
P2010	220	3.15	4.72	40.44	336.95	3032.55
P2011	4.7	6	.38	3.21	26.70	240.30
P2012	6.8	6	.44	3.78	31.44	282.94
P2013	10	6	.51	4.32	35.94	323.44
P2014	15	6	.64	5.42	45.14	406.24
P2015	22	6	.74	6.34	52.78	474.98
P2016	33	6	.96	8.19	68.24	614.13
P2017	47	6	1.23	10.54	87.84	790.53
P2018	68	6	1.64	14.05	117.04	1053.33
P2019	100	6	3.73	31.93	266.04	2394.33
P2020	150	6	4.72	40.44	336.95	3032.55
P2021	1.0	10	.38	3.21	26.70	240.30
P2022	2.2	10	.38	3.21	26.70	240.30
P2023	3.3	10	.38	3.21	26.70	240.30
P2024	4.7	10	.46	3.88	32.32	290.87
P2025	6.8	10	.52	4.43	36.88	331.87
P2026	10	10	.62	5.30	44.14	397.23
P2027	15	10	.78	6.65	55.38	498.38
P2028	22	10	.99	8.49	70.75	636.75
P2029	33	10	1.34	11.43	95.25	857.25
P2030	47	10	1.77	15.18	126.44	1137.93
P2031	68	10	3.73	31.93	266.04	2394.33
P2032	100	10	4.72	40.44	336.95	3032.55
P2033	1.5	16	.38	3.21	26.70	240.30
P2034	2.2	16	.42	3.58	29.63	266.63
P2035	3.3	16	.47	4.02	33.43	300.83
P2036	4.7	16	.55	4.65	38.70	348.30
P2037	6.8	16	.65	5.54	46.14	415.24
P2038	10	16	.81	6.91	57.53	517.73
P2039	15	16	1.06	9.06	75.50	679.50
P2040	22	16	1.41	12.05	100.37	903.27
P2041	33	16	1.89	16.18	134.83	1213.43
P2042	47	16	3.73	31.95	266.04	2394.34
P2043	68	16	4.72	40.44	336.95	3032.55
P2044	1.5	25	.43	3.64	30.33	272.93
P2045	2.2	25	.48	4.08	33.95	305.55
P2046	3.3	25	.57	4.85	40.35	363.15
P2047	4.7	25	.68	5.78	48.12	433.02
P2048	6.8	25	.84	7.17	59.69	537.18
P2049	10	25	1.09	9.30	77.48	697.28
P2050	15	25	1.48	12.65	105.38	948.38
P2051	22	25	3.73	31.93	266.04	2394.34
P2052	33	25	4.72	40.44	336.95	3032.55
P2053	0.1	35	.38	3.21	26.70	240.30
P2054	0.15	35	.38	3.21	26.70	240.30
P2055	0.22	35	.38	3.21	26.70	240.30
P2056	0.33	35	.38	3.21	26.70	240.30
P2057	0.47	35	.38	3.21	26.70	240.30
P2058	0.68	35	.38	3.21	26.70	240.30
P2059	1.0	35	.39	3.33	27.82	250.32
P2060	1.5	35	.48	4.06	33.78	303.88
P2061	2.2	35	.55	4.67	38.88	349.88
P2062	3.3	35	.67	5.74	47.77	429.87
P2063	4.7	35	.83	7.04	58.65	527.85
P2064	6.8	35	1.05	8.98	74.79	673.09
P2065	10	35	1.40	11.97	99.75	897.75
P2066	15	35	4.72	40.44	336.95	3032.55
P2067	0.1	50	.40	3.40	28.33	254.93
P2068	0.15	50	.40	3.40	28.33	254.93
P2069	0.22	50	.40	3.40	28.33	254.93
P2070	0.33	50	.40	3.40	28.33	254.93
P2071	0.47	50	.40	3.40	28.33	254.93
P2072	0.68	50	.45	3.82	31.80	286.20
P2073	1.0	50	.59	4.99	41.55	373.95
P2074	1.5	50	.63	5.40	45.00	405.00
P2075	2.2	50	.80	6.84	57.00	513.00
P2076	3.3	50	1.07	9.15	76.19	685.69
P2077	4.7	50	2.27	19.40	161.60	1454.40
P2078	[illegible]	50	4.72	40.44	[illegible]	3032.55

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7400TTL		LM320K-5	1.35	CD4026	2.50	2114L 450ns	4.00
7400N	.19	LM320K-12	1.35	CD4027	.66	4116 200ns	2.95
7402N	.20	LM320K-15	1.35	CD4028	.85	8-4116 200ns	18.40
7404N	.25	LM320T-5	.95	CD4029	1.35	MM5262	.40
7409N	.27	LM320T-8	.95	CD4030	.45	MM5280	3.00
7410N	.25	LM320T-12	.95	CD4035	1.00	MM5320	5.95
7414N	.70	LM320T-15	.95	CD4040	1.35	MM5330	5.94
7420N	.25	LM323K-5	5.95	CD4042	.85	PD411D-3	4.00
7422N	.39	LM324N	1.00	CD4043	.85	PD411D-4	5.00
7430N	.25	LM339N	1.00	CD4044	.85	Pin101L	8.95
7442N	.58	LM340K-5	1.00	CD4046	1.67	4200A	9.95
7445N	.82	LM340K-8	1.35	CD4049	.45	8Z525	2.90
7447N	.63	LM340K-12	1.35	CD4050	.60	91L02A	1.50
7448N	.77	LM340K-15	1.35	CD4051	1.13	HD0165-5	9.95
7450N	.25	LM340K-24	1.35	CD4060	1.42	MM5/100	4.50
7474N	.35	LM340T-5	.85	CD4066	.71	GIAY38500-1	9.95
7475N	.49	LM340T-8	.85	CD4068	.40	MCM6675-1A	9.95
7480N	.88	LM340T-12	.85	CD4069	.40	9368	3.50
7490N	1.70	LM340T-15	.85	CD4070	.50	410D	10.00
7490N	.43	LM340T-18	.85	CD4071	.45	416	16.00
7492N	.43	LM340T-24	.85	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	1.45	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	MM5841	14.45
74125N	.45	LM709H	.59	CD4116	.47	MM5865	7.95
74145N	.77	LM723HN	.60	CD4490	5.50	CT7010	8.95
74150N	1.20	LM733N	.85	CD4507	1.00	CT7015	8.95
74151N	.69	LM741CH	.35	CD4508	2.85	MM5375AA/N	3.90
74154N	1.25	LM741N	.35	CD4510	1.00	MM5375AG/N	4.90
74157N	.69	LM747HN	.75	CD4511	.94	7205	16.50
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	9.95
74174N	.96	LM1305	1.27	CD4520	1.02	DS0026CN	3.75
74175N	.85	LM1307	2.00	CD4527	1.51	DS0056CN	3.75
74190N	1.15	LM1310	2.75	CD4528	1.60	MM53104	2.50
74192N	.87	LM1458	.55	CD4553	3.50		
74193N	.85	LM1812	7.50	CD4566	2.45	**MICROPROCESSOR**	
74221N	1.25	LM1889	3.00	CD4583	2.35	6502	10.95
74298N	1.65	LM2111	1.75	CD4585	1.10	6504	9.95
74365N	.75	LM2902	2.25	CD40192	3.00	6522	9.95
74366N	.75	LM3900N	.60	74C00	.35	6530	9.50
74367N	.75	LM3905	1.75	74C04	.40	6800	6.95
		LM3909N	.95	74C10	.35	6802	11.95
74LS00 TTL		MC1458P	.55	74C14	.89	6820	4.95
74LS00N	.29	NE5508	1.35	74C20	.35	6850	5.95
74LS02N	.29	NE555V	.39	74C30	.35	6880A	3.95
74LS04N	.35	NE556A	.85	74C48	1.95	8085	12.95
74LS05N	.25	NE566A	1.00	74C74	.85	Z80	9.95
74LS08N	.35	NE566N	1.50	74C76	1.25	Z80A	11.95
74LS10N	.35	NE567V	1.00	74C90	1.25	8212	2.90
74LS13N	.55	NE5708	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
74LS22N	.35	78M05	.85	74C175	1.35	8228	4.95
74LS28N	.35	7510B	1.75	74C192	1.65	8251	6.95
74LS30N	.35	75491CN	.50	74C221	1.90	8253	15.00
74LS33N	.60	75492CN	.55	74C895	6.00	8255	5.75
74LS38N	.50	75494CN	.89	74C906	.75	8257	10.95
74LS74N	.45			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	80388	7.50	74C925	7.50	1861P	9.50
74LS95N	1.00	8700CJ	13.95	74C926	6.95	CDP1802CD	28.95
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	.69	9400CN/F	7.40	8095	.65	**UART/PIFO**	
74LS136N	.50	ICL7103	9.50	8096	.65	AY5-1013	5.50
74LS151N	.75	ICL7107	14.25	8097	.65	AY5-1014	7.50
74LS155N	.79			8098	.65	3341	6.95
74LS157N	1.10	**CMOS**		BT09	1.75		
74LS162N	1.10	CD4000	.25	BT10	4.50		
74LS163N	1.10	CD4001	.35	BT13	3.00	**PROM**	
74LS191N	1.25	CD4002	.35	BT20	5.50	1702A	4.50
74LS190N	1.25	CD4006	1.10	BT23	3.10	2532	19.75
74LS221N	1.25	CD4007	.35	BT24	3.50	2708	4.70
74LS258N	1.00	CD4008	1.20	BT25	3.20	2716T1	6.50
74LS367N	.89	CD4009	.45	BT26	1.69	2716 5 Volt	6.50
		CD4010	.45	BT28	2.75	B/2716 5 Volt	48.00
LINEAR		CD4011	.35	BT97	1.69	2732	19.75
CA3045	.90	CD4012	.28	BT98	1.69	2758	11.00
CA3046	1.10	CD4013	.47			8741A	55.00
CA3081	1.80	CD4014	1.25	**MOS/MEMORY**		8748	55.00
CA3082	1.90	CD4015	1.00	**RAM**		8748-8	55.00
CA3089	3.40	CD4016	.55	2101-1	2.95	8755A	55.00
LM301AN/AH	.35	CD4017	1.05	2102-1	.95	N82S23	2.95
LM305H	.87	CD4018	.94	2102AL-4	1.45	N82S123	4.95
LM307N	.35	CD4019	.45	2102AN-2L	1.65	N82S126	7.75
LM308N	1.00	CD4020	1.02	2104A-4	4.95	N82S129	4.95
LM309K	1.25	CD4021	1.35	2107B-4	3.75	N82S131	4.95
LM311H/N	.90	CD4022	1.10	2111-1	3.75	N82S136	8.75
LM317T	1.65	CD4023	.28	2112-2	3.95	N82S137	8.75
LM317K	3.75	CD4024	.75	2114	3.75	DM8577	2.90
LM318	1.50	CD4025	.28	2114L 300ns	4.25	8223	3.50

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 Tin	Low Profile
Pin 1 UP Pin	1 UP
8 .15 22	.30
14 .21 24	.35
16 .28 28	.42
18 .27 36	.58
20 .29 40	.57

2 level 14 pin ea. 70

WIRE WRAP LEVEL 3

Pin		Pin	
14	.55	24	.93
16	.57	28	1.00
18	.67	40	1.59

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
2.0100 MHz	1.95
2.097152 MHz	4.50
2.4576 MHz	4.50
3.2768 MHz	4.50
5.0688 MHz	4.50
5.185 MHz	4.50
5.7143 MHz	4.50
6.5536 MHz	4.50
14.31818 MHz	4.25
18.432 MHz	4.50
22.1184 MHz	4.50

KEYBOARD ENCODERS

AY5-2376	$12.50
AY5-3600	17.95
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
DA15P	1.95
DA15S	2.10
Complete Set	3.10
	9.50

Hixon 3½ Digit LED mul. timeter $89.95
Stopwatch Kit 29.95
Auto Clock Kit 17.95
Digital Clock Kit 19.75

8K/16K Epson 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 plastic box	4.00
5 per type	6.75

½ watt 5% per type .05

DIP Switches
4-position $ .95 7-position 1.00
5-position 1.00 8-position 1.05
6-position 1.00

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	29.95

LEDS

Red T01¾	.15
Green, Yellow T01¾	.20
Jumbo Red	.20
Green, Orange, Yellow Jumbo	.25

Digilite 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. **$169.95**

OR WIRE WRAP TOOLS in stock
Portable Multimeter $18.00

Complete line of AP Products in stock

SPECIAL PRODUCTS

MM5865 Stopwatch Timer with 10 pg. spec	9.00
PC board	7.50
Switches Mom. Pushbutton	.27
3 pos. slide	.25
Encoder HD0165-5	6.95

Paratronics

Model 10 Trigger Expander Kit	$229.00
Model 100 Bus Grabber Kit	$369.00
Clock Calendar Kit	**$23.95**
2.5 MHz Frequency Counter Kit	**$37.50**
3D MHz Frequency Counter Kit	**$47.75**

TRANSFORMERS

6V 300 ma	3.25
12 Volt 2 amp wall plug	7.95
12 6 CT 2 amp	5.95
12 6 CT 4 amp	9.45
12 6 CT 8 amp	12.45
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 8 16 VA wall plug	9.75

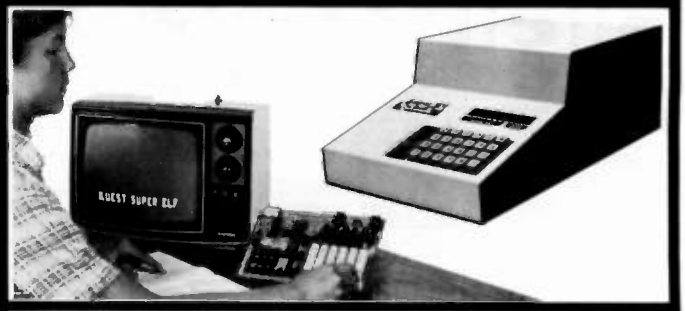
DISPLAY LEDS

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	.30
FND800/810	CC/CA	.800	2.70
3 digit Bubble			.60
10 digit display			1.25
7520 Clarex photocells			.39
TIL311 Hex			9.50
MAN3640	CC	.30	1.10
MAN4610	CA	.40	1.20
MAN4640	CC	.40	1.20
MAN6710	CA	.60	.95
MAN6740	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
102P3 transformer 2.25
MA1012A Transformer 2.25

Televideo Terminal
Model 912 $785.00
Model 920 $885.00

4116 200ns Dynamic RAM
8/$18.40



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.

Free 14 page brochure.
of complete Super Elf system.

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 $\pm .17E^{38}$), 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.

Type-N-Talk by Votrax

Text to speech synthesizer with unlimited vocabulary, built-in text to speech algorithm, 70 to 100 bits per second speech synthesizer, RS232C interface $345.00.

1802 16K Dynamic RAM Kit $149.00

Expandable to 64K. Hidden refresh w/clocks up to 4 MHz w/no wait states. Addl. 16K RAM **$25.00**

Tiny Basic Extended on Cassette	**$15.00**
(Added commands include Stringy, Array, Cassette I/O etc.) S-100 4-slot expansion	**$ 9.95**
Super Monitor VI.I Source Listing	**$15.00**

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.**

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. **Dealers: Send for excellent pricing/margin program.**

Editor Assembler	**$25.00**
(Requires minimum of 4K for E/A plus user source)	
1802 Tiny Basic Source listing	**$19.00**
Super Monitor V2.0/2.1 Source Listing	**$20.00**

PROM Eraser

assembled. 25 PROM capacity **$37.50** (with timer **$69.50**). 6 PROM capacity OSHA/UL version **$78.50** (with timer **$108.50**).

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	**$161.00**
Color Video Kit	129.95

81 IC Update Master Manual $79.95

Comp. IC data selector, 2 vol. master reference guide. Over 51,000 cross references. Free update service through 1981. Domestic postage $4.75.

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. Article in June *Radio Electronics*.

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**

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. **$9.95**

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. **$405.00.** 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 **$625.00.**

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 **$35.95.** Kit with chassis and all hardware **$51.95.** Add $5.00 shipping. Kit of hardware **$16.00.** Woodgrain case **$10.00.** $1.50 shipping.

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.

FREE: Send for your copy of our NEW 1981 QUEST CATALOG. Include 48¢ stamp.

RAMSEY ELECTRONIC'S Inc.

PARTS WAREHOUSE

We now have available a bunch of goodies too good to bypass. Items are limited so order today

2575 Baird Rd.
Penfield, NY 14526
716-586-3950

Call Your Phone Order In Today

TERMS: Satisfaction guaranteed or money refunded. C.O.D. add $2.00. Minimum order $6.00. Orders under $10.00 add $1.50. Add 5% for postage, insurance, handling. Overseas add 15%. N.Y. residents add 7% tax.

MINI KITS - YOU HAVE SEEN THESE BEFORE NOW HERE ARE OLD FAVORITE AND NEW ONES TOO. GREAT FOR THAT AFTERNOON HOBBY.

FM MINI MIKE

A super high performance FM wireless mike kit! Transmits a stable signal up to 300 yards with exceptional audio quality by means of its built in electret mike. Kit includes case, mike, on-off switch, antenna, battery and super instructions. This is the finest unit available.

FM-3 Kit $14.95
FM-3 Wired and Tested 19.95

Color Organ

See music come alive! 3 different lights flicker with music. One light each for, high, mid-range and lows. Each individually adjustable and drives up to 300 W. runs on 110 VAC.

Complete kit, ML-1 **$8.95**

Video Modulator Kit

Converts any TV to video monitor. Super stable, tunable over ch. 4-6. Runs on 5-15V, accepts std. video signal. Best unit on the market! Complete kit, VD-1 **$7.95**

Led Blinky Kit

A great attention getter which alternately flashes 2 jumbo LEDs. Use for name badges, buttons, warning panel lights, anything! Runs on 3 to 15 volts. Complete kit, BL-1 **$2.95**

Super Sleuth

A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2 W rms output, runs on 6 to 15 volts, uses 8-45 ohm speaker. Complete kit, BN-9 **$5.95**

CPO-1

Runs on 3-12 Vdc 1 wall out, 1 KHZ good for CPO, Alarm, Audio Oscillator. Complete kit **$2.95**

FM Wireless Mike Kit

Transmits up to 300' to any FM broadcast radio, uses any type of mike. Runs on 3 to 9V. Type FM-2 has added sensitive mike preamp stage.

FM-1 kit $3.95 FM-2 kit $4.95

Whisper Light Kit

An interesting kit, small mike picks up sounds and converts them to light. The louder the sound, the brighter the light. Includes mike, controls up to 300 W, runs on 110 VAC.

Complete kit, WL-1 **$6.95**

Tone Decoder

A complete tone decoder on a single PC board. Features: 400-5000 Hz adjustable range via 20 turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts. Complete kit, TD-1 **$5.95**

Universal Timer Kit

Provides the basic parts and PC board required to provide a source of precision timing and pulse generation. Uses 555 timer IC and includes a range of parts for most timing needs.

UT-5 Kit $5.95

Mad Blaster Kit

Produces LOUD ear shattering and attention getting siren like sound. Can supply up to 15 watts of obnoxious audio. Runs on 6-15 VDC

MB-1 Kit $4.95

Siren Kit

Produces upward and downward wail characteristic of a police siren. 5 W peak audio output, runs on 3-15 volts, uses 3-45 ohm speaker.

Complete kit, SM-3 $2.95

60 Hz Time Base

Runs on 5-15 VDC. Low current (2.5ma). 1 minimonth accuracy. TB-7 Kit $5.50
TB-7 Assy $9.95

CLOCK KITS

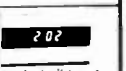
Your old favorites are here again. Over 7,000 Sold to Date. Be one of the gang and order yours today!

Try your hand at building the finest looking clock on the market. Its satin finish anodized aluminum case looks great anywhere, while six .4" LED digits provide a highly readable display. This is a complete kit, no extras needed, and it only takes 1-2 hours to assemble. Your choice of case colors: silver, gold, black (specify).

Clock kit, 12/24 hour, DC-5 **$24.95**
Clock with 10 min. ID timer, 12/24 hour, DC-10 **$29.95**
Alarm clock, 12 hour only, DC-8 **$29.95**
12V DC car clock, DC-7 **$29.95**

For wired and tested clocks add $10.00 to kit price.
SPECIFY 12 OR 24 HOUR FORMAT

Car Clock



The UN-KIT, only 5 solder connections

Here's a super looking, rugged and accurate auto clock which is a snap to build and install. Clock movement is completely assembled — you only solder 3 wires and 2 switches. Takes about 15 minutes! Display is bright green with automatic brightness control photocell — assures you of a highly readable display day or night. Comes in a satin finish anodized aluminum case which can be attached 5 different ways using 2 sided tape. Choice of silver, black or gold case (specify).

DC-3 kit, 12 hour format **$22.95**
DC-3 wired and tested **$29.95**

Calendar Alarm Clock

The clock that's got it all. 6-.5" LEDs, 12/24 hour, snooze, 24 hour alarm, 4 year calendar, battery backup, and lots more. The super 7001 chip is used. Size 5x4x2 inches. Complete kit, less case (not available)

DC-9 **$34.95**

Under Dash Car Clock

12/24 hour clock in a beautiful plastic case features 6 jumbo RED LEDS, high accuracy (.001%), easy 3 wire hookup, display blanks with ignition, and super instructions. Optional dimmer automatically adjusts display to ambient light level.

OC-11 clock with mtg. bracket **$27.95 kit**
OM-1 dimmer adapter **$2.50**
Add $10.00 Assy. and Test

Video Terminal

A completely self-contained, stand alone video terminal card. Requires only an ASCII keyboard and TV set to become a complete terminal unit. Features are: single 5V supply, XTAL controlled sync and baud rates (to 9600), complete computer and keyboard control of cursor. Parity error control and display. Accepts and generates serial ASCII plus parallel keyboard input. The 6418 is 64 char. by 16 lines with scrolling, upper and lower case (optional), and has RS-232 and 20ma loop interfaces on board. Kits include sockets and complete documentation.

RE 6418, terminal card kit (add $60.00 for wired unit) **$189.95**
Lower Case option **$13.95**
Power Supply **$14.95**
RF Modulator kit **$7.95**

PARTS PARADE

IC SPECIALS

LINEAR

301	$ .35
324	$1.50
380	$1.50
555	$ .45
556	$1.00
565	$1.00
566	$1.00
567	$1.25
741	10/$2.00
1458	$ .50
3900	$ .50
3914	$2.95
8038	$2.95

CMOS

4011	.50
4013	.50
4046	$1.85
4049	.50
4059	$9.00
4511	$2.00
4518	$1.35
5639	$1.75

TTL

74S00	$ .40
7447	$ .65
7475	$ .50
7490	$ .50
74196	$1.35

SPECIAL

11C90	$15.00
10116	$ 1.25
7208	$17.50
7207A	$ 5.50
7216D	$21.00
7107C	$12.50
5314	$ 2.95
5375AB/G	$ 2.95
7001	$ 6.50

FERRITE BEADS

With info and specs 15/$1.00
6 Hole Balun Beads 5/$1.00

Sockets

8 Pin	10/$2.00
14 Pin	10/$2.00
16 Pin	10/$2.00
24 Pin	4/$2.00
28 Pin	4/$2.00
40 Pin	3/$2.00

READOUTS

FND 359 .4" C.C.	$1.00
FND 507/510 .5" C.A.	1.00
MAN 72/HP7730 .33" C.A.	1.00
HP 7651 .43" C.A.	2.00

TRANSISTORS

2N3904 NPN C-F	15/$1.00
2N3906 PNP C-F	15/$1.00
2N4403 PNP C-F	15/$1.00
2N4410 NPN C-F	15/$1.00
2N4916 FET C-F	4/$1.00
2N5401 PNP C-F	5/$1.00
2N6028 C-F	4/$1.00
2N3771 NPN Silicon	$1.50
2N5179 UHF NPN	3/$2.00
Power Tab NPN 40W	3/$1.00
Power Tab PNP 40W	3/$1.00
MPF 102/2N5484	$.50
NPN 3904 Type T+R	50/$2.50
PNP 3906 Type T+R	50/$2.50
2N3055	$.80
2N2646 UJT	3/$2.00

Diodes

5.1 V Zener	20/$1.00
1N914 Type	50/$1.00
1KV 2Amp	8/$1.00
100V 1Amp	15/$1.00

25 AMP
100V Bridge
$1.50 each

Mini-Bridge 50V
1 AMP
2 for $1.00

Resistor Ass't

Assortment of Popular values - ¼ watt. Cut lead for PC mounting. ½" center. ½" leads, bag of 300 or more. **$1.50**

Switches

Mini toggle SPDT $1.00
Red Pushbuttons N.O. 3/$1.00

Earphones

3" leads, 8 ohm, good for small tone speakers, alarm clocks, etc.
5 for $1.00

Mini 8 ohm Speaker

Approx 2¼" diam. Round type for radios, mike etc.
3 for $2.00

Slug Tuned Coils

Small 3/16" Hex Slugs turned coil 3 turns. 10 for $1.00

CAPACITORS

TANTALUM Dipped Epoxy	ALUMINUM Electrolytic	DISK CERAMIC
1.5 uF 25V 3/$1.00	1000 uF 16V Radial .50	.01 16V disk 20/$1.00
1.8 uF 25V 3/$1.00	500 uF 20V Axial .50	1 16V 15/$1.00
.22 uF 25V 3/$1.00	150 uF 16V Axial $1.00	.001 16V 20/$1.00
	10 uF 15V Radial 10/$1.00	100 pF 20/$1.00
		.047 16V 20/$1.00

DC-DC Converter

+5 vdc input prod. -9 vdc @ 30ma
+9 vdc produces -15 vdc @ 35ma $1.25

Ceramic IF Filters

Mini ceramic filters 7 kHz B.W. 455 kHz $1.50 ea.

25K 20 Turn Trim Pot $1.00
1K 20 Turn Trim Pot $ .50

Trimmer Caps

Sprague - 3-40 pf Stable Polypropylene .50 ea.

Crystal Microphone

Small 1" diameter ¾" thick crystal mike cartridge $.75

Mini RG-174 Coax

10 ft. for $1.00

Coax Connector

Chassis mount BNC type $1.00

9 Volt Battery Clips

Nice quality clips 5 for $1.00
⅜" Rubber Grommets 10 for $1.00

Parts Bag

Asst. of chokes, disc caps, tant. resistors, transistors, diodes, MICA caps etc.
sm. bag (100 pc) $1.00 lg. bag (300 pc) $2.50

Connectors

6 pin type gold contacts for mA-1003 car clock module price .75 ea.

Leds - your choice, please specify
Mini Red, Jumbo Red, High Intensity Red, Illuminator Red 8/$1
Mini Yellow, Jumbo Yellow, Jumbo Green 6/$1

Varactors

Motorola MV 2209 30 PF Nominal cap 20-80 PF - Tunable range - .50 each or 3/$1.00

Crystals

3.579545 MHZ	$1.50
10.00000 MHZ	$5.00
5.248800 MHZ	$5.00

AC Adapters

Good for clocks, nicad chargers, all 110 VAC plug one end.

8.5 vdc @ 20 mA	$1.00
16 vac @ 160mA	$2.50
12 vac @ 250mA	$3.00

Solid State Buzzers

small buzzer 450 Hz 86 dB sound output on 5-12 vdc at 10-30 mA. TTL compatible $1.50

AC Outlet

Panel Mount with Leads 4/$1.00

Audio Prescaler

Make high resolution audio measurments, great for musical instrument tuning, PL tones, etc. Multiplies audio UP in frequency, selectable x10 or x100, gives .01 HZ resolution with 1 sec. gate time! High sensitivity of 25 mv. 1 meg input z and built-in filtering gives great performance. Runs on 9V battery, all CMOS.

PS-2 kit **$29.95**
PS-2 wired **$39.95**

600 MHz PRESCALER

Extend the range of your counter to 600 MHz. Works with all counters. Less than 150 mv sensitivity, specify -10 or -100

Wired, tested, PS-1B **$59.95**
Kit, PS-1B **$44.95**

30 Watt 2 mtr PWR AMP

Simple Class C power amp features 8 times power gain. 1 W in for 8 out, 2 W in for 15 out, 4W in for 30 out. Max output of 35 W, incredible value, complete with all parts, less case and T-R relay.

PA-1, 30 W pwr amp kit **$22.95**
TR-1, RF sensed T-R relay kit **6.95**

MRF-238 transistor as used in PA-1 8-10db gain 150 mhz **$11.95**

RF actuated relay senses RF (1W) and closes DPDT relay. For RF sensed T-R relay TR-1 Kit **$6.95**

Power Supply Kit

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

Complete kit, PS-3LT **$6.95**

OP-AMP Special

BI-FET LF 13741 - Direct pin for pin 741 compatible, but 500,000 MEG input z, super low 50 pa input current, low power drain.

50 for only $9.00 10 for $2.00

Regulators

78MG	$1.25	7812	$1.00
79MG	$1.25	7815	$1.00
723	$.50	7905	$1.25
309K	$1.15	7912	$1.25
7805	$1.00	7915	$1.25

Shrink Tubing Nubs

Nice precut pces of shrink size: 1" x ¼" shrink to ⅛". Great for splices 50/$1.00

Mini TO-92 Heat Sinks

Thermalloy Brand 5 for $1.00
TO-220 Heat Sinks 3 for $1.00

Opto Isolators - 4N28 type **$.50 ea.**
Opto Reflectors - Photo diode + LED **$1.00 ea.**

Molex Pins

Molex already precut in length of 7. Perfect for 14 pin sockets. 20 strips for $1.00

CDS Photocells

Resistance varies with light, 250 ohms to over 3 meg 3 for $1.00

See List of Advertisers on page 130

SEMICONDUCTORS SURPLUS

2822 North 32nd Street, #1 • Phoenix, Arizona 85008 • Phone 602-956-9423

ATLAS FILTERS

ATLAS CRYSTAL FILTERS FOR ATLAS HAM GEAR

Your Choice

$15.95 ea.

5.645 - 2.7/8
5.595 - 2.7 USB
5.595 - 2.7/8/L
5.595 - 2.7 LSB
5.595 - .500/4
9.0 - USB/CW

Soldering Kit

New Weller Soldering Iron Kit
#SP-23F..... 9.99 each
Kit includes:
- 1 - 25 Watt soldering iron, develops 750° of tip temperature
- 3 - tips (screwdriver, chisel, cone)
- 1 - soldering aid tool
- 1 - coil 60/40 rosin core solder

CERAMIC PLATE CAPS

$1.09 each
#1 type for 3/8 plate cap
#2 type for 5/8 plate cap

Used NiCads

Used C Nickel Cadmium Batteries
1.8 amp hour
Pack of ten $8.99 per pack

CERAMIC COIL FORMS

$1.99 each

#1	3/16" x 4/8"
#2	3/16" x 1/4"
#3	1/4" x 3/4"
#4	3/8" x 7/8"
#5	3/8" x 5/8"

All of the above have powdered iron cores.

#6	1/2"x2 3/4"

NEW BOGNER DOWNCONVERTER
Industrial version.
1 year guarantee..... $225.00
NOT FOR SALE IN ARIZONA

UHF/VHF RF POWER TRANSISTORS
CD2867/2N6439
60 Watts output
Reg. Price $45.77
SALE PRICE..... $19.99

CHOKES

.1-3 uH	2.99
VIV .15 .15 uH	2.99
VIV 150 150 uH	2.99
5-20 uH	1.69
Variable coil 10-80 uH	2.99
Transformer dual 8.8 uH	1.00
.47 uH	1.00 ea. or 10/7.50
.68 uH	1.00 ea. or 10/7.50
1 uH	1.00 ea. or 10/7.50
1.2 uH	1.00 ea. or 10/7.50
1.5 uH	1.00 ea. or 10/7.50
2.2 uH	1.00 ea. or 10/7.50
2.7 uH	1.00 ea. or 10/7.50
3.3 uH	1.00 ea. or 10/7.50
6.5 uH	1.00 ea. or 10/7.50
7.5 uH	1.00 ea. or 10/7.50
10 uH	1.00 ea. or 10/7.50
15 uH	1.00 ea. or 10/7.50
20 uH	1.00 ea. or 10/7.50
22 uH	1.00 ea. or 10/7.50
33 uH	1.00 ea. or 10/7.50
39 uH	1.00 ea. or 10/7.50
47 uH	1.00 ea. or 10/7.50
50 uH	2.99
56 uH	1.69
62 uH	1.00 ea. or 10/7.50
68 uH	1.00 ea. or 10/7.50
100 uH	2.99
120 uH	1.69
185 uH	1.00 ea. or 10/7.50
538 uH	1.00 ea. or 10/7.50
680 uH	1.00 ea. or 10/7.50
1000 uH	1.00 ea. or 10/7.50
1630 uH	1.50
.1 mH	2.99
.2 mH	2.99
.22 mH	2.99
.27 mH	2.99
.33 mH	2.99
.39 mH	2.99
.240 mH	2.99
1.2 mH	2.99
1.5 mH	2.99
1.65 mH	2.99
1.75 mH	2.99
1.9 mH	2.99
1 mH	1.69
1.88 mH	3.99
2 mH	2.99
2.4 mH	2.99
2.5 mH	1.00 ea. or 10/7.50
2.7 mH	2.99
3.0 mH	2.99
3.6 mH	2.99
4.3 mH	2.99
4.7 mH	2.99
5 mH	2.99
5.11 mH	2.99
6 mH	2.99
7.2 mH	2.99
8.25 mH	2.99
8.28 mH	2.99
8.6 mH	2.99
10 mH	2.99
12 mH	2.99
15 mH	2.99
17 mH	2.99
19.6 mH	2.99
20 mH	2.99
20.5 mH	2.99
22.6 mH	2.99
24 mH	2.99
27.4 mH	2.99
28.7 mH	2.99
29.9 mH	2.99
30 mH	2.99
36 mH	2.99
36.5 mH	2.99
40 mH	2.99
40.2 mH	2.99
43 mH	2.99
47 mH	2.99
50 mH	2.99
59 mH	2.99
60 mH	2.99
71.5 mH	2.99
78.7 mH	2.99
86 mH	2.99
100 mH	2.99
120 mH	2.99
150 mH	2.99
175 mH	2.99
200 mH	2.99
205 mH	2.99
237 mH	2.99
240 mH	2.99
300 mH	2.99
360 mH	2.99
390 mH	2.99
430 mH	2.99
500 mH	1.50
600 mH	2.99
1000 mH	2.99
1.5 Hy	2.99
2.0 Hy	2.99
2.5 Hy	2.99
3.0 Hy	2.99
5.0 Hy	2.99
10 Hy	2.99

HIGH VOLTAGE CAPS

420 MFD @ 400 VDC	3.99 each
600 MFD @ 400 VDC	3.99 each

New Fairchild Prescaler Chip

95H90DCQM..... 6.50 each
350 MHz prescaler divide by 10/11

Johnson AIR Variables

1/4 x 2 1/2" shaft
$2.50 each

193-10-6	2.2 to 34 pF
193-	1.5 to 27.5pF
193-	.6 to 6.4pF

$1.00 each

160-107-16	.5 to 12 pF
193-10-9	2.2 to 34 pF
193-10-104	2.2 to 34 pF
193-4-5	3 to 30 pF

RF Power Device

MRF454 Same as MRF458
12.5 VDC, 3-30 MHz
80Watts output, 12dB gain
$17.95 ea.

E.F. JOHNSON TUBE SOCKETS

#124-0311-100 ..... 6.99 each
For 8072 etc.
#124-0107-001 ..... 13.99 each
For 4CX250B/R, 4X150A etc.
#124-0111-001 ..... 4.99 each
Chimney for 4CX250B/R and 4X150
#124-0113-001 and 124-0113-021
$12.99 each
Capacitor for #124-0107-001
#123-209-33 Sockets....6.99 each
For 811A, 572B, 866, etc.

UNELCO CAPS

6.8pF	47pF	
8.2pF	62pF	
10pF	100pF	
12pF	160pF	
13pF	180pF	
14pF	200pF	
20pF	240pF	
24pF	380pF	
33pF	470pF	
36pF	1000pF	
43pF	350V	$1.00 each

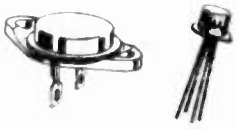
86 Pin Motorola Bus Edge Connectors

Gold plated contacts
Dual 43/86 pin .156 spacing
Solder tail for PCB ..... $3.00 each

110VAC MUFFIN FANS

New $11.95
Used $5.95

Transistors



2N2857JAN	2.50
2N2949	3.60
2N2947	15.00
2N2950	4.60
2N3375	8.00
2N3553	1.57
2N3818	5.00
2N3866	1.00
2N3866JAN	2.50
2N3866JANTX	4.00
2N3925	10.00
2N3948	2.00
2N3950	25.00
2N3959	3.00
2N3960JANTX	10.00
2N4072	1.60
2N4427	1.10
2N4429	7.00
2N4877	1.00
2N4959	2.00
2N4976	15.00
2N5070	8.00
2N5071	15.00
2N5108	4.00
2N5109	1.50
2N5179	1.00
2N5583	4.00
2N5589	6.00
2N5590	8.00
2N5591	11.00
2N5635	5.44
2N5636	11.60
2N5637	20.00
2N5641	5.00
2N5643	14.00
2N5645	10.00
2N5842	8.00
2N5849	20.00
2N5942	40.00
2N5946	14.00
2N5862	50.00
2N6080	7.00
2N6081	10.00
2N6082	11.00
2N6083	13.00
2N6084	14.00
2N6095	11.00
2N6096	20.00
2N6097	28.00
2N6166	38.00
2N6368	22.99
A210/MRF517	2.00
BLY38	5.00
40280/2N4427	1.10
40281/2N3920	7.00
40282/2N3927	10.48

High Voltage Caps

30 MFD @ 500 VDC	1.69
22 MFD @ 500 VDC	1.69
100 MFD @ 450 VDC	2.29
150 MFD @ 450 VDC	3.29
225 MFD @ 450 VDC	4.29
.001/1000pF @ 10 KV	.89
.001 @ 3 KV	4/1.00
.0015 @ 3 KV	3/1.00
.01 @ 4 KV	.79
.01 @ 1.6KV	4/1.00
.02 @ 8 KV	2.00
.01 @ 1 KV	6/1.00

NEW 2" ROUND SPEAKERS
100 Ohm coil $.99 each

PLASTIC TO-3 SOCKETS
4/$1.00

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

78MO5
Same as 7805 but only 1/2 Amp
5 VDC .49 each or 10/$3.00

TRIMMER CAPS

Sprague. Stable Polypropylene.
.50 each or 10/4.00
not sold mixed
1.2 to 13pF
2 to 30pF
3.9 to 18pF
3.9 to 40pF
3.9 to 55pF

Carbide Circuit Board Drill Bits
for PCB Boards
5 mix for $5.00

J-Fet

J310 N-CHANNEL J-FET 450 MHz
Good for VHF/UHF Amplifier,
Oscillator and Mixers 3/$1.00

MURATA CERAMIC FILTERS

SFD 455D	455 KHz	2.00
SFB 455D	455 KHz	1.60
CFM455E	455 KHz	5.50
CFU455H	455 KHz	3.00
SFE 10.7MA	10.7 MHz	2.99

TEXAS INSTRUMENT TIL-305P
5 x 7 array alphanumeric display
$3.85 each

ORDERING INSTRUCTIONS

Check, money order, or credit cards welcome. (Master Charge and VISA only.) No personal checks or certified personal checks for foreign countries 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 or decision 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 supersede 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.

Our toll free number for *charge orders only* is 800-528-3611.

SEMICONDUCTORS SURPLUS

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See List of Advertisers on page 130

DIGITAL RESEARCH: PARTS

"TOP QUALITY PARTS FOR LESS"

Precision Hybrid Oscillator Module

Has both 1 MHZ and 2 MHZ TTL outputs — Hermetically sealed — Ultra high stability over wide temp range — originally cost over $40.00 each — We made a super purchase from a major computer manufacturer — 5 Volt operation - fits standard 24 pin socket - Manufactered by Motorola oscillator division.

MC6871A

3/20.00

7.50 w/data

NEO 2137 by NEC

- Microwave R.F. transistor (N.P.N.)
- Micromold package #37
- Dual Emitter leads
- FT to 4.5 GHZ
- VCEO 10V-CC 20 MA. HFE 40-200
- Gain 10V-20MA-1GHZ = 14DB Typical
- Very low noise - High gain 1.5 DB @ 500 MHZ
- Cleared for high reliability space applications

COMPARE **1.50**

LM117

An easy to use adjustable Voltage Regulator - only two external resistors needed to set the output voltage - TO-3 Case - adjustable from 1.2 to 37V - Regulator is floating, so it can be used in a wide variety of applications, as long as the input-to-output differential voltage is 40V or less - 1.5A output current - house numbered - prime - Motorola.

1.75

Video Game Board

Hockey • Tennis • Handba

- General Instruments AY3-8500
- Features Exciting Sounds
- On Screen Scoring
- For 2 Players
- Speed & Paddle Controls
- Works on 9 Volts D.C.

Each board comes with RF Modulator (Ch. 3 or 4) and schematic. The only parts needed to complete game are speaker, 2 Meg Pots & Switches

4.45

3 for 12.00

Video Paddle Controls

2 for 1.00

Can be used with game board at left.

Rectifier Diode

IN4007

11/1.00

1000 Volts, 1 Amp
DO-41 Case • Prime •
Long Lead • Marked

Transformer

32VCT @ 1 amp
6V @ 1 amp

3.25

Measures:
2" x 2¼" x 2¼"
2⅜" Mounting Centers

SCOTCH LOK

Great for connecting a wire to an existing wire without stripping. Absolutely invaluable in hard to reach areas such as under car dash, inside television, etc. Simply put Scotch Lok over existing wire, insert new wire to be connected. With a standard pair of pliers, compress metal on insulator. No need for tape. Super neat installation. Once you use this you will never go back to the old way.

15/1.00

IC Specials

MC1488-1489 - RS232 Driver and Receiver **99¢** pr.

NE556-Dual NE555

2/1.25

NE555

3/1.25 or 10/3.30

Variable Inductors

30-40 uh
.9 uh - 1.2 uh
11 uh to 20 uh
.25 uh - .35 uh
.85 uh - .95 uh

4/1.00

Micro Mini Toggle Switch

99¢

6 for 5.00

SPDT • Made in USA with Hardware

JFET OP AMP

Super High Input Impedance (10^{12} OHMS) — High Frequency Response. TO 4 MHZ. Large DC Voltage Gain 106 DB — New generation OP-AMP with Vastly Superior Features!

LF356BH - **75¢ or 3/2.00**

MA1010A Clock Module

- Giant .84" LED
- Complete - add only transformer and switches
- 12 hour display format
- 50 or 60 HZ operation
- Power failure indication
- Fast and slow set controls
- Brightness control capability
- PM indicator

4.25

Fixed Inductors

.39 uh - **6/1.00** 12.5 uh - **8/1.00**
500 uh - Hash Filter
@ 2 Amps - **4/1.00**

Molded Choke

13 uh - **8/1.00** 50 mh - **6/1.00**
1.2 mh - **8/1.00**

5 Watt Zeners

6.8v	15v	48v
11v	24v	55v
12.6 v	30v	60v

5% • Some House Numbered Cut & Formed • Prime

10 for 1.00

IN4735 • 6.2V • 1 Watt
Cut & Formed 20/1.00

EIAJ #1SS98

NEC #4981-7E
Microwave - Schottky barrier diode

HP-Hot Carrier diodes
5082-2835

99¢ or 6/5.00

SEE WHAT BILLY BOB HAS TO SAY ON PAGE 18 OF OUR NEW CATALOG!

TERMS:
Add postage, we pay balance. Orders under $15 add 75¢ handling. No C.O.D. We accept Visa, MasterCard and American Express cards. Tex. Res. add 5% Tax. Foreign orders (Canada 10%) add 20% P & H.

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Digital Research: Parts

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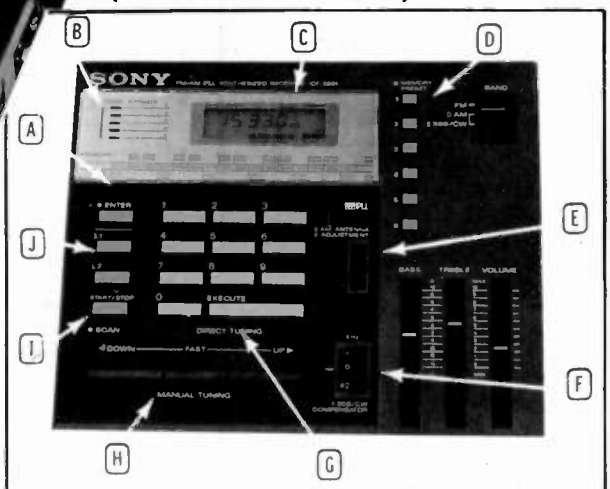
INTRODUCING SONY'S NEW DIGITAL DIRECT ACCESS RECEIVER!

only **$299.95** plus $5.00 shipping

(NOW IN STOCK)

Revolutionary Instant Access Digital Shortwave Scanner

- Continuous Scanning of LW, MW, SW, & FM Bands
- Instant Fingertip Tuning—No More Knobs!
- 6 Memories for Any Mode (AM,SSB/CW, & FM)
- Dual PLL Frequency Synthesized—No Drift!



A 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

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

PHONE
(312)848-6777

7400

SN7400N	.20	SN7472N	.29	SN74156N	.79
SN7401N	.20	SN7473N	.35	SN74157N	.69
SN7402N	.25	SN7474N	.35	SN74160N	.89
SN7403N	.25	SN7475N	.49	SN74161N	.89
SN7404N	.25	SN7476N	.35	SN74162N	.89
SN7405N	.29	SN7479N	5.00	SN74163N	.89
SN7406N	.35	SN7480N	.50	SN74164N	.89
SN7407N	.35	SN7482N	.99	SN74165N	.89
SN7408N	.29	SN7483N	.69	SN74166N	1.25
SN7409N	.29	SN7485N	.89	SN74167N	2.79
SN7410N	.25	SN7486N	.35	SN74170N	1.95
SN7411N	.29	SN7489N	1.75	SN74172N	4.95
SN7412N	.35	SN7490N	.49	SN74173N	1.39
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SN7439N	.25	SN74125N	.49	SN74196N	.89
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SN7441N	.89	SN74132N	.75	SN74198N	1.49
SN7442N	.59	SN74136N	.75	SN74199N	1.49
SN7443N	1.10	SN74141N	.99	SN74221N	1.25
SN7444N	1.10	SN74142N	3.25	SN74251N	.99
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SN7453N	.20	SN74151N	.69	SN74366N	.69
SN7454N	.20	SN74152N	.69	SN74367N	.69
SN7459A	.25	SN74153N	.79	SN74368N	.69
SN7460N	.20	SN74154N	1.25	SN74390N	1.49
SN7470N	.29	SN74155N	.79	SN74393N	1.49

74LS

74LS00	.29			74LS192	1.15
74LS01	.29			74LS193	1.15
74LS02	.29	74LS92	.75	74LS194	1.15
74LS03	.29	74LS93	.75	74LS195	1.15
74LS04	.35	74LS95	.99	74LS197	1.19
74LS05	.35	74LS96	1.15	74LS221	1.19
74LS08	.35	74LS107	.45	74LS240	1.49
74LS09	.35	74LS109	.45	74LS241	1.49
74LS10	.35	74LS112	.45	74LS242	1.49
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74LS12	.35	74LS114	.49	74LS244	1.49
74LS13	.59	74LS122	.89	74LS245	2.95
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74LS28	.35	74LS139	.89	74LS260	.69
74LS30	.35	74LS151	.89	74LS266	.69
74LS32	.35	74LS153	.89	74LS273	1.95
74LS33	.59	74LS154	1.75	74LS279	.89
74LS37	.45	74LS155	.89	74LS283	.89
74LS38	.39	74LS156	.89	74LS290	.99
74LS40	.35	74LS157	.89	74LS293	.99
74LS42	.89	74LS158	.89	74LS298	1.25
74LS47	.89	74LS160	1.15	74LS352	1.29
74LS48	1.15	74LS161	1.15	74LS353	1.29
74LS49	1.15	74LS162	1.15	74LS365	.69
74LS51	.35	74LS163	1.15	74LS366	.69
74LS54	.35	74LS164	1.15	74LS367	.69
74LS55	.35	74LS165	1.15	74LS368	.69
74LS73	.45	74LS168	1.19	74LS373	1.95
74LS74	.45	74LS169	1.19	74LS374	1.95
74LS75	.59	74LS170	1.95	74LS375	.89
74LS76	.45	74LS173	.99	74LS386	.69
74LS78	.49	74LS174	.99	74LS393	2.49
74LS83	.89	74LS175	.99	74LS399	2.49
74LS85	1.25	74LS181	2.95	74LS670	2.49
74LS86	.49	74LS190	1.25	81LS95	1.95
74LS90	.69	74LS191	1.25	81LS97	1.95

74S

74S00	.45			74S243	3.25
74S02	.45			74S244	3.25
74S03	.45	74S124	3.95	74S251	1.45
74S04	.55	74S133	.55	74S253	1.45
74S05	.55	74S134	.69	74S257	1.35
74S08	.50	74S135	1.19	74S258	1.35
74S09	.50	74S136	1.75	74S260	.79
74S10	.45	74S138	1.35	74S280	2.95
74S11	.45	74S139	1.35	74S287	3.25
74S15	.45	74S140	.79	74S288	2.75
74S20	.45	74S151	1.35	74S373	3.49
74S22	.45	74S153	1.35	74S374	3.49
74S30	.45	74S157	1.35	74S387	2.95
74S32	.55	74S158	1.35	74S471	10.95
74S38	1.25	74S160	2.95	74S472	10.95
74S40	.50	74S174	1.59	74S473	10.95
74S51	.45	74S175	1.59	74S474	12.95
74S64	.50	74S188	2.95	74S475	12.95
74S65	.50	74S194	1.95	74S570	5.95
74S74	.75	74S195	1.95	74S571	5.95
74S86	.79	74S196	1.95	74S572	9.95
74S112	.79	74S240	2.95	74S573	9.95
74S113	.79	74S241	2.95	74S940	3.15
74S114	.79	74S242	3.25	74S941	3.15

CA—LINEAR

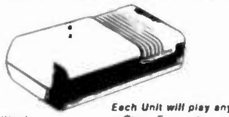
CA3010H	.99			CA3089N	3.75
CA3013H	2.15	CA3060N	3.25	CA3096N	3.95
CA3023H	3.25	CA3080H	1.25	CA3130H	1.39
CA3035H	2.49	CA3081N	2.00	CA3140H	1.25
CA3039H	1.35	CA3082N	2.00	CA3160H	1.25
CA3046N	1.30	CA3083N	1.60	CA3401N	.59
CA3059N	3.25	CA3086N	.85	CA3600N	3.50

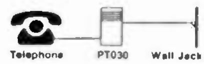
CD—CMOS

CD4000	.39			CD4098	2.49
CD4001	.39			CD4506	.75
CD4002	.39			CD4507	.99
CD4006	1.19	CD4041	1.49	CD4508	3.95
CD4007	.25	CD4042	.99	CD4510	1.39
CD4009	.49	CD4043	.89	CD4511	1.29
CD4010	.49	CD4044	.89	CD4512	1.49
CD4011	.39	CD4046	1.79	CD4514	3.95
CD4012	.25	CD4047	2.50	CD4515	2.95
CD4013	.49	CD4048	1.35	CD4516	1.49
CD4014	1.39	CD4049	.49	CD4518	1.79
CD4015	1.19	CD4050	.69	CD4519	.89
CD4016	.59	CD4051	1.19	CD4520	1.29
CD4017	1.19	CD4052	1.19	CD4526	1.79
CD4018	.99	CD4053	1.19	CD4528	1.79
CD4019	.49	CD4056	2.95	CD4529	1.95
CD4020	1.19	CD4059	9.95	CD4543	2.79
CD4021	1.39	CD4060	1.49	CD4562	11.95
CD4022	1.19	CD4066	.79	CD4566	2.79
CD4023	.29	CD4068	.39	CD4583	2.49
CD4024	.79	CD4069	.45	CD4584	.75
CD4025	.23	CD4070	.55	CD4723	1.95
CD4026	2.95	CD4071	.49	CD4724	1.95
CD4027	.69	CD4072	.49	MC14409	17.95
CD4028	.89	CD4073	.39	MC14410	18.95
CD4029	1.49	CD4075	.39	MC14411	15.95
CD4030	.49	CD4076	1.39	MC14412	15.95
CD4034	3.49	CD4078	.55	MC14419	7.95
CD4035	.99	CD4081	.39	MC14433	15.95
CD4040	1.49	CD4082	.39	MC14538	2.49
		CD4093	.99	MC14541	1.95

Phone Tunes

As Seen on "Good Morning America"
Replaces the Telephone Ringer Bell with a Selection of 30 Familiar Tunes





Each Unit will play any of the following tunes:

- Rule Brittania
- O Canada
- Colonel Bogey
- Westminister Chimes
- Mexican Hat Dance
- Twinkle, Twinkle Little Star
- Deutschlandlied
- God Save the Queen
- Close Encounters
- Happy Birthday
- Wedding March
- Jingle Bells
- Auld Lang Syne
- Soldiers Chorus
- Sailor's Hornpipe
- Charge!
- Greensleeves
- Lorelei
- Eyes of Texas
- Star Spangled Banner
- Oranges and Lemons
- Wilhelmua
- Mozart Sonata
- Pomp & Circumstance
- William Tell Overture
- Bach Toccata in D Minor
- Shave and a Haircut
- Blue Danube Waltz
- Beethoven's 5th
- La Marseillaise

FEATURES

Replaces monotonous telephone ringer bell. Easily connects to any standard telephone. Can be used alongside regular phone or replace a remote ringer elsewhere in building or outside. FCC approved. Can be used on any telephone system — worldwide. Use a different tune to identify extension phones. Microprocessor controlled. Adjustable volume control and variable tune speed control. Operates on two 9-volt batteries or AC Adapter (not included)

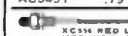
PT030 Phone Tunes $49.95
AD30 AC Adapter $8.95

DISCRETE LEDS

XC556R	.200" red	5/$1		MV50	.085" red	6/$1
XC556G	.200" green	4/$1		XC209R	.125" red	5/$1
XC556Y	.200" yellow	4/$1		XC209G	.125" green	4/$1
XC556C	.200" clear	4/$1		XC209Y	.125" yellow	4/$1
XC22R	.200" red	5/$1		XC526R	.185" red	5/$1
XC22G	.200" green	4/$1		XC526G	.185" green	4/$1
XC22Y	.200" yellow	4/$1		XC526Y	.185" yellow	4/$1
MV10B	.170" red	4/$1		XC526C	.185" clear	4/$1

Diffused Bi-Color LED

Part No.	1-99	100+
XC5491	.79	.69



RL-2 . . $.39 ea. or 3/$1.00

DISPLAY LEDS

C.A. — Common Anode
D.D. — Double Digit
C.C. — Common Cathode
RHD — Right Hand Decimal

Type	Polarity	Ht	Price
MAN 1	C.A.—red	.270	2.95
MAN 2	5x7 D.M.—red	.300	4.95
MAN 3	C.C.—red	.125	.25
MAN 52	C.A.—green	.300	.99
MAN 54	C.C.—green	.300	.99
MAN 71	C.A.—red	.300	.75
MAN 72	C.A.—red	.300	.75
MAN 74	C.C.—red	.300	1.25
MAN 82	C.A.—yellow	.300	.49
MAN 84	C.C.—yellow	.300	.99
MAN 3620	C.A.—orange	.300	.49
MAN 3630	C.A.—orange ± 1	.300	.99
MAN 3640	C.C.—orange	.300	.99
MAN 4610	C.A.—orange	.400	.99
MAN 6610	C.A.—orange—DD	.560	.99
MAN 6630	C.A.—orange ± 1	.560	.99
MAN 6640	C.C.—orange—DD	.560	.99
MAN 6650	C.C.—orange ± 1	.560	.99
MAN 6660	C.A.—orange	.560	.99
MAN 6710	C.A.—red—DD	.560	.99
MAN 6740	C.C.—red—DD	.560	.99
MAN 6750	C.C.—red ± 1	.560	.99
DLO304	C.C.—orange	.300	1.25
DLO307	C.A.—orange	.300	1.25
DLG500	C.C.—green	.500	1.25
DLG507	C.A.—green	.500	1.25
DL704	C.C.—red	.300	1.25
DL707	C.A.—red	.300	1.25
DL728	C.C.—red	.500	1.49
DL741	C.A.—red	.600	1.25
DL747	C.A.—red	.600	1.49
DL750	C.C.—red	.600	1.49
DLO847	C.A.—orange	.800	1.49
DLO850	C.C.—orange	.800	1.49
DL33B	C.C.—red	.110	.35
FND358	C.C. ± 1	.357	.99
FND357	C.C.	.357	.75
FND500	C.C. (FND503)	.500	.99
FND507	C.A. (FND510)	.500	.99
HDSP-3401	C.A.—red	.800	1.50
HDSP-3403	C.C.—red	.800	1.50
HDSP-3406	C.C. red ± 1	.800	1.50
5082-7751	C.A., R.H.D.—red	.430	1.25
5082-7760	C.C., R.H.D.—red	.430	1.25
5082-7300	4x7 Numeric (RHD)	.600	22.00
5082-7302	4x7 Numeric (LHD)	.600	22.00
5082-7340	4x7 Hxdcl. (0-9/A-F)	.600	22.50
4N28	Photo Xsistor Opto-Isol.		.69
LIT-1	Photo Xsistor Opto-Isol.		.69
MOC3010	Optically Isol. Triac Driver		1.25

SOCKETS — Test TEXTOOL Sockets — RECEPTACLES

ZERO INSERTION FORCE

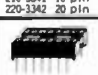
- Nickel Boron Plating
- G.F. PSF Plastic Body
- For testing IC's

Part No.	Pins	Price	Part No.	Pins	Price
214-3339	14 pin	5.95	222-3343	22 pin	9.95
216-3340	16 pin	6.49	224-3344	24 pin	9.75
218-3341	18 pin	7.95	228-3345	28 pin	11.95
220-3342	20 pin	8.95	240-3346	40 pin	12.95

- Nickel Boron Plating
- G.F. PSF Plastic Body
- Wire Wrap Contacts

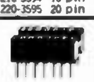
Part No.	Pins	Price	Part No.	Pins	Price
214-3592	14 pin	9.75	222-3596	22 pin	12.95
216-3593	16 pin	9.95	224-3597	24 pin	12.75
218-3594	18 pin	10.95	228-3598	28 pin	13.95
220-3595	20 pin	11.95	240-3599	40 pin	15.95

LOW PROFILE (TIN) SOCKETS



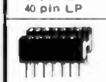
	1-24	25-49	50-100
8 pin LP	.17	.16	.15
14 pin LP	.20	.19	.18
16 pin LP	.22	.21	.20
18 pin LP	.29	.28	.27
20 pin LP	.34	.32	.30
22 pin LP	.37	.36	.35
24 pin LP	.38	.37	.36
28 pin LP	.45	.44	.43
36 pin LP	.60	.57	.58
40 pin LP	.63	.62	.61

SOLDERTAIL STANDARD (TIN)



	1-24	25-49	50-100
14 pin ST	.27	.25	.24
16 pin ST	.30	.27	.25
18 pin ST	.35	.32	.30
24 pin ST	.49	.45	.42
28 pin ST	.99	.90	.81
36 pin ST	1.39	1.26	1.15
40 pin ST	1.59	1.45	1.30

SOLDERTAIL (GOLD) STANDARD



	1-24	25-49	50-100
8 pin SG	.39	.35	.31
14 pin SG	.49	.45	.41
16 pin SG	.54	.49	.44
18 pin SG	.59	.53	.48
24 pin SG	.79	.75	.69
28 pin SG	1.10	1.00	.90
36 pin SG	1.65	1.40	1.26
40 pin SG	1.75	1.59	1.45

WIRE WRAP SOCKETS (GOLD) LEVEL #3

	1-24	25-49	50-100
8 pin WW	.59	.54	.49
10 pin WW	.69	.63	.58
14 pin WW	.79	.73	.67
16 pin WW	.85	.77	.70
18 pin WW	.99	.90	.81
20 pin WW	1.19	1.08	.99
22 pin WW	1.49	1.35	1.23
24 pin WW	1.39	1.26	1.14
28 pin WW	1.69	1.53	1.38
36 pin WW	2.19	1.99	1.79
40 pin WW	2.29	2.09	1.89

1/4 WATT RESISTOR ASSORTMENTS – 5%

		10 Ohm	12 Ohm	15 Ohm	18 Ohm	22 Ohm		
ASST. 1	5 ea.	27 Ohm	33 Ohm	39 Ohm	47 Ohm	56 Ohm	50 pcs.	$1.95
		68 Ohm	82 Ohm	100 Ohm	120 Ohm	150 Ohm		
ASST. 2	5 ea.	180 Ohm	220 Ohm	270 Ohm	330 Ohm	390 Ohm	50 pcs.	$1.95
		470 Ohm	560 Ohm	680 Ohm	820 Ohm	1K		
ASST. 3	5 ea.	1.2K	1.5K	1.8K	2.2K	2.7K	50 pcs.	$1.95
		3.3K	3.9K	4.7K	5.6K	6.8K		
ASST. 4	5 ea.	8.2K	10K	12K	15K	18K	50 pcs.	$1.95
		22K	27K	33K	39K	47K		
ASST. 5	5 ea.	56K	68K	82K	100K	120K	50 pcs.	$1.95
		150K	180K	220K	270K	330K		
ASST. 6	5 ea.	390K	470K	560K	680K	820K	50 pcs.	$1.95
		1M	1.2M	1.5M	1.8M	2.2M		
ASST. 7	5 ea.	2.7M	3.3M	3.9M	4.7M	5.6M	50 pcs.	$1.95

ASST. 8R Includes Resistor Assts. 1-7 (350 pcs.) **$10.95 ea.**

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Part No.	Function	Price
7045IPI	CMOS Precision Timer	14.95
7045EV/Kit*	Stopwatch Chip, XTL	24.95
7106CPL	3½ Digit A/D (LCD Drive)	16.95
7106EV/Kit*	IC, Circuit Board, Display	34.95
7107CPL	3½ Digit A/D (LED Drive)	15.95
7107EV/Kit*	IC, Circuit Board, Display	29.95
7116CPL	3½ Digit A/D LCD Dis. HLD.	18.95
7117CPL	3½ Digit A/D LED Dis. HLD.	17.95
7201IDR	Low Battery Volt Indicator	2.25
7205IPG	CMOS LED Stopwatch/Timer	12.95
7205EV/Kit*	Stopwatch Chip, XTL	19.95
7206CJPE	Tone Generator	5.15
7206CEV/Kit*	Tone Generator Chip, XTL	12.95
7207AIPD	Oscillator Controller	6.50
7207AEV/Kit*	Freq. Counter Chip, XTL	13.95
7208IPI	Seven Decade Counter	17.95
7209IPA	Clock Generator	3.95
7215IPG	4 Func. CMOS Stopwatch CKT	13.95
7215EV/Kit*	4 Func. Stopwatch Chip, XTL	19.95
7216AIJI	8-Digit Univ. Counter C.A.	32.00
7216CIJI	8-Digit Freq. Counter C.A.	26.95
7216DIPI	8-Digit Freq. Counter C.C.	21.95
7217IJI	4-Digit LED Up/Down Counter	12.95
7218CIJI	8-Digit Univ. LED Drive	10.95
7224IPL	LCD 4½ Digit Up Counter DRI	11.25
7226AIJL	8-Digit Univ. Counter	31.95
7226AEV/Kit*	5 Function Counter Chip, XTL	74.95
7240IJE	CMOS Bin Prog. Timer/Counter	4.95
7242IJA	CMOS Divide-by-256 RC Timer	2.05
7250IJE	CMOS BCD Prog. Timer/Counter	6.00
7260IJE	CMOS BCD Prog. Timer/Counter	5.25
7555IPA	CMOS 555 Timer (8 pin)	1.45
7556IPD	CMOS 556 Timer (14 pin)	2.20
7611BCPA	CMOS Op Amp Comparator 5MV	2.25
7612BCPA	CMOS Op Amp Ext. Cmvr. 5MV	2.95
7621BCPA	CMOS Dual Op Amp Comp. 5MV	3.95
7631CCPE	CMOS Tri Op Amp Comp. 10MV	5.35
7641CCPD	CMOS Quad Op Amp Comp. 10MV	7.50
7642CCPD	CMOS Quad Op Amp Comp. 10MV	7.50
7660CPA	Voltage Converter	2.95
8038CCPD	Waveform Generator	4.95
8048CCPE	Monolithic Logarithmic Amp	21.60
8069CCQ	50ppm Band—GAP Volt Ref. Diode	2.50
8211CPA	Volt Ref/Indicator	2.95
8212CPA	Volt Ref/Indicator	2.95

74C

74C00	.39			74C221	1.95
74C02	.39	74C95	1.59	74C240	2.25
74C04	.39	74C107	1.89	74C244	2.25
74C08	.39	74C151	2.95	74C373	2.49
74C10	.39	74C154	3.95	74C374	2.59
74C14	.75	74C157	2.25	74C901	.69
74C20	.39	74C160	1.69	74C903	.69
74C30	.39	74C161	1.60	74C911	10.95
74C42	1.39	74C162	1.49	74C912	10.95
74C48	1.95	74C163	1.69	74C915	1.69
74C73	.79	74C164	1.59	74C917	10.95
74C74	.79	74C173	1.39	74C922	5.49
74C85	1.95	74C174	1.39	74C923	5.75
74C86	.99	74C175	1.19	74C925	7.50
74C89	6.95	74C192	1.69	74C926	7.50
74C90	1.29	74C193	1.69	80C95	.79
74C93	1.29	74C195	1.59	80C97	.79

LINEAR

LH0002CN	6.85			LM702H	.79
LM10CLH	4.50			LM703CN	.89
LM11CLH	4.75	LM340T-5	1.25	LM709N	.29
LH0070-DH	4.95	LM340T-12	1.25	LM710N	.79
TL071CP	.79	LM340T-15	1.25	LM711N	.79
TL072CP	1.39	LM341P-5	.75	LM723N	.69
TL074CN	2.49	LM341P-12	.75	LM733N	1.00
LH0082CD	35.80	LM341P-15	.75	LM739N	1.19
TL082CP	1.19	LM342P-5	.69	LM741CN	.35
TL084CN	2.19	LM342P-12	.69	MC1741SCG	3.00
LH0094CD	36.80	LM342P-15	.69	LM747N	.79
LM300H	.99	LM348N	1.25	LM748N	.59
LM301CN	.35	LM350K	5.75	LM1014N	2.75
LM302H	1.95	LF351N	.60	LM1310N	1.95
LM304H	1.95	LF353N	1.00	LM1458CN	.59
LM305H	.99	LF355N	1.10	LM1488N	1.25
LM307CN	.45	LF356N	1.10	LM1489N	1.25
LM308CN	1.00	LM358N	1.00	LM1496N	1.95
LM309H	1.95	LM359N	1.79	LM1556V	1.75
LM309K	1.25	LM370N	4.49	LM1800N	2.95
LM310CN	1.75	LM373N	3.25	LM1871N	5.49
LM311/CN	.90	LM377N	2.95	LM1872N	5.49
LM312H	2.49	LM380N	1.25	LM1877N-9	3.25
LM317MP	1.15	LM381N	1.95	LM1889N	3.20
LM317T	1.75	LM382N	1.79	LM1896N	1.75
LM317K	3.95	LM384N	1.95	LM2002T	1.49
LM318CN	1.95	LM386N-3	1.29	LM2877P	2.05
LM319N	1.95	LM387N	1.45	LM2878P	2.25
LM320K-5	1.35	LM389N	1.35	LM2896P-1	2.25
LM320K-12	1.35	LM392N	.69	LM3189N	2.95
LM320K-15	1.35	LF398N	4.00	LM3900N	.69
LM320T-5	1.25	LM399H	5.00	LM3905CN	1.25
LM320T-12	1.25	TL494CN	4.49	LM3909N	1.15
LM320T-15	1.25	TL496CP	1.75	LM3914N	3.95
LM323K	5.95	NE510A	6.00	LM3915N	3.95
LM324N	.99	NE529A	4.95	LM3916N	3.95
LM329DZ	.65	NE531H	3.95	RC4136N	1.25
LM331N	3.95	NE536H	6.00	RC4151NB	3.95
LM334Z	1.30	NE540H	6.00	RC4194TK	6.95
LM335Z	1.40	NE544N	4.95	RC4195TK	5.49
LM336Z	1.75	NE550A	1.30	LM4500A	3.25
LM337T	1.95	NE555V	.39	ICL8038B	4.95
LM337MP	1.15	LM556N	.99	LM13080N	1.29
LM338K	6.95	NE564N	3.95	LM13600N	1.49
LM339N	.99	LM565N	1.25	75138N	1.95
LM340K-5	1.35	LM566CN	1.95	75450N	.89
LM340K-12	1.35	LM567V	1.25	75451CN	.39
LM340K-15	1.35	NE570N	4.95	75492	.89

CAPACITOR CORNER

50 VOLT CERAMIC DISC CAPACITORS

Value	1-9	10-99	100+	Value	1-9	10-99	100+
10 pf	.08	.06	.05	.001µF	.08	.06	.05
22 pf	.08	.06	.05	.0047µF	.08	.06	.05
47 pf	.08	.06	.05	.01µF	.08	.06	.05
100 pf	.08	.06	.05	.022µF	.09	.07	.06
220 pf	.08	.06	.05	.047µF	.09	.07	.06
470 pf	.08	.06	.05	.1µF	.15	.12	.10

100 VOLT MYLAR FILM CAPACITORS

.001mf	.12	.10	.07	.022mf	.13	.11	.08
.0022mf	.12	.10	.07	.047mf	.21	.17	.13
.0047mf	.12	.10	.07	.1mf	.27	.23	.17
.01mf	.12	.10	.07	.22mf	.33	.27	.22

+20% DIPPEO TANTALUMS (Solid) CAPACITORS

.1/35V	.39	.34	.29	1.5/35V	.41	.37	.29
.15/35V	.39	.34	.29	2.2/35V	.51	.45	.34
.22/35V	.39	.34	.29	3.3/25V	.53	.47	.37
.33/35V	.39	.34	.29	4.7/25V	.63	.56	.45
.47/35V	.39	.34	.29	6.8/25V	.79	.69	.55
.68/35V	.39	.34	.29	15/25V	1.39	1.25	.95
1.0/35V	.39	.34	.29	22/6V	.79	.69	.55

MINI. ALUMINUM ELECTROLYTIC CAPACITORS

Axial	1-99	100-499	500+	Radial	1-99	100-499	500+
.47/50V	.16	.14	.10	.47/25V	.15	.13	.12
1.0/50V	.19	.16	.12	.47/50V	.16	.14	.13
3.3/50V	.17	.15	.11	1.0/16V	.15	.13	.12
4.7/25V	.18	.15	.11	1.0/25V	.16	.14	.13
10/25V	.18	.15	.11	1.0/50V	.17	.15	.14
10/50V	.19	.16	.12	4.7/16V	.15	.13	.12
22/25V	.19	.16	.12	4.7/25V	.16	.14	.13
22/50V	.24	.20	.18	4.7/50V	.17	.15	.14
47/25V	.25	.21	.19	10/16V	.15	.13	.12
47/50V	.29	.25	.23	10/25V	.16	.14	.13
100/25V	.28	.24	.22	10/50V	.17	.15	.14
100/50V	.41	.37	.34	47/50V	.25	.21	.19
220/25V	.39	.34	.33	100/16V	.21	.17	.14
220/50V	.49	.45	.41	100/25V	.25	.23	.21
470/25V	.54	.49	.45	100/50V	.37	.34	.31
1000/16V	.79	.69	.61	220/16V	.25	.21	.19
2200/16V	.89	.79	.69	470/25V	.35	.31	.27

✓See List of Advertisers on page 130

DEALER DIRECTORY

Phoenix AZ

The Southwest's most progressive communications company stocking Kenwood, Icom, Yaesu, MFJ, B&W, Astron, Larsen, Cushcraft, Hy-Gain, Bearcat, and more. Would like to serve you! Power Communications Corp., 1640 West Camelback Rd., Phoenix AZ 85015, 241-Watt.

Culver City CA

Jun's Electronics, 3919 Sepulveda Blvd., Culver City CA 90230, 390-8003. Trades 463-1886 San Diego. Call us for a low quote.

Fontana CA

Complete lines ICOM, DenTron, Ten-Tec, Mirage, Cubic, Lunar, over 4000 electronic products for hobbyist, technician, experimenter. Also CB radio, landmobile. Fontana Electronics, 8628 Sierra Ave., Fontana CA 92335, 822-7710.

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Experimenter's paradise! Electronic and mechanical components for computer people, audio people, hams, robot builders, experimenters. Open six days a week. Gateway Electronics Corp., 2839 W. 44th Ave., Denver CO 80211, 458-5444.

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Amateur Radio Center, Inc. "Everything for the Amateur" Since 1960, 2805 N.E. 2nd Avenue, Miami FL 33137, 573-8383, TWX 522035.

Columbus GA

KENWOOD—YAESU—DRAKE

The world's most fantastic amateur showroom! You gotta see it to believe it! Radio Wholesale, 2012 Auburn Avenue, Columbus GA 31906, 561-7000.

Smyrna GA

For your Kenwood, Yaesu, ICOM, Drake and other amateur needs, come to see us. Britt's Two-Way Radio, 2506 N. Atlanta Rd., Smyrna GA 30080, 432-8006.

Preston ID

Ross WB7BYZ, has the Largest Stock of Amateur Gear in the Intermountain West and the Best Prices. Call me for all your ham needs. Ross Distributing, 78 So. State, Preston ID 83263, 852-0830.

Terre Haute IN

Your ham headquarters located in the heart of the midwest. Hoosier Electronics, Inc., #9 Meadows Center, P.O. Box 3300, Terre Haute IN 478003, 238-1456.

Littleton MA

The ham store of N.E. you can rely on. Kenwood, ICOM, Wilson, Yaesu, DenTron, KLM amps, B&W switches & wattmeters, Whistler radar detectors, Bearcat, Regency, antennas by Larsen, Wilson, Hustler, GAM. TEL-COM Inc. Communications & Electronics, 675 Great Rd., Rt. 119, Littleton MA 01460, 486-3040.

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New England's Distributor and Authorized Service Center for all Major Amateur Lines. Tufts Radio Electronics, Inc., 61 Lowell Road, Hudson NH 03051, 883-5005.

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See us for products like Ten-Tec, R. L. Drake, Dentron and many more. Open Monday through Saturday, 0830 to 1730. WB8VGR, WB8UXO, WD8OKN and W8RP behind the counter. Purchase Radio Supply, 327 E. Hoover Ave., Ann Arbor MI 48104. 668-8696.

St. Louis MO

Experimenter's paradise! Electronic and mechanical components for computer people, audio people, hams, robot builders, experimenters. Open six days a week. Gateway Electronics Corp., 8123-25 Page Blvd., St. Louis MO 63130, 427-6116.

Charlotte NC

Santec, Hy-Gain, Cubic Comm., Antenna Specialists, Wilson, W2AU/W2VS, B&W, Pathcom, Nye Viking, Electra, MFJ, Bash, CQ, Arrl., Ameco, Callbook Service, Sales New & Refurbished. Home-Tronics, 1217 Plaza, Charlotte NC 28205, 334-7974.

Somerset NJ

New Jersey's only factory-authorized ICOM and YAESU distributor. Large inventory of new and used specials. Most major brands in stock. Complete service and facilities. Radios Unlimited, 1760 Easton Avenue, P.O. Box 347, Somerset NJ 08873, 469-4599.

Amsterdam NY
UPSTATE NEW YORK

Kenwood, ICOM, Drake, plus many other lines. Amateur Dealer for over 35 years. Adirondack Radio Supply, Inc., 185 West Main Street, Amsterdam NY 12010, 842-8350.

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Amateur radio hardwood displays made to your specifications—callsigns, plaques, awards or special orders. High quality, fast service, low prices. A.&M. Woodcraft, 313 N. Madison St., P.O. Box 243, Rome NY 13440, 337-5642.

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Featuring: Kenwood, Yaesu, ICOM, Drake, Ten-Tec, Swan, DenTron, Alpha, Robot, MFJ, Tempo, Astron, KLM, Hy Gain, Mosley, Larsen, Cushcraft, Hustler, Mini Products. You won't be disappointed with equipment/service. Radio World, Oneida County Airport-Terminal Building, Oriskany NY 13424, 337-0203.

Columbus OH

The biggest and best Ham Store in the midwest featuring quality Kenwood products with working displays. We sell only the best. Authorized Kenwood Service. Universal Amateur Radio Inc., 1280 Aida Dr., Reynoldsburg (Columbus) OH 43068, 866-4267.

Scranton PA

ICOM, Bird, CushCraft, Beckman, Fluke, Larsen, Hustler, Antenna Specialists, Astron, Avanti, Belden, W2AU/W2VS, CDE, AEA, Vibroplex, Ham-Key, CES, Amphenol, Sony, Fanon/Courier, B&W, Ameco, Shure. LaRue Electronics, 1112 Grandview St., Scranton PA 18509, 343-2124.

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Complete 2 way service shop. Call Dee, W5FSP. Selling Antenna Specialists, Avanti, Azden, Bird, Hy-gain, Standard, Vibroplex, Midland, Henry, CushCraft, Dielectric, Hustler, ICOM, MFJ, Nye, Shure, Cubic, Tempo, Ten-Tec and others. Appliance & Equipment Co., Inc., 2317 Vance Jackson Road, San Antonio TX 78213, 734-7793.

Vienna VA

The Washington metropolitan area's leading supplier of the latest in Amateur Radio and Test Equipment. On your next trip to the Nation's Capital, stop by and see us. Electronic Equipment Bank, Inc., 516 Mill St. N.E., Vienna VA 22180, 938-3350.

DEALERS

Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the January '82 issue must be in our hands by November 1st. Mail to 73 Magazine, Peterborough NH 03458. ATTN: Nancy Ciampa.

PROPAGATION

J. H. Nelson
4 Plymouth Dr.
Whiting NJ 08759

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	7A	7	7	7	7	7	7	7A	14	21A	21
ARGENTINA	14	7	7	7B	7B	7	14	21	21A	21A	21A	21
AUSTRALIA	21	14	7B	7B	7B	7B	7B	14B	14	21	21	21A
CANAL ZONE	14	7	7	7	7	7	7	14	21A	21A	21	21
ENGLAND	7	7	7	7	7	7	14	21A	21A	21	14	7A
HAWAII	21A	14	7B	7	7	7	7	7B	14	21	21	21A
INDIA	7	7B	7B	7B	7B	7B	14	14A	14	14B	7B	7B
JAPAN	14	14	7B	7B	7	7	7	7B	7B	7B	14	21
MEXICO	14	14	7	7	7	7	7	7B	7B	7B	14	21
PHILIPPINES	14	14	7B	7B	7B	7B	7B	14B	14	14	14B	14
PUERTO RICO	7A	7	7	7	7	7	7A	14	21	21A	21	14
SOUTH AFRICA	14	7	7	7B	7B	7A	21	21	21A	21A	21	21
U. S. S. R.	7	7	7	7	7B	7B	14	21A	21	14B	7B	7
WEST COAST	21	14	7	7	7	7	7	14	21	21A	21A	21

CENTRAL UNITED STATES TO:

ALASKA	21	14	7	7	7	7	7	7	7A	14	21A	21
ARGENTINA	21	14	7	7B	7B	7	7A	14	21A	21A	21A	21
AUSTRALIA	21	14	7B	7B	7B	7B	7B	14B	14	21	21	21A
CANAL ZONE	14A	14	7	7	7	7	7	14	21	21A	21A	21
ENGLAND	7	7	7	7	7	7	14	14A	21A	21	14	7
HAWAII	21A	14	7A	7	7	7	7	7	14	21	21A	21A
INDIA	14	7A	7B	7B	7B	7B	7B	14	14	14B	7B	7B
JAPAN	21A	14	7B	7B	7	7	7	7	7B	7B	14	21
MEXICO	14	7	7	7	7	7	7	14	21	21A	21	14
PHILIPPINES	21A	14	7B	7B	7B	7B	7B	7	14	14	14B	21
PUERTO RICO	14	7A	7	7	7	7	7A	14	21	21A	21A	14
SOUTH AFRICA	14	7	7	7B	7B	7B	7	14	21A	21A	21	21
U. S. S. R.	7	7	7	7	7B	7B	7B	14	21	14B	7B	7B

WESTERN UNITED STATES TO:

ALASKA	21	14	7	7	7	7	7	7	7	14	21A	21
ARGENTINA	21	14	7A	7B	7B	7	7	14	21	21A	21A	21A
AUSTRALIA	21A	14	14	7	7	7	7B	7	14	14	21	21A
CANAL ZONE	21	14	7	7	7	7	7	14	21	21	21A	21A
ENGLAND	7B	7	7	7	7	7	7B	14	21A	14A	14	7B
HAWAII	21A	21	14	7	7	7	7	7	14	21	21A	21A
INDIA	14	14A	14B	7B	7B	7B	7B	7B	14	14B	7B	7B
JAPAN	21A	14A	14	7	7	7	7	7	7	7B	14	21A
MEXICO	21	14	7	7	7	7	7	14	21	21A	21A	21
PHILIPPINES	21A	21	14	7B	7B	7B	7	7	14	14	14B	21
PUERTO RICO	14A	14	7	7	7	7	7	14	21	21A	21A	21
SOUTH AFRICA	14A	14	7	7B	7B	7B	7B	14	21	21A	21A	21
U. S. S. R.	7B	7	7	7	7B	7B	7B	14	21	14	7B	7B
EAST COAST	21	14	7	7	7	7	7	14	21	21A	21A	21

First letter = day waves Second = night waves
A = Next higher frequency may also be useful
B = Difficult circuit this period F = Fair G = Good
P = Poor * = Chance of solar flares; # = of aurora

NOVEMBER

SUN	MON	TUE	WED	THU	FRI	SAT
1 G/F	2 F/F	3 G/F	4 G/F*	5 P/P*	6 F/F	7 G/F
8 G/F	9 G/F	10 G/G	11 G/G	12 G/G	13 G/G	14 G/F
15 G/G	16 G/G	17 G/G	18 G/G	19 G/F*	20 F/F*	21 F/P*
22 P/P #	23 P/P #	24 G/G	25 G/G	26 G/G	27 G/G	28 G/F
29 G/F	30 G/G					

World Class Performance and Features

The FT-ONE is the culmination of an all-out design project by Yaesu's top engineering team. Working without the usual cost constraints, Yaesu's design group is proud to unveil the instrument they "always wanted to design," a revolutionary blend of computer and RF technology.

GENERAL COVERAGE, ALL SOLID STATE

The FT-ONE is a full-coverage all-mode transceiver, equipped for reception on any frequency between 150 kHz and 29.99 MHz, with transmit coverage on all nine present and proposed amateur bands. In countries where permitted, the FT-ONE may be programmed to transmit throughout the 1.8-29.99 MHz range.

KEYBOARD FREQUENCY ENTRY

Fully digitally synthesized, the FT-ONE uses a front panel keyboard for initial frequency entry. Frequency change is then accomplished via the main tuning dial or the pushbutton scanner, with tuning in either 10 Hz or 100 Hz steps possible. Truly the contester's dream, the FT-ONE permits extremely fine tuning and instantaneous band change with equal facility.

DUAL VFO SYSTEM

Ten digital VFO's with memory are provided, in conjunction with an A-B selection scheme that allows instant recall of any transmit, receive, or transceive frequency desired. For split-frequency operation, such as on 7 MHz SSB, the operator may select TX on VFO-A and RX on VFO-B, automatically storing the calling and listening frequencies for each pile up. For net operations, a non-volatile memory board is available as an option, to eliminate the possibility of dumping memory.

FULL CW BREAK-IN

Recent advances in solid-state technology have finally made full CW break-in reliable enough to be incorporated into a Yaesu product. Now you can select traditional semi-break-in (for use with amplifiers not equipped for full break-in) or full high-speed break-in. When using amplifiers so equipped, the keyer output lead may be interrupted via a rear panel jack and routed to the break-in sequencing input on your amplifier.

SWITCHING REGULATOR POWER SUPPLY

Extremely compact and light in weight, the switching regulator power supply reduces substantially the space required to produce the operating voltages used in the FT-ONE. Highly efficient and uniquely stable, the switching regulator supply provides superb reliability in a field of design long neglected by amateur manufacturers.

ELITE CLASS PERFORMANCE FEATURES

In addition to the full break-in and superb receiver filters, Yaesu's design team packed the FT-ONE with subtle virtues that others might have overlooked. Rear panel jacks allow the use of both an external receiver and an independent receive antenna, such as a 160 meter Beverage. While scanning, automatic halting on a received signal may be programmed . . . perfect for watching a band for openings. If you're a DX-peditioner, an optional Curtis 8044 keyer board is available, so you won't need an external keyer that only wastes suitcase space. And if your amplifier fan is louder than it should be, there's even a microphone squelch (AMGC) to reduce background noise pickup between words and sentences!

ONE YEAR FACTORY WARRANTY

Because of the level of attention to design detail, parts selection, and factory quality control, your FT-ONE is backed by a one-year *factory* warranty for the original purchaser at retail. Prompt and meticulous attention to your warranty needs will be provided by our Ohio And California Service Centers. In addition, all units sold in the United States will be inspected and tested after clearing Customs, and will include a Service Manual in the puchase price.

GAIN/INTERCEPT OPTIMIZED RECEIVER FRONT END

Utilizing up-conversion with a first IF of 73 MHz, the FT-ONE RF amplifier stage uses push-pull power transistors configured to produce a typical output intercept of +40 dBm. The first mixer utilizes a diode ring module followed by a low noise post amp, for optimum noise figure consistent with modern day intercept requirements. The result is a receiver with a typical two-tone dynamic range well in excess of 95 dB (14 MHz, CW bandwidth). Additional gain tailoring is provided via a PIN diode attenuator controlled from the front panel.

FILTERS READY FOR COMPETITION

Three filter bandwidths are available for CW operation (two for FSK!), using optional 600 Hz or 300 Hz crystal filters. Filter insertion losses are equalized for constant IF gain. Both IF Shift and Variable Bandwidth are provided, and two CW filters may be cascaded, for competition-grade selectivity. For SSB work, the Variable Bandwidth feature eliminates the need for costly 1.5 kHz or 1.8 kHz filters, as any intermediate bandwidth may easily be programmed using the standard, cascaded SSB filters. To top it all off, a high-performance audio peak and notch filter is standard equipment.

EXPANDED OPERATING DISPLAYS

Digital displays for the VFO Frequency, memory channel, and RIT offset are provided for quick frequency identification. The large front panel meter provides easy viewing of transceiver operating parameters, including final transistor collector current, input DC voltage, FM discriminator center tuning, speech processor compression level, and forward/reflected relative power.

NOT AVAILABLE AS OPTIONS

It's hard to believe that other manufacturers still insist on making such essential items as a noise blanker or speech processor extra-cost options. We find that these are less expensive to incorporate and more reliable in operation when installed on our assembly line. No AC power supply is available as an option for the FT-ONE, either; it's equipped for operation from 100/110/117/200/220/234 volts AC, or 13.5 volts DC. And it goes without saying that there will not be an external VFO offered for the FT-ONE — we're confident that ten VFO's are quite enough!

Experience the FT-ONE in your Authorized Yaesu Dealer's showroom today. This may be the last Amateur transceiver you will ever own. ⌐83

Warranty policy available upon request. SASE, please.

Specifications subject to change without notice or obligation.

FT-ONE

A Bold Adventure In Engineering!

YAESU
The radio.

1081

YAESU ELECTRONICS CORPORATION, 6851 Walthall Way, Paramount, CA 90723 ● (213) 633-4007
Eastern Service Ctr., 9812 Princeton-Glendale Rd., Cincinnati, OH 45246 ● (513) 874-3100

"Comm-packed."

NEW

BIG performance... small size... smaller price!!!

TR-2500

The TR-2500 is a compact 2 meter FM handheld transceiver featuring an LCD readout, 10 channel memory, lithium battery memory back-up, memory scan, programmable automatic band-scan, Hi/Lo power switch and built-in sub-tone encoder.

TR-2500 FEATURES:

- **Extremely compact size and light weight**
  Measures 66 (2-5/8) W x 168 (6-5/8) H x 40 (1-5/8) D, mm (inches). Weighs 540 grams (1.2 lbs) with Ni-Cd pack. (Photo shown, actual size).
- **LCD digital frequency readout**
  Easy to read in direct sunlight or dark (with lamp switch). Low current drain. Shows frequencies and memory channels, plus four "Arrow" mode indicators.
- **Ten channel memory**
  Nine memories for simplex or ±600 KHz offset. "M0" memory for non-standard split frequency repeaters.
- **Lithium battery memory back-up**
  Built-in Lithium battery (estimated 5 year life) maintains memory when Ni-Cd pack is fully discharged or removed.

CONVENIENT TOP CONTROLS

- **HI/LO power output selection**
  Allows operation at 2.5 watts or 300 mw RF output.

Actual size

- **Memory scan**
  Scans only channels in which frequency data is stored. Stops on busy channel, resumes scan approximately 2 seconds after signal ceases.
- **Programmable automatic band scan**
  Upper and lower frequency limits and scan steps of 5 KHz and larger (5, 10, 15, 20, 30 KHz, etc.) may be programmed. Scan locks on busy channel, resumes approximately 2 seconds after signal ceases.
- **UP/DOWN manual scan**
  Up/Down manual scan in 5 KHz steps.
- **Built-in tuneable sub-tone encoder**
  Sub-tone encoder, with activate switch, tuneable (variable resistor) to desired CTCSS tone. Optional TU-1 programmable (DIP-switch) encoder accessory available.
- **Built-in 16 key autopatch encoder**
  16 keys provide telephone dual tone modulation.
- **"SLIDE-LOC" battery pack**
  Slides into position, locks into place.
- **Reverse operation**
  Shifts receiver to transmit frequency, and transmitter to receive frequency.
- **Keyboard frequency selection**
  Sets operation frequency across full range.
- **Extended frequency coverage**
  Covers 143.900 to 148.995 MHz in 5 KHz steps.
- **Optional power source**
  Using optional MS-1 mobile or ST-2 AC charger/power supply, radio may be operated while charging. (Automatic drop-in connections.)
- **High impact plastic case**
  Provides extra strength to resist damage.
- **Battery status indicator**
  Flashes to indicate low battery charge level.
- **Two lock switches**
  Prevent accidental frequency change and accidental transmission.

Standard accessories included:

- Flexible rubberized antenna with BNC connector
- 400 mAH heavy-duty Ni-Cd battery pack
- AC charger
- Plugs for external microphone and speaker

More information on the TR-2500 is available from all authorized dealers of Trio-Kenwood Communications 1111 West Walnut Street, Compton, California 90220.

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Optional accessories:

- ST-2 Base station power supply and quick charger (approx. 1 hr)
- MS-1 Mobile stand/charger/supply
- TU-1 Programmable sub-tone (CTCSS) encoder
- SMC-25 Speaker microphone
- LH-2 Deluxe top grain cowhide leather case
- PB-25 Extra Ni-Cd battery pack, 400 mAH, heavy duty
- BH-2 Belt hook
- WS-1 Wrist strap
- EP-1 Earphone
- _____ RF power amplifier (To be announced later.)

Specifications and prices are subject to change without notice or obligation.