SPECIAL CONSTRUCTION FEATURE
Build A 2 Meter Amp

The Solar Powered
Ham Shack

Extend Your
HT’s Coverage

73 Reviews
Azden
2 Meter HT
Ramsey 2 Meter
Transceiver Kit

Special Advertising Insert:
Holiday Catalog from
Radio City, Inc.
Discover Why The Most Advanced Compact On The Road...

...Is So Easy To Operate.
Introducing the IC-3230 Dual Band Mobile

One-Touch Mobile Radio
The IC-3230 was designed for the mobile FM'er who wants high performance and ease of use. The 3230 is a one-touch transceiver for the most often-used functions. It's simple and safe to use while driving. Main functions are activated with one-touch action switches. Hold the same button in slightly longer to access secondary functions—no need to hunt for a separate function switch.

Human Engineered
The color-coded, illuminated controls and the display are laid out the way people naturally use radios: UHF on the right, VHF on the left, each independently controlled. And with the optional Talk-Back feature, your eyes never have to leave the road to change frequencies. The 3230's voice synthesizer tells you just where you are! The same option works with crossband repeat, which gives your DTMF handheld the range and power of your mobile. TalkBack lets your handheld tell you what frequency your 3230 is set to. And, of course, full-duplex operation means you can use your mobile with the ease of a telephone—including 14 memories, single-button autopatch, autodialing and 911 access.

A Base Station, Too!
ICOM's mobiles aren't just for the road anymore. With the optional PS45/PS200 power supply, the fun continues! The PS45 becomes a docking station for your 3230 to slip into and becomes an excellent entry-level base station. Or buy one for home, one for the road, and stay in touch! IC-3230: A High-Performance Pack in an Easy-To-Use Compact.

For Information (And Where You Can Get A Test Drive)
Call 1-206-450-6088

ICOM America, Inc., 2380-116th Ave. N.E., Bellevue, WA 98004
Customer Service Hotline (206) 454-7619
All prices and specifications subject to change without notice or consent. All ICOM radios significantly exceed FCC regulations limiting spurious emissions. 3200a.

CIRCLE 179 ON READER SERVICE CARD
**STARTEK INTERNATIONAL INC.**

**FREQUENCY COUNTERS**

**Made in USA**

**WARRANTY**

5 YEARS all parts  
1 YEAR labor  
ALL MODELS

---

**FIND FREQUENCIES FAST**

With the new, high sensitivity, ultra-fast, Auto Trigger & Hold STARTEK frequency counters. Increase readability distance with the new Band Pass Filters. All products made in USA.

**AUTO TRIGGER & HOLD**

Now, for the first time, available on inexpensive, portable counters with our new ATH™ Series. This feature is the most significant improvement ever made to the pocket sized counters! It allows “Hands Free” operation to automatically read & hold a signal as quick as 80ms or 8% of a second.

---

**ATH Series**

Say goodbye to random counting & false readings with the ATH™ Series

**ATH-30**  
1-2800 MHz One-Shot Feature

**ATH-50**  
5 Hz to 2800 MHz One-Shot Feature

---

**ATH SERIES FEATURES INCLUDE:**

- Easy to use – simple controls
- Ultra fast response time
- Extra BRIGHT LED digits
- 3-5 hour battery operation
- Automatic clean dropouts
- Maximized sensitivity, <1mV typical
- Signal strength Bar Graph
- 2 ranges – 6 fast gate times
- 9-12V auto-polarity power jack
- StarCab™ aluminum cabinet

---

**In Stock… Same Day Shipment!**

ATH, Ultra High Sensitivity Frequency Counter  
ATH-15  
ATH-30  
ATH-50

**Economy Frequency Counter**

1350  
$119.

BP-3  
Above 3 filters (SAVE 50%)  
$177.

---

**Accessories**

- CC-10  
- CC-10 L  
- RS-100

---

**TA-30 Antenna** (priced separately)

---

**Introducing NEW ATH-50**

---

**STARTEK INTERNATIONAL INC.**

**FREQUENCY COUNTERS**

**Made in USA**

---

**n-cads and a/c charger included with all models**

---

**Factory Direct Order Lines**

**SAME DAY SHIPMENT**

Orders Only  
305-561-2211  
Orders & Information  
305-561-9133  
FAX 305-561-9133

---

**CIRCLE 247 ON READER SERVICE CARD**
ALINCO’s newest 2-Meter mobile, the DR-130T, packs a big punch. This compact radio delivers 50 Watts of cool running power, and offers the durability and reliability that Hams have come to expect from ALINCO.

Standard features include 50 CTCSS Tones, Programmed Memory scan, Programmable “Time-Out” Timer, CTCSS Encode, and others. With the optional EJ-19U plug-in module, 100 memory channels are available. All memory channels can store “odd-split” frequencies, and also store CTCSS Encode/Decode status.

Odd Splits! This radio can store repeater offsets from 0 to 15,995 MHz. A different offset can be stored in each memory channel, and most other functions can also be stored independently in each memory channel.

For brochures and operation manuals, try our new 24 hour Hot Line.

Holiday Price Break
Discounts available thru Dec. 31 ’93
DR-600T $30 DJ-F11TH $20

438 Amapola Ave., #130 Torrance, CA 90501
Phone: (310) 618-8616 / Fax: (310) 618-8758
TABLE OF CONTENTS

SPECIAL CONSTRUCTION FEATURE

10 The FARA Project
An economical, easy-to-build, 25 watt 2 meter amplifier...............A1GPO

FEATURES

20 Improved VOX Mobile Extender
Give your handheld the power of a mobile.........................K6YDW

26 The Solar Control-ar
A solar panel charge controller for all seasons......................WB5PPV

REVIEWS

39 Ramsey Electronics FX-146 Transceiver Kit
Roll your own 2 meter rig............................................KT2B

42 Azden AZ-61 6m FM Transceiver
Advanced features in the palm of your hand..........................WB6NOA

November 1993
Issue #398

DEPARTMENTS

72 Above and Beyond
81 Ad index
76 Ask Kaboom
70 ATV
89 Barter 'n' Buy
58 Carr's Corner
81 Dealer Directory
17 Feedback Index
77 Ham Help
66 Hams with Class
53 Hamsats
62 Homing In
6 Letters
4 Never Say Die
88 New Products
69 Packet & Computers
96 Propagation
68 QRQ
8 QRX
57 Random Output
82 73 International
86 Special Events
94 Uncle Wayne's Bookshelf

FEEDBACK...

FEEDBACK!

It's like being there—right here in our offices! How?
Just take advantage of our Feedback page on page
17. You'll notice a feedback number at the beginning of
each article and column.
We'd like you to rate what you read so that we can
print what types of things you like best. And then we
will draw one Feedback winner each month for a free
subscription to 73.

Manuscripts 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 materials.
Please enclose a stamped, self-addressed envelope with each submission. Payment for the use of any unsolicited
material will be made upon publication. A minimum will be paid for accepted articles that have been submitted
electronically (CompuServe: pnn 70105.776 or MCI Mail: WBGEPUP or Genie address: MAG073) or on disk as an
IBM-compatible ASCII file. You can also contact us at the 73 BBS at (603) 792-9430, 300-2400 baud, 8 data bits,
nos parity, one stop bit. All contributions should be directed to the 73 editorial office. "How to Write for 73"
guidelines are available upon request. US citizens must include their Social Security number with submitted
manuscripts.

73 Amateur Radio Today (ISSN 1052-2522) is published monthly by Wayne Green Inc., 70 Route 202N,
Peterborough NH 03458. Entire contents ©1993 by Wayne Green Inc. No part of this publication may be reproduced
without written permission of the publisher. For Subscription Services, write to 73 Amateur Radio Today,
P.O. Box 7693, Riverton, NJ 08077-7693, or call 1-800-289-0388. The subscription rate is: one year $24.97, two
years $39.97; Canada: $34.21 for one year, $57.73 for two years, including postage and 7% GST. Foreign
postage: $19.00 surface or $42.00. annual additional per year. All foreign orders must be accompanied by payment
in US funds. Second class postage paid at Peterborough, NH, and at additional mailing offices. Canadian
second class mail registration #176101. Canadian GST registration #125393314. Microfilm Edition—University
Microfilms, Ann Arbor, MI 48106. POSTMASTER: Send address changes to 73 Amateur Radio Today, P.O. Box
7693, Riverton NJ 08077-7693.

Contract: If you can read this fine print, you are hereby legally bound to fulfill your obligation to the future of
ham radio. You are ordered to seek out a bright, young mind and turn it on to our exciting hobby. Be an Elmer.
(On first day of school, don't forget to tell your student off on the right foot, make sure he or she has subscriptions to 73 and Radio
Fax).
Amateur Radio Frontiers

There are still plenty of frontiers for the adventurous ham to explore and pioneer. Everything hasn’t been invented, by a long shot. Indeed, there are tons of articles I’d love to see published in 73, if only you’d write ’em.

For instance, I’ve seen pitiful little in recent years on slow-scan developments. We need to (a) digitize slow-scan so we can send some really detailed full-color pictures, and (b) use modern compression technology to keep the bandwidth down. When’s the last time you saw any articles on things like this? What do you need to get your mind working and your fingers busy? With the progress we’ve had in slow-scan technology in the last few years, any interested ham with totally zero technical knowledge and a will could have come from zero to being the top expert in the field. All it takes is some interest and the determination to overcome obstacles.

When I first got interested in RTTY I knew zilch. But I was fascinated, so I read everything I could find... which wasn’t much. I lacked the only expert in the field I knew, John Williams W2BFD. I built my own equipment using John’s designs, a Model 12 Teletype machine he got for me, and got on the air. Wow, what fun! This was when I first learned about digitally encoding information and the ability of frequency-shift keying to get through interference far better than off-on (CW) keying.

Teletype used a five-bit code, which meant that there were just 32 possible combinations of zeros and ones, or marks and spaces, as we called them. This is why telegrams and news Teletypes all used to print in upper-case letters. We didn’t have any lower case. We even had to shift to handle numbers and punctuation. This is why ASCII code, which all computers use today, has eight bits. This allows 256 combinations of zeros and ones, giving us far more flexibility.

When I couldn’t get anyone to put out a newsletter to help us pioneers learn more about RTTY I finally gave up and did it myself. Indeed, that’s what got me into the publishing business. I called it Amateur Radio Frontiers, and that was back in 1951. I wrote it, drafted the schematics, sold the advertising, took the photos, set the type, pasted it up, handled the subscriptions... everything. It was incredibly valuable experience, and it changed my life.

**Digital Compression Systems**

With modern microcomputers it’s relatively easy to digitize pictures. You can feed ’em into your computer from a home video camera or a scanner. But a decent picture can take a megabyte or more of memory, which is why we haven’t been seeing much in the way of live video digitized yet. At 30 megabytes per second, that eats up a whale of a lot of memory in a hurry, no matter what you’re using for storage.

So, the engineers have been working to compress the data, using various approaches (algorithms). The International Standards Organization’s Joint Photographic Experts Group (JPEG) uses a discrete cosine transform which compresses files by 90–95%, giving us ratios of 10:1 to 20:1.

Iterated Systems of Noncross, GA, went the fractal route and has been able to compress data around 75:1.

Fractals? If you haven’t messed with these babies you’ve missed a whole new world of math and beauty. IBM’s Mandelbrot got interested in chaos theory a decade ago and discovered that seemingly chaotic systems produced similar patterns when plotted. He called the resulting patterns fractals. Computer owners with color displays can generate these beautiful patterns. If you aren’t familiar with fractals and chaos theory, you’re letting the real world get away from you. As hams, you’re supposed to be up on science and electronics. You’re not flying under false colors, are you?

So, let’s see some articles on digitized slow-scan pictures. Let’s see some articles on the theory and practice of compression techniques. And, let’s see some protocols for digital slow-scan.

If we can at least send our American standard video picture quality (NTSC) by digital slow-scan, then we can start working on ways to move to high definition slow-scan. One step at a time. More and more of us are buying high definition color monitors for our computers, so we’ve got the makings of some wonderful slow-scan pictures.

You may not be an expert on digital video now, but by next year are you going to be even further behind? Or will be you one of the people writing the articles? When I got started publishing my RTTY newsletter it didn’t take long before I knew what I was doing. A few years later I published the first book on ham RTTY. In the meantime my columns in CQ helped get thousands of hams involved with this fun part of the hobby.

**Digitized Voice?**

With all broadcast radio going digital, as well as TV, hams better start thinking in digital terms or we’re going to be as far out of date as if we were still using spark gaps for our CW. Yes, I know, many old-timers are still upset having to change to sideband 30 years ago. I think all of the “spark forever” crowd have finally won their Silent Keys certificates, though they were still a grumbling, resentful bunch when I started hammering in the 1950s.

With digital broadcast test stations showing three times the signal coverage with a hundred of the power... plus the ability for six different stations to share each channel... digital is definitely coming. Sideband gave us six times the bang for the buck over AM, plus it allowed more stations per kHz. It certainly met the rule of thumb criterion for a new technology to be 10 times better than the old in order to survive. Well, so does digital, so nothing can stop it.

With that in mind I’d like to see some special temporary authority (STA) hams experimenting, complete with articles for 73.

**Data Compacting**

In addition to the usual search for compressing algorithms, we might start setting up some protocols for packet and RTTY which would compress our transmissions. This doesn’t even have to be high-tech. CW ops invented the Q-code to shorten their transmissions. So how about some simple look-up tables our computers can use to cut down on redundant messages? A sort of packet approach to the Q-code? For instance, “N-x” might translate into “the name here is...”

We could even simplify names a bit with “Bob” being “bb” and “Bill” being “bl.” Wayne being “wn,” and so on. That would speed up the more common names.

With data compression we should be able to get contacts down to a few seconds of air time, “rv” could mean “the rig here is an ICOM 735.” The second character could indicate up to 256 different models of rigs. Ditto for antennas. Yes, “q” would mean “I faithfully promise to send you a QSL card for this wonderful contact and hope that you will send one in return.” A “w” with one added character would indicate up to 256 different kinds of weather, thus slicing at least two to three minutes of air time from every contact.

In this way we’ll be able to make several contacts a minute and thereby expand the copied relay later when we have time. Few of us bother to communicate anything the other chap is saying anyway, so what’s lost? The only really significant element of the contact is making sure you have the call right. You’ve got the Callbook on a CD-ROM, so you don’t really need a lookup table any more.

With data compression we’ll be on our way toward completely automatic contacts. We’ll be able to get reports from our computer on who we’ve contacted while we’re at work or sleeping. Or watching ball games or TV. I’m reminded of RTTY back in 1950 when I’d come home from work and pick up 50 feet or so of printout and read what’d been talked about on the RTTY channel all day.

If we do find something of common interest we can send prewritten documents from our computers. In the old days we’d punch Teletype tape with stories we might want to repeat. When there was an interest in some subject we’d punch our computer and read it out loud and they’d zip through at 60 wpm. It’s a little easier today.

**Oops, We Lost 100,000 Hams!**

Just when we were all getting our arms into joint computing ourselves on boosting our numbers to 600,000 licensed hams (FCC count) we get the bad news that the ARRL has done a survey and found that 16% of us are missing. Holy jumping Morse code, that’s a hundred thou, pfft! How’d that happen?

Well, as I’ve been reminding you and you’ve been ignoring, the FCC no longer bothers to delete our Silent Key award winners, nor our bored or unemployed dropouts. And with our license now good for 10 years, there’s a lot of buried ham in the Callbook, Tons.

So, even with the increased input of no-code hams, are we breaking even? Maybe, just. And speaking of the ARRL survey, it seems like we have an awful lot of old-timers with a serious death wish for our hobby. I can’t spread a lot of guilt on you because the chaps who are the problem don’t read 73. Most of them hate it. Continued on page 76.
"What a great field radio. Mobile, too! I couldn't afford an HF rig until now." 

"Yaesu did it again!"

"What a great price! Terrific features, high performance — and within my budget."

It's a small price to pay for such a wealth of features.

If you're trading up from an older rig, but have a budget, you want the most you can afford in top-notch HF. Then the FT-840 is for you. It's right on the money! Considering a mobile HF or field radio and doubt the quality and features of tiny HF rigs? Then the FT-840 is for you. It won't disappoint you!

Built to handle rigorous field operation, the new intense LCD display affords sharp visibility in bright sunlight. Die-cast heat sink and internal thermally switched fan keep the FT-840 running cool. Modular design circuit boards ensure operating efficiency — manufacturing excellence you'd expect in much higher priced radios.

For high performance, the FT-840 features a low noise front end that uses the latest in FET RF amplifier design. Two DDSs and magnetic encoder for silent, smooth tuning and fast switching. Twin band-stacking VFOs. And, automatic 10-m FM (optional) repeater offset with selectable CTCSS. Even two optional external antenna tuners to customize your rig.

Top of the line quality and features at a remarkably low price. Just what you'd expect from Yaesu! For high-tech performance, and a wealth of features that won't break your budget ask your dealer about the FT-840.

Yaesu
Performance without compromise.

© 1993 Yaesu USA, 17210 Edwards Road, Cerritos, CA 90701 (310) 404-2700
Specifications subject to change without notice. Specifications guaranteed only within amateur bands. Some accessories and/or options are standard in certain areas. Check with your local Yaesu dealer for specific details.
Dick Beaton N7RB, Helena MTS Wayne—As an old CW op, I'm not going to jump in and tell you that we have to keep all those CW frequencies. If CW is secret and a useful means of communication, it is a real dud. It's fun if you like it. It is hard to believe the ARRL still promotes traffic handling classes when the whole point of using QSL will do it better and faster.

I was licensed in 1934 and worked as a CW operator in the CCC camps in North Dakota. Do you believe I furnished my own home-brew station? It was that job that helped me get a job with Northwest Airlines, first as a radio operator in '38, and later as a station manager in '42. We even used CW for handling reservation traffic from 1939 until about 1944! Before that it was all GHCS.

Well, anyway, I was one of the first around here to promote the no-code license idea. I've also been promoting your 30 series. I have my no-code taught code off and on for years and was one of the first VE's around here, also among the first on packet. At least, I thought I was. We all hummed my brains and I could easily prove it. I don't get on as much anymore as most guys just won't talk. And I'm with you! QSL if a DX station gives me that old QSL via a bureau, I just tell them "no QSL needed." They used to come in with new QSLs now. They are just another card in the drawer. (How about using packet for QSLs and making an excuse for sending traffic?) I have a good handle on you and for many countries I've worked and could care less. It isn't a big deal anymore. I do have WAS on Geritol net 3767 kHz. The only thing on my call is a Kenwood world map word and my "Ham of the Year" plaque from the local club.

One thing you could quit harping on here in your reports is the "hams must have" or "hams should have" thing. I think that very few of the hams I know could afford such a thing. Your background gets you into places that are out of reach for me and I tend to quit comparing yourself with the rest of the hams. You are one of the privileged elite. As a VE, I know that some people have a tough time coming up with five bucks. I know how it is because I was one of them. You weren't. When I was a kid we used to get the battery out of our Whispert to light the filaments in the old four-tube regenerative radio with a horn speaker. The problem was we went without radio a lot because the "B" battery didn't last very long. I set out to "invent" a substitute without spending any money. My slide projector and goose egg was on WPA. I succeeded, too. I didn't exactly know for sure what I was doing, but I ended up using a dog collar and some 201-A filament. I used one side of an audio transformer for a choke and the capacitor out of a Model T Ford coil for a filter. The filter and goose egg lead together to make a diode that rectified the 110 AC. It worked like a charm.

After WWII I went through a lot of surplus equipment. It was all junk and I had an AM rig, just home-brew CW until the HW-101.

---

From The Hamshack

The mess on 14,315 makes me ashamed, but I have resisted the temptation to jump in and tell them off. It must be the big amplifiers those guys have. I don't think the Extra Class license did it. I've got an amplifier, but haven't had it hooked up for a long time. That's why I've seldom had to have anything good to say, anyway. I used to check into the QCWA net in Montana and all those old guys do talk about their health complaints and the weather.

Incidentally, you wanted to know what new products we use. Well, I had an R-5 vertical which worked great but was limited to bands higher than 40 meters, so I sold it and bought a GAP. It works fine, too, but on 80 the "low" angle of radiation makes it useless for visiting with guys within 100 miles or so. I tried to put a Blat in the attic here without any success. That didn't go over a hole in the hall closet, so I had to give up trying to make it work. It doesn't even look like it should work!

I've been 76 years old and sorry I'm going to miss all the wonderful new things just over the horizon. Then again, I've lived to see a hulium revolution in the world of scientific knowledge. I missed a lot because I went to the college of hard knocks, but I think I know a lot more than quite a few college grads who never learned anything very useful.

One last thing: Hope you succeed in getting the school system fixed. Everyone should know Ohm's Law and DOS 73 to a great editor. You and Rush Limbaugh should get together! You have a lot in common.

Dick "Eric" E. Howe, Har-de-har. I've never been a DXpeditioner until now and I've been on the road much. Travel is mostly a matter of decision. It doesn't have to cost a lot. For instance, Sherry and I spent a week in France. We rode public transportation and must have cost a bundle! Well, we flew business class, stayed in a very nice hotel, went everywhere, saw everything, had some great dinners. Now how much would you budget for a trip like that, total?

The flight, hotel, meals, taxis, tips, and everything for a week came in at $551. A couple years ago we flew round-trip to Munich business class, rented a car, drove to Vienna, Krakow, Prague, and Berlin. We must have cost a bundle! We flew business class hotels. Fine meals. Two weeks. The total cost was under $1,000.

Of course I was able to do some business on each trip, which more than paid the cost of the trip. In Vienna I signed a contract with an Italian publisher to use 73Brides. In Rome I made import agreements with two record companies. Travel doesn't have to be expensive if you do it right. And it isn't. In Boston we did $50 worth of business.

How much does it cost to drive to Hallifax? Peanuts. Then there's the short flight to St. Pierre. The hotel was inexpensive. So were the first class meals. So we DXed there for a few days.

---

Any ham who has trouble coming up with $5 sure isn't much of an entrepreneur... and isn't using his ham-know-how for anything but his own fun. There are too many people making monev these days for anyone to be poor... unless they've been too lazy to get an education. Maybe you've noticed that the richer, very well-educated people sound like they... and very few poorly-educated rich people. It's almost enough to make someone think.

College is a waste of time, no matter what you want to do. You can learn 10 times as much in half the time. With the required books to keep right and not stop, I'm still learning. I've read over 100 books in the last few months and have 50 more by my bed being read. No... Wayne

Matt Thomas N7WF, Ortonville MI I am writing to you because a few hams have really made me sick. I was scanning the 20 m a long time ago and heard a small group of hams cursing and swearing like mad on 14,315 MHz. What kind of representation is this group? I was that I were a shortwave listener thinking of getting a license, this would probably convince me to change my mind. The only time I have heard hams is at school. I thought hams were to promote international good will. In my opinion, this hardly promotes international goodwill.

By the way, I really enjoy reading "Never Say Die." Wayne, you have some interesting opinions.

John R. Lownber, II, Lawrence KS KS has been on 14,315 MHz for a long time. "Never Say Die" column in the June 1993 issue. I have been a sporadic reader of 73 for years and your column is often the most interesting part of the magazine and certainly the most unpredictable.

In this column you hammered on one of the problems which are not keeping me from seriously pursuing an amateur radio license: There seems to be hardly anyone out there working 14,315 MHz. Whether or not I call many hams with my little Sony 2010 I find very little worth listening to. Using the receiver section of my elderly Drake, I find nothing that compares to its superior ability to separate one signal from the next.

I went through a study guide for the no-code Technician license and was surprised to find that the so-called "significant technical requirement" consists mostly of extremely basic electronic theory for that an operator has actually done anything with electronics should already know.

Of course, the no-code Technician license is all that is interesting, lacking privileges on the HF bands capable of reasonable long-range contacts. Even with the addition of passing the 5 wpm Morse code test, only the 10 meter band is available for telephony, the other bands allowing only the very lowest digital data (I have not seen that most primitive of digitial systems, CW).

If the ARRL cannot be bribed away from the current physical ailment: A proposal for using manually-generated Morse code can be separated from the other privileges. The sensible thing to have once passed the 5 wpm code test (3 wpm would be better), to meet the requirement of the treaty, you would gain all of the General Class privileges upon passing the General Class written test, except on frequencies designated for type A1A, on only gaining A1A privileges on passing the 13 wpm code test, and likewise for the Advanced and Extra Classes.

That would be consistent with the objective of the amateure radi c service as a source for skilled electronics technicians, as it would provide additional technical knowledge without holding the acknowledgment of their advance in knowledge hostage to skill in using the ham radio band.

Eric P. Nichols KL7AJ, North Pole AK Here's an interesting figure for you. I recently acquired an HF packet station (actually a by-product of the AMTOR station I wanted). At any rate, I opened up all the AX2E monitors and tuned to the 14.103 MHz PacketCluster, listening everything, and found another packet printer. After a six-hour period, I did some statistics on the printout. Lo and behold, 98.4 percent of all printed matter was either time-keeping and error-correcting information. The remaining 0.6% of the printed matter was actual text. So, the point is that inanities are not restricted to phone bands, they are built into the very soul of packet radio! A little food for thought!

One nice thing about packet, though, is that I can selectively reject calls from such unwanted areas as JAs. I call my program my "JA notch," and it saves a whole lot of wasted time and effort. Back in my phone days I used to call "QC nc JAs," but someone told me that was uncouth. Packet allows me to be selectively rude (or rudely selective) with no guilt!

Mind you, I have nothing against Japan per se, but if you have ever operated in Alaska you will know that JAs are about all you can get without experiencing a very long climb. Most JAs likely will not even know that those JAs are6 most unlikely to ever have the airtime, let alone talk. Most JAs rely on vast quantities of front-to-back ratio to solve the problem, but that leaves them with no ability to the JA QSO even in case you want some desired Asian country!

By the way, I devised a new more efficient signal reporting system in which the typical QSO is contained within the report itself. The report has two numbers and two letters A1 or A2 in place of "QSO." For example: "AL7HC, this is KL7AJ. Your report is 571S. 73s."

"3s. KL7AJ clear."

Translation: "AL7HC this is KL7AJ, you're five by nine, the rig here is a Yaesu, the weather is rainy."

"KL7AJ this is AL7HC. Roger 571S, your report is 73s."

"3s. KL7AJ clear."

As you can clearly see, this four character report is more than adequate for more than 98.4% of all amateurs QSOs. For the long-winded, a third letter might be used to describe the current physical ailment: "H" for heart problems; "K" for kidney stones; "P" for prostate surgery, etc.

---

Number 2 on your Feedback card

6 73 Amateur Radio Today • November, 1993
**REPEATER**

A microprocessor-controlled repeater with autopatch and many versatile dtmf control features at less than you might pay for a bare-bones repeater or controller alone!

We don't skimp on rf modules, either! Check the features on R144 Receiver below, for instance: GaAs FET front-end, helical resonators, sharp crystal filters, hysteresis squelch.

---

**ACCESSORIES**

**LOW-COST GAASFET PREAMPS**

**LNG-**

**ONLY $59 [Full tested]**

**FEATURES:**
- Very low noise: 0.7dBv, 0.8dBf, 0.9dBf
- High gain: 13-20dB, depends on freq
- Wide dynamic range - resist overload
- Stable: low-feedback dual-gate FET

**LNM-**

**MINIATURE PREAMP**

**ONLY $29.95 [Full tested]**

- GaAs FET Preamp similar to LNG, except designed for low cost & small size.
- Only 0.87W x 1.5/8L x 3/4H. Easily mounts in many radios.

**LNS-**

**IN-LINE PREAMP**

**ONLY $89.95 [Full tested]**

- GaAs FET Preamp with features similar to LNG series, except automatically switched off out of line during transmit. Use with base or mobile transceivers up to 25W. Tower mounting brackets incl.

**HELI-RESONATOR PREAMPS**

- GaAs FET preamps with 3 or 4 section helical resonators reduce intermod & cross-band interference with only 0.52 channel spacing (MODEL HRG-***)
- $90 vhf, $110 uhf.

**RECEIVING CONVERTERS**

- Low noise converters to receive vhf and uhf bands on a 1CM receiver.
- Kit less case $49, kit w/case & BNC jacks $74, w/kit in case $99.

**TRANSMITTING CONVERTERS**

- XV2 for vhf and XV4 for uhf. Models to convert 10M sab, av, fm, etc to 2M, 220, 222, 439, and uhf 1W output. Kit only $89. PA's up to 45W available.

---

**FM RECEIVERS**

- **R144/R220 FM RECEIVERS** for 143-174 or 220-225 MHz. GaAs FET front end, 0.15V sensitivity! Both crystal & ceramic filters plus helical resonator front end for exceptional selectivity: 1kHz at 1kHz audio bandwidth. **R144 $199, R220 $219.**

---

**FM RECEIVERS**

- **R144/R220 FM RECEIVERS** for 143-174 or 220-225 MHz. GaAs FET front end, 0.15V sensitivity! Both crystal & ceramic filters plus helical resonator front end for exceptional selectivity: 1kHz at 1kHz audio bandwidth. **R144 $199, R220 $219.**

---

**FM RECEIVERS**

- **R144/R220 FM RECEIVERS** for 143-174 or 220-225 MHz. GaAs FET front end, 0.15V sensitivity! Both crystal & ceramic filters plus helical resonator front end for exceptional selectivity: 1kHz at 1kHz audio bandwidth. **R144 $199, R220 $219.**
RF Radiation Feedback

The FCC has extended the comment period on a proposal (in E.T. docket 93-62) that the commission adopt new guidelines for evaluating the environmental effects of radio frequency radiation. The federal agency will hear comments until November 13 on the proposed guidelines, which are the same as those already adopted by the American National Standards Institute and the IEEE.

The FCC says the request for extension was made by the National Association of Broadcasters, and was supported by other interested parties. The NAB's request was to allow a study to develop non-measurement-based techniques for complying with the Commission's new rules. **TNX Westlink Report No. 656, September 1, 1993.**

Vanity Callsigns Authorized

Both the House and Senate have approved legislation authorizing the FCC to issue unique amateur radio callsigns, at a cost of $7 per year, to the ham community. The surprise measure was inserted into the recently-signed deficit reduction bill of President Clinton.

According to a congressional aide close to the plan, "We envision that the legislation will probably be implemented so that an amateur pays $35 every five years, although there is no language in the bill that says they have to do it that way. It only says they have the authority because they do not have this authority right now. . . . As I understand it, the proceeds will go to the FCC to augment their budget, to pay for equipment, staff, and stuff." The only amateurs who would be subject to the new fees are those requesting special, distinctive callsigns.

Another little-known tack-on to the deficit plan provides for spectrum auctions. The government is set to receive more than $10 billion over the next five years when it sells radio spectrum to the highest bidder for new communications services. **TNX W5YI Report, Issue 16, August 15, 1993.**

Instant Ham

A petition has been filed before the FCC by the Western Carolina Amateur Radio Society VEC that seeks a rules change permitting instant ham radio licensing. Specifically, the Knoxville-based testing group wants the commission to amend Part 97 to allow amateur radio operating privileges to commence upon passing the required exam, without having to wait for the issuance of a first license.

The WCARS VEC argument states that anyone who holds a valid Certificate of Successful Completion for an amateur operator's license which was issued within a year should be authorized with the rights and privileges for that license class. They propose a temporary callsign structure based on the Class D citizen's radio service precedent which was set several years ago under deregulation. Proponents believe this measure would save the government time and money they spend answering phone calls from those waiting for their licenses to arrive.

This proposal, designated as RM-8288, is open for comments to the FCC. **TNX Westlink Report No. 656, September 1, 1993.**

Codeless Coast Guard

For the first time since 1924, the United States Coast Guard has closed down its Morse code operations on 500 kHz. The final CW transmission ended an era at 0002, July 31, 1993. Coast Guard radio operators first began listening for distress signals on 500 kHz at the turn of the century, and set up its permanent station nearly 70 years ago to monitor the frequency continuously.

Officials say the advent of satellite and digital technology has made Morse code obsolete on the high seas. A misty-eyed Coast Guard radioman tapped out the final 73, saying "We now look forward to serving you on the next generation of communications equipment and systems via the Global Marine Distress and Safety System (GMDS)." **TNX W5YI Report, Issue 16, August 15, 1993.**

Lunar Repeater

Northern California's Project OSCAR group has proposed installing the first repeater on the moon. Project OSCAR is the group that built and orbited the world's first amateur radio satellite. During recent meetings, the organization has decided to revive "Project Moonray" to take amateur radio into the 21st century.

Moonray is short for Moon Relay, a concept first proposed by W6OLO back in 1965. The idea was to build a repeater that would fit under the seat of the Lunar Rover. But, the project was shelved after Congress cut funding for manned moon missions beyond Apollo 17.

No specific timetable has been offered, although organizers hope to get the project off the ground by the turn of the century—which is only six years and a few months away. **TNX Westlink Report No. 655, August 13, 1993.**

Going Commercial?

We're not talking about the relaxed business communications rules which took effect in September. We're talking about Commercial Radio Operator License examinations. If you've been thinking about sitting for one of these exams, now may be your best chance.

While it may not be common knowledge, many of the questions for the General Radiotelephone Operator License examination are taken verbatim from the Amateur Advanced and Amateur Extra Class question pools. Those questions are expected to remain in the pool, at least through the summer of 1994—and possibly beyond.

A GROL is required to adjust, maintain, or internally repair transmitters in the aviation, maritime, and international fixed public radio services. The General Radiotelephone Operator License replaced the old First and Second Class Radiotelephone licences back in 1984. It is issued for the lifetime of the holder. **TNX W5YI Report, Issue 17, September 1, 1993.**

Chile Bird

The first Microsat of Chile, named CESar-1, is slated for launch in early 1995, according to the Radio Club Federation in Santiago. The organization will control the new satellite, once it is in orbit.

The Microsat class bird will orbit at an altitude of 900 km. The Radio Club Federation says CESar-1 will boost communication between local amateurs and the rest of the world. **TNX Westlink Report No. 656, September 1, 1993.**

Island Quake Mobilizes Hams

The strongest earthquake to shake the world in more than four years rocked the island of Guam on August 8. The temblor struck early Sunday morning, measuring 8.1 on the Richter scale.

More than 130,000 island residents were left without electricity and at least 40 people were injured. Tourists fled from hotels where structural cracks were seen and bridges also suffered damage.

Communication with the northern part of the island became critical due to knocked-out telephone lines and the need for emergency services. Amateur radio and MARS stations were utilized to carry information to and from the disaster area.

Guam is west of the International Date Line, 3,800 miles west of Hawaii, and 1,500 miles south of Japan. There were no reports of injuries or damage at the US military facilities on the 30-mile-long island. **TNX Westlink Report No. 656, September 1, 1993.**

TNX . . .

... to all our contributors! You can reach us by phone at (603) 924-0058, or by mail at 73 Magazine, Route 202 North, Peterborough NH 03458. Or get in touch with us on CompuServe ppn 70310.7755; MCI Mail "WGEPB"; or the 73 BBS at (603) 924-9343 (300-2400 baud, 8 data bits, no parity, one stop bit). News items that don't make it into 73 are often put in our other monthly publication, Radio Fun. You can also send news items by FAX at (603) 924-9327.
Tired of being controlled by your data controller software? Take control with PC-Pakratt for Windows. PC-Pakratt for Windows lets you do all the things you wanted to do in DOS but were afraid to try—or couldn’t remember the command for.

With full Windows™ functionality (like background operation, cut & paste, etc.) and extensive on-line context-sensitive help, PC-Pakratt for Windows is the easiest way to use a data controller. You don’t have to remember cryptic commands, either—just click a button and you’re on your way.

Not only is PC-Pakratt for Windows the easiest way to communicate, it’s the friendliest. Change the colors, display font, or operating window layout—you are in control here!

PC-Pakratt for Windows cleans up with top-notch features, too. Control two data controllers simultaneously for dual-, tri-, or even quad-port operation. Pick your favorite mode—PACTOR, Packet, AMTOR/SITOR, Morse, RTTY (Baudot/ASCII), NAVTEX, or TDM. PC-Pakratt for Windows supports all current AEA Data Controllers.

Call AEA’s literature request line at (800) 432-8873 for more information, or call us direct at (206) 774-5554. Contact your favorite ham radio equipment dealer for a demonstration and best pricing.
The FARA Project
An economical, easy-to-build, 25 watt 2 meter amplifier.

by James R. Valdes WA1GPO

The Falmouth (Massachusetts) Amateur Radio Association (FARA) is well-known on Cape Cod for its hospitality to newcomers. It is also one of the more active groups in Southeastern Massachusetts supporting two repeaters and a digital Node/LAN. One subgroup of the association is the HACKERS, a group of amateurs who enjoy designing and building their own equipment. When the HACKERS noted that a majority of the new members joining FARA were using 2 meter HTs, we recognized that we might entice some of these new hams into joining this select group of builders by helping them construct a power amplifier for 2 meters. We did this as a group project: Those with tools drilled the holes and those without cleaned and prepped the circuit boards for fabrication or wounded the inductors. Those who had experience building gear Elmered those who didn't. All of the participants contributed to the success of this project.

This article describes a 2 meter amplifier capable of running 25-30 watts output. More than 35 amplifiers have been procured at a cost of less than $50 each in these quantities.

Photo A shows the final version of the circuit board; the completed amplifier is shown in Photo B. It is designed around one of the newer bipolar RF devices from Motorola, an MRF1946A (Q1). This device compares favorably with many of the RF FETs available as the MRF1946 is capable of developing 10 dB gain at 146 MHz, while the older bipolar devices (the 2N6080 series) produce only about 5.7 dB gain. RF FETs are generally rated at 13 dB gain at 28 volts; in the 12-14 volt range they also yield about 10 dB. The design presented here is unconditionally stable, while FET amplifiers require a bias supply and careful tuning at the higher voltages to maintain stability. The cost of the MRF1946A is only about two-thirds that of the FETs, yielding the most "Bang for the Buck!"

Circuit Description
Motorola produced an application note (RF Device Data, Application AN955) for a 150 mW to 30 watt land mobile VHF amplifier in the 160 MHz range, based on the MRF1946.

This was the starting point for this design. The schematic diagram is shown in Figure 1. DC voltage into the amplifier is decoupled by C1, C2, C3, L1, C4, C5, and L2. D2 is the reverse polarity protection diode—if the voltage is inadvertently reversed, D2 will limit the reverse voltage to 0.7 volts and fuse F1 will open, protecting the amplifier. The output strip line (Z1) described in the application note was lengthened for operation at 146 MHz and the output capacitor (C10) was empirically adjusted to yield an efficiency in the 70% range, just about what one would expect of a Class-C amplifier. The output circuit was derived from the formulas given in the RSGB VHF/UHF Manual. This manual is highly recommended for those interested in VHF/UHF construction. Similar examples of impedance calculations can be found in several editions of The Radio Amateur’s Handbook. This approach was intended to demonstrate the microstrip vs. lumped constant techniques for impedance matching as one of the more subtle objectives of the HACKERS group is to provide some informal education on radio construction and

Figure 1. Schematic diagram.

10 73 Amateur Radio Today • November, 1993
**MFJ ACCESSORIES**

**impact Speaker/Mics**  
ve's a Compact Speaker/Mic that fitsfortably in your hand and has a full speaker for crystal clear audio.

**Mini Speaker/Mics**  
These tiny MFJ Speaker/Mics are so small and so lightweight you'll forget they're there---until you get a call.

**UHF NHF 1.5 KW load.**  
**12 or 24 hour**

**MFJ-284 or MFJ-286**  
**$24.95**

**MFJ Coax Antenna Switches**  
Select any of several antennas from your operating desk with these MFJ Coax Switches. They feature mounting holes and automatic grounding of unused terminals. One year unconditional guarantee.

**MFJ-1701**  
**$34.95**

**MFJ-1702B**  
**$59.95**

**MFJ-1704**  
**$59.95**

**MFJ Low Pass Filter**  
Suppress TVI, RFI, telepherone and other interference by reducing unwanted harmonics going to your antenna.

**MFJ-260B**  
**$29.95**

**MFJ-260B**  
**$29.95**

**MFJ Iambic Paddles**  
**MFJ Deluxe Iambic Pad**

**MFJ-284 or MFJ-286**  
**$24.95**

**MFJ-Cross 28M**  
**$24.95**

**JSX-Neod SWR Meter**  
**MFJ-1024**  
**$19**

**MFJ-4228**  
**$24.95**

**MPJ-283, MFJ-235,**  
**MFJ-285L, MFJ-285W,**  
**MFJ-294 for access**

**12/24 Hour LCD Clocks**  
**$39**

**MFJ-108B**  
**$59.95**

**MFJ-112B**  
**$59.95**

**Code Practice Oscillator**  
**MFJ-557**  
**24**

**MFJ-557 Deluxe Code Practice Oscillator**

**Use your rig's 12 VDC power supply to power two HF/VHF rigs and six or more accessories with this MFJ high current multi channel DC outlet.**

**2 pairs of 30 amp**

**Write or call FREE MFJ Catalog**

**Dealer/Orders:**  
**Free MFJ Catalog**

**Nearest Dealer/Orders:**  
**800-647-1800**

**Technical Help:**  
**800-647-TECH**

**1 year unconditional guarantee**

**30 day money back guarantee (less ship. & Handling)**

**RTPY: 5100**

**MFJ ENTERPRISES, INC.**

**Box 494, Miss., State, MS 78762**

**(901) 323-3569, 8-30 CST, Mon-Fri.**

**Add 14% HST.**

**MFJ...making quality affordable**

**Prices and specifications subject to change © 1983 MFJ Enterprises, Inc.**

**CIRCLE 86 ON READER SERVICE CARD**
design practices. A low-pass filter network (C13, C14, L5) is in series with the output to enhance harmonic rejection.

Incorporated into the design is a resistive input attenuator network (R2, R3, R4, R5). The RF power transistor (Q1) is intended to be driven with 2 to 3 watts input; higher drive levels will not increase the output substantially. Most of the older HTs can drive the amplifier directly, but the new breed of high power, 4 to 7 watt HTs will require the input attenuator. When the attenuator is used, the 50 ohm microstrip must be isolated at the 10 ohm resistors. Cut the circuit foil at the locations noted on the parts placement diagram. Figure 2. The attenuator represents a nominal 3 dB loss; that is, half of the power is dissipated in the network. In addition to limiting the drive power to a safe level, the attenuator also enhances the stability of the amplifier by isolating the amplifier from the driver. It also presents a nominal 50 ohm resistive load to both units. If the attenuator is not required, the network consisting of resistors R2, R3, R4, R5 should be omitted.

An RF-actuated T/R relay (K1) has been incorporated into the amplifier. RF on the input is sampled by C16, rectified and limited by D3, D4, R6, and C17 to turn on Q2, which pulls in the relay. We considered using solid-state T/R switching. However, relay switching has the advantage that the amplifier can be turned off when it is not required. Conversely, diode-switched amplifiers must be powered at all times. This is in keeping with the spirit of the FCC regulations that require radio amateurs to use “the minimum power necessary to carry out the desired communications.” Relay switching also results in a more compact, easier-to-duplicate amplifier. The relay specified in the Parts List is a small, open-frame style. Its performance is adequate for 2 meters.

Should you be a “purist,” you can compensate for the inductance of the relay by installing a variable capacitor (C15) in series with the input to the relay, as noted on the parts placement diagram. This capacitor was
SIMPLE, AFFORDABLE & FUN
DESIGNED FOR ONE REASON... TO HAVE FUN! AND BOY DOES IT DELIVER!!!

$495

• Change bands in a second. Just plug in desired module!

It's SMALL
Makes mobile or portable fun for more hams than ever before. Fits almost any car, even compacts. Measuring only 2.5" x 7.25" x 9.75", this five lb. travel companion tucks in a briefcase with plenty of room to spare.

It's HOT
Receiver runs circles around rigs at twice the price. 90 dB dynamic range, low phase noise design lets you hear the weak ones even on crowded bands. It's no fun if you can't hear em!

It's SIMPLE
Just sit down and operate. Master every feature in minutes - no modern rig is as easy to use. Change band modules in a flash to work 160-10 meters including WARC.

It's AFFORDABLE
At $495, it's half the price of the closest competition. No other rig packs so much performance at so low a price. Have fun on HF without spending a fortune.

It's NOT A TOY
Crystal mixing (no synthesizer) coupled with meticulous circuit design yields sporting clean receive audio. And you'll marvel at the unsolicited compliments on transmit audio.

MADE IN USA
• Patented "Jones" Filter provides variable bandwidth 9 pole crystal filter - 500 Hz to 2.5 kHz. The right filter for every condition at the touch of a knob.
• "SYNCHRO-LOCK" software keeps VFO virtually drift free regardless of temperature variations.
• Optional Noise Blanker
• SSB and CW 50 Watts Output Adjustable To 5 Watts
• Runs Off 12-14 VDC
• Rx - 10 Amps, Tx - 6 Amps
• Receive Offset Tuning
• Built-in tambour Keyer with Legendary QSK. Speed adjustable on front and shown in display.

$495* Includes one band module of your choice
$25* Each additional band module

SCOUT ACCESSORIES:

<table>
<thead>
<tr>
<th>MODEL</th>
<th>PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>296 Mobile Bracket</td>
<td>$15.00</td>
</tr>
<tr>
<td>297 Noise Blanker</td>
<td>$19.50</td>
</tr>
<tr>
<td>927 11 Amp Power Supply</td>
<td>$70.00</td>
</tr>
<tr>
<td>938 Tiny Switching Supply (Only 3 lbs!)</td>
<td>$95.00</td>
</tr>
<tr>
<td>700C Hand Mike</td>
<td>$39.95</td>
</tr>
<tr>
<td>607 Weighted Key Paddle</td>
<td>$35.00</td>
</tr>
<tr>
<td>291 Antenna Tuner</td>
<td>$89.00</td>
</tr>
</tbody>
</table>

VISA, MC, DISCOVER
*Plus shipping and handling; call toll-free for charges.

CALL 1-800-833-7373
Telephone Hours: 9:00 AM - 5:30 PM Eastern

TEN-TEC
"America's Best"

KITS ARE BACK!

Introducing "If Kits" - New division of Ten-Tec! Call 615-452-7172 to request your kit catalog.

Ten-Tec Inc. 1105 Daily Point Parkway, Hendersonville, TN 37075 USA Office: (615) 455-7777 Fax: (615) 455-6440 Super Dept.: (615) 429-0394
not used on our production run. All of the input and output foil runs are constructed of 50 ohm microstrip (Z2-Z6) etched into the circuit board. The circuit can be modified for solid-state T/R switching. A PIN Diode T/R switch may be a better choice for packet operations, which require high speed switching. Several articles (including “A 2 Meter FET Amplifier for Your Handheld” by John Cunningham AA4AW, 73 Amateur Radio Today, Oct. 1992, p.20) and the ARRL handbooks contain examples of diode switching.

A word of caution concerning the circuit board. It must be constructed of 1/16", double-sided, G-10 glass-epoxy board with 2 or 3 oz. copper. A full-size negative for the circuit board is provided (see Figure 3). The side of the board opposite the stripline remains a solid copper ground plane as it is not etched. Failure to reproduce the board exactly as shown, with the materials specified, will dramatically affect the performance of the amplifier because the dimensions for the striplines are critical.

Low impedance grounds are crucial to the operation of the amplifier. A number of holes (18) must be drilled through the board (see Figure 4). No. 20 wire is inserted through these holes and soldered to electrically tie both sides of the circuit board together at the
"ITC" The Only Affordable Full Function Spectrum Analyzer

PRICES START AT $1295.00
SA600 MODEL 2mHz - 600mHz

A MUST FOR:
- COUNTERSURVEILLANCE
- SATELLITE TELEVISION
- RF ALARM SYSTEMS
- TWO-WAY & HAM RADIO
- ALL RF BASED SYSTEMS

You Do Not Have To Spend $10K To Get a Full Function Spectrum Analyzer (HP, TEK ect.) And Don't Spend $3K to $4K For So Called Low Cost Limited Function Analyzers. (Avcom, B&K, ProTek) ITC delivers full function analyzers for less. Let's look at the features ITC Spectrum Analyzers provide.

80 dB DYNAMIC RANGE ON SCREEN. ITC Exclusive EFPLA
Log Amp. (pat. pending) Other low priced units only have 60 dB or 70 dB on screen.

-110 dB SENSITIVITY AT ALL SPAN WIDTHS. Only ITC provides -110 dBm .7 uv. sensitivity at wide & narrow span widths. Other low cost units provide 80 - 95 dB only at narrow spans.

HIGH STABILITY Only ITC Analyzers provide high stability and low drift at any span. (I < then 1kHz per Hr. after warm-up)

EASY OF OPERATION:
The SA Series controls are simple to understand and use, even if you never used a Spectrum Analyzer before you will be on line in no time.

FEATURES: Baseline Clipper, Video Filter, 5" CRT, 10 push-button Frequency select switches plus a 10 Turn Frequency control for 100:1 tuning ratio. Providing easy frequency selection. The Dispersion is variable form 0 mHz to 50mHz per/div.

DIMENSIONS: 6"h x 12"W x 17"D

CALL 1-800-232-3501 FOR SPECIAL INTRODUCTORY OFFER ON ALL MODELS

SA SERIES PRICES:
SA600A $1295.00 2mHz to 600mHz
SA1000A $1595.00 2mHz to 1000mHz
SA1800A $1895.00 2mHz to 1800mHz

Opt. 1 50 mHz marker Generator $200.00
Opt. 3 4/5 kHz Narrow Band Filter provides 5 kHz resolution BW $350.00
Opt. 5 Tracking Generator internal $250.00
Opt. 6 Center Frequency Readout $250.00

TERMS: MC, VISA, DISC, AE, CHECK, MO, COD
PRICES & SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE OR OBLIGATION

CIRCLE 112 ON READER SERVICE CARD
points indicated. Some flux may enhance the solderability on the ground plane side of the circuit board. Be sure to use only rosin core-solder!

**Construction**

Photo C is a view of the amplifier mounted in the suggested enclosure; it should be noted that the circuit board shown in this view is one of the earlier prototypes. It’s a good idea to use the circuit board as a template to mark the case for the mounting holes before soldering the components to the board.

The MRF1946A utilizes an 8-32 stud for the heat sink and mounts with a single hole through the circuit board. Take care when mounting the device to insure that no strain is placed on the transistor’s leads when it is soldered. It must fit flush on the circuit board. A little thermal heat-sink compound on the flange of the transistor mounting stud is recommended to maximize heat transfer. Careful—don’t get this stuff on your clothes because you’ll never get it off! The circuit board mounts to the case with 4-40 hardware. Use 4-40 nuts under the circuit board corners to space the transistor mounting stud correctly. The heat sink (aluminum channel stock) and the chassis details are given in Figure 5. I prefer BNC connectors for the RF connections as they mount with a single hole and perform better that UHF connectors at the frequencies of interest. The LEDs, switches, and reverse polarity protection diode are wired from the case-mounted components to the circuit board. Don’t forget to install the fuse in series with the DC power plug.

Attention should be paid to standard VHF construction practices. Some pitfalls to be aware of when constructing the amplifier are:

- Components should be mounted flush to the board; i.e., the fixed capacitors should be mounted as close to the foil as possible. Bend the leads perpendicular to the body after removing any enamel from the leads, then solder the components to the board with the minimum lead length possible.
- The wires through the board should be bent into a “Z” shape after insertion through the board prior to soldering.
- Periodically, the flux should be removed from the board during the construction process. Pay particular attention to the striplines

*Continued on page 18*
**_SERVICE** worldwide

Do you really read the feedback cards? You bet! The results are tabulated each month, and the editors take a good, hard look at what you do and don't like. To show our appreciation, we draw one feedback card each month and award the lucky winner a free one-year subscription (or extension) to 73.

To save on postage, why not fill out the Product Report card and the Feedback card and put them in an envelope? Toss in a damming or praising letter to the editor while you're at it. For the low, low price of 29 cents!

| 1 Never Say Die | 14 QRP |
| 2 Letters | 15 Packet & |
| 3 QRX | Computers |
| 4 The FARA Project | 16 ATV |
| 5 Improved V.OX | 17 Above and Beyond |
| 6 The Solar Control-ar | 18 Ask Kaboom |
| 7 Review: Ramsey Electronics | 19 Dealer Directory |
| 8 FX-146 Transceiver Kit | 20 73 International |
| 9 Review: Axon AZ-61 6n | 21 Special Events |
| 10 FM Transceiver | 22 New Products |
| 11 Hamstats | 23 Barter 'n Buy |
| 12 RTTY Loop | 24 Random Output |
| 13 Carr's Corner | 25 Propagation |
| 14 Homing In | 26 Ham Help |
| 15 Hams with Class | |

---

**SRC-10 REPEATER/LINK CONTROLLER**

DTMF muting
Intelligent ID'er
Auxiliary outputs
Easy to interface
Alarm monitor input
Telemetry response tones
Low power CMOS, 22ma @ 12v
Detailed application manual
Programmable COS polarities
Repeater & link courtesy tones
Synthesized link/remote base capability

$149.00 Assmbed & Tested

**CREATIVE CONTROL PRODUCTS**

3185 Burntting Avenue
Grand Junction, CO 81501
(203) 434-9405

---

**ICOM® SPECIALIST**

**SALES AND SERVICE**

Technician for 17 years with ICOM can revitalize your old equipment...or trade in for new.

**CAP or MARS mod performed on purchases at no extra charge, if requested at time of sale.**

**SERVICE: $50 per hour***

**NO MINIMUM * FAST TURNAROUND**

---

**ITECH**

Lewisville West Center
701 S. I-35E, Suite 115
Lewisville, TX 75067
(W/N Corner I-35 & Fx Ave.)
Phone: 214/219-1490 * FAX: 214/219-1687

WASWZD

Fred Palmer
Bea Palmer

---

**Most Revolutionary High-Frequency Amateur Radio Antennas in 20 years!**

The FLYTECRAFT™ SFX Line of Monoband Vertical HF Antennas

- Unique models for 40, 30, 20, 15, 10 meters. Each only 9 ft. tall (10 meter is slightly shorter.)
- Precision internal wound helix gives full-size, incredible performance - world-wide DX or domestic. A prize from everywhere: England - "Your vertical sounds great!" Canada - "I can't believe your antenna in only 3 meters high!
- Fasten set-up and tear down, or leave up permanently - unobtrusive, ideal for antenna restricted areas. Separates down to 4 ft.
- Antennas boast low angle radiation. Most suitable for mobile and home use. Ship direct from factory.

**Most Revolutionary High-Frequency Amateur Radio Antennas in 20 years!**

The FLYTECRAFT™ SFX Line of Monoband Vertical HF Antennas

- Unique models for 40, 30, 20, 15, 10 meters. Each only 9 ft. tall (10 meter is slightly shorter.)
- Precision internal wound helix gives full-size, incredible performance - world-wide DX or domestic. A prize from everywhere: England - "Your vertical sounds great!" Canada - "I can't believe your antenna in only 3 meters high!
- Fasten set-up and tear down, or leave up permanently - unobtrusive, ideal for antenna restricted areas. Separates down to 4 ft.
- Antennas boast low angle radiation. Most suitable for mobile and home use. Ship direct from factory.

---

**Is Your Shack Grounded?**

Ground It

Solid Copper Buss Stainless Steel Hardware Grounding Stud Every 6 inches
Top or Back Installation

Ground all of your equipment chassis's to a single earth ground in one easy installation. Money back guarantee, if not satisfied!

Add $3 UPS shipping
Mail check/money orders to 3 ft.$16.95
custom J.M.S. 4 ft.$21.95
35 Hilltop Ave., Dept. 7
Stamford, CT 06907

---

**X-BAND TRANSMITTER**

Miniature (2/4 x 3/4 x 1"
GaAs microstrip transmitter provides 10 dBm centered at 10.525 GHz. Integrated microstrip patch antenna eliminates the need for an external antenna. Advanced matching techniques secured good temperature stability with low frequency pulling. Great for long-range testing of radar detectors, calibration of radar receiving equipment, and point-to-point communication links.

Complete Assembled System $39.00
Parts & Kit Installation $29.00

---

**DIGITAL FIELD STRENGTH METER**

ANTENNA DEVELOPMENT
COMPARISON PHASE
POLARIZING, GROUNDING
ADJUSTMENTS PATTERN
RF LEVEL IN RADIO ENVIRONMENT
MICROWAVE OVEN LAGENAGE
HELPS DETECT T.V./T-HUNT
SNFF 60 CYCLE NOISE
DC TO 12 GHZ

$119.95

INNOTEK, Inc.
P.O. Box 80996, Fort Wayne, IN 46898
(219) 489-1711

---

**THEDMAMCENTRE**

Factory Authorized Dealer & Service For

KENWOOD

**CALL US FOR**

Great Prices & Great Service

---

**73 Amateur Radio Today** November, 1993 17
The FARA Project
Continued from page 16

and the transistor mounting tabs. These areas must be clean. If not, you may have some difficulties when tuning the amplifier.

Parts List

<table>
<thead>
<tr>
<th>Component</th>
<th>Type</th>
<th>No. Required</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1, C2, C4</td>
<td>0.001 µF</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C5, C17</td>
<td>0.1 µF</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>C8, C9</td>
<td>120 pF</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>C10</td>
<td>68 pF</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>C13, C14</td>
<td>22 pF</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>C16</td>
<td>3 pF</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>C3</td>
<td>2.2 µF</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>C6, C7, C11, C12</td>
<td>ARCO 423</td>
<td>4</td>
<td>CS/RF</td>
</tr>
<tr>
<td>C15</td>
<td>ARCO 249</td>
<td>1</td>
<td>CS/RF</td>
</tr>
<tr>
<td>R1, R7</td>
<td>3.3k, 1/4W</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>R2, R3</td>
<td>10 ohm, 1W</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>R4, R5, R8</td>
<td>330 ohm, 1W</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>R6</td>
<td>2.2k, 1/4W</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>D1</td>
<td>MRF 1445 A</td>
<td>1</td>
<td>RF</td>
</tr>
<tr>
<td>Q2</td>
<td>2N2222</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>D1</td>
<td>LED—red</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>D2, D5</td>
<td>1N914</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>L1</td>
<td>7T, #18 wound over R8</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>L2</td>
<td>4T, #18 3/8&quot; Id.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>L3</td>
<td>2T, #18 1/8&quot; Id.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>L5</td>
<td>4T, #18 1/4&quot; Id.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>L4</td>
<td>0.22 µH wire/wire bead</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>K1</td>
<td>Relay, P/N MEC-1 ORV-SH-212L</td>
<td>1</td>
<td>M</td>
</tr>
<tr>
<td>J1</td>
<td>2-pin, Jones/TRW/Cinch</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>J2, J3</td>
<td>BNC chassis receptacle, UG11094/U</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CH1</td>
<td>Bud chassis AC-431, 4&quot; x 6&quot; x 2&quot;</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>BP1</td>
<td>Bud bottom plate, 4&quot; x 6&quot; inches</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>HS1</td>
<td>Heat sink, 2 x 1 x 4 channel stock</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Misc. #4 hardware</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M: Mouser Electronics, Tel. 1-800-346-6873</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CS: Circuit Specialists, Inc., Tel. 1-800-528-1417</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ideal for SKYWARN and A.R.E.S.
Now you can do something about the weather

The ULTIMETER® II Home Weather Station protects your equipment, helps you alert others to dangerous weather extremes

This ultra-reliable Weather Station is your first alert to changing local weather conditions, gives you up-to-the-second data to transmit on SKYWARN and A.R.E.S. networks.

The ULTIMETER II tells you when high winds threaten so you can crank down your tower and safeguard other equipment. You get over 20 weather functions vital to ham and other homeowners, including high/low temperature readings with pre-set alarms that help you plan your day, guard against frostbite, protect plants and people.

The ULTIMETER II’s unique low-impedance wind sensor (patents pending) resists RFI, improves reliability and shows speed and direction simultaneously. Comes with 40 ft. cable.

HOME WEATHER STATION...only $179
Order by Dec. 24 and get a coupon for a SECOND CONTROL UNIT for remote use, only $49 ( $96 value )
NEW! Add our PC DATA LOGGER......Only $69
Det. in US, add $8.25 shipping & ins. NJ res, add 6% tax
Check, VISA, MC accepted. Credit card phone orders.
800-USA-PEET (872-7338)
FAX orders: 908-517-0669
PEET BROS. COMPANY
601-3117 Woodland Rd., W. Allenhurst NJ 07711
Our 18th Year Free Brochure ©1993 Peet Bros. Co.

Tune Up

The amplifier is quite easy to tune: Only a DC ammeter (5A full-scale), a 12-14 volt 5A power supply, a suitable RF power meter (50 watts full-scale), and dummy load are required. Initially the amplifier should be tuned at 12 volts with an input power of no more than 1 watt. Until the amplifier is completely tuned, RF should be applied to the input for no more than three to five seconds at any one time. Prior to mounting the amplifier in the enclosure you should rough-tune the amplifier. Be sure the transistor is mounted to the heat sink when tuning.

Tune the amplifier as follows:

1. Apply 12 volts, with the ammeter in series with the positive lead. There should be no current indicated on the meter. Set the power switch to OFF, then peak the relay compensating capacitor (C15), if installed, for maximum output in the bypass mode.

2. Turn the power switch ON and apply 1 watt (as noted). The relay should pull in. Tune all capacitors (C6, C7, C11, C12) for maximum output. Do not tune the relay compensating capacitor (C15) at this time.

3. Set the power supply voltage to 14 volts and increase the drive to the maximum 2 to 3 watts input at the transistor, 4 to 7 watts maximum at the input of the amplifier, provided the attenuator is in place.

4. Again, tune the capacitors for maximum output.

Pay attention to the current being drawn. You will notice a substantial increase in current when the series output capacitor (C12) is off resonance. Tune the amplifier for the best efficiency: that is, tune for the highest power output consistent with the minimum current being drawn. Nominal values are about 3.5 amperes at 28 watts output.

Results

To date, the 30 amplifiers we have built have been a great success! The primary goal of the Hackers Group—that of introducing new hams to the construction side of the hobby—was met. They were able to construct a useful piece of equipment at a nominal cost and they enjoyed doing it.

This was a group project and everyone who participated contributed to its success. I would personally like to acknowledge the support of four individuals: Don NJ1CT, who helped coordinate the project and who prodded me into designing the unit; Bob W1HWU, whose expertise in circuit board fabrication was crucial to the success of the project; Harry W2RKB, who helped with the circuit boards and tune-up; and, last but not least, John NI10, who provided the CAD drawings.
**NEW YORK CITY'S**

**LARGEST STOCKING HAM DEALER**

**COMPLETE REPAIR LAB ON PREMISES**

"Aqui Se Habla Espanol!"

**BARRY INTERNATIONAL**

**FAX: 212-925-7001**

**Phone: 212-925-7000**

**Monday - Friday 9 A.M. to 8:00 P.M.**

**Saturday 10:00 A.M. to 5:00 P.M.**

**ALL SALES FINAL**


**WE NOW STOCK COMMERCIAL COMMUNICATIONS SYSTEMS**

HAM DEALER INQUIRIES INVITED. PHONE IN YOUR ORDER & BE REIMBURSED COMMERCIAL RADIOS stock & serviced on premises.

Amateur Radio Courses Given On Our Premises, Call Export Orders Shipped Immediately.

**FOR THE BEST Buys in town call:**

**212-925-7000**

Los Precios Mas Bajos en Nueva York

**WE SHIP WORLDWIDE!**

Export Orders expedited.


**TELEPHONE AUTO PATCH**

Patches telephone calls from your radio to phone line. Great for making and receiving phone calls where there are no phone lines.

Simplex, semi-duplex, full duplex, CES & CSI Models stocked: SDI-50, PPV, CS700/600/900 etc Our service Lab will wire in systems for you if requested.

Save money on batteries. Ask for Special Prices.

Mail all orders to: BARRY ELECTRONICS CORP., 512 BROADWAY, NEW YORK, NY 10012 (4 BLOCKS NORTH OF CANAL ST., BETWEEN SPRING AND BROOME ST.)

**MAIL ALL ORDERS TO: BARRY ELECTRONICS CORP., 512 BROADWAY, NEW YORK, NY 10012**

**TELEPHONE SCRAMBLERS**

For cellular and regular phones. $29.95 each

**CAR Stereo with Scrambler**

Phillips DC-77 $429.95 in stock

**ANTENNAS**

Academy, Antenna Specialist, Barkers, Wiltzmann, Comet, Comtronics, Diamond G.D.P., Flex, Gain, Hustler, Larsen, etc.

**EIMAC**

3-500Z, 572B, 6J6C, 12BY7A, 6146B

**BIRD Wattmeters & Elements In Stock**

Not available for export

**COMMERCIAL RADIOS STOCKED:** IC-OM, Motorola, MAXON, Standard, Yaesu. We serve municipalities, businesses, Civil Defense, etc. Portables, mobiles, bases, repeaters.

**ALL SALES FINAL**

Technical help offered upon purchase

**FAX: 212-925-7001**

**CIRCLE 41 ON READER SERVICE CARD**
This article improves upon my original “Mobile Extender Using VOX Control” project, which first appeared in the December 1987 issue of 73 (pages 44-45). While the original project worked OK—it had a few drawbacks. For one thing, it utilized parts which are difficult to impossible to find today. This new and improved version solves that problem and goes a step further. It uses commonly available parts but also works quite a bit better. This version also eliminates the intermittent reception problem which cropped up in the original, thereby improving communications.

Why Build the Extender?

This project can be invaluable at parades, public events, and especially in search and rescue work. When the extender is operating, you can leave your vehicle and still be in contact with others on the repeater channel via the extender. This is important if you can’t access the local repeater via your handheld-talkie in your portable location. Using the extender allows you to use the higher power mobile radio in your vehicle to access the repeater. You will also have the advantage of a gain mobile antenna over a rubber ducky.

Circuit Description

In the original circuit, the speaker output of the receiver went to an audio transformer, with a diode in series on the secondary, which produced a DC voltage to drive the input of an LM3900 Norton op amp IC. This arrangement was satisfactory, but at times would become intermittent due to voltage changes on the input to the LM3900. The improved version, shown in Figure 1, is not as dependent on varying input voltages, thereby making the circuit more reliable. Voice modulation is no longer required to activate the circuit. Instead, it will activate upon hearing the receiver noise, when the squelch is opened.

Two identical circuits, using a single LM386 400 mW audio amplifier IC in each channel, instead of a single LM-3900 IC, are built to make the extender. The IRF511 power MOSFET is available from Radio Shack and other suppliers. If a relay output is desired, the IRF511 can be replaced by an NPN transistor. The IRF511 has very low on-state resistance, combined with high transconductance, and the capability of sinking 3 amperes.

When the gate of the MOSFET is driven high, the drain goes low, which will key the T/R relay in the transceiver. The only voltage on the drain is supplied by the relay of the radio. Parallel to the drain output of the MOSFET is an over-voltage protection circuit consisting of a zener diode (Z1, Z2), and a 0.01 μF disc capacitor (C7, C16) to prevent voltage spikes from destroying the MOSFET.

Diodes (D1, D2) rectify the output voltage of the LM386 IC from AC to DC, to operate the MOSFET keying transistor (or NPN/fre-
Transmit Audio Circuit

The transmit audio section is identical to the original article. The speaker output of one receiver goes through a 470k ohm resistor (R15, R17), to a 0.1 µF capacitor (C17, C18), then terminates at the microphone input of the other transmitter. The values of the resistor/capacitor network may vary, depending on your radio, but the device has been found to work with several different types. It is suggested that the network be placed directly at the I/O jacks (J1, J2), instead of on the PC board. See Figure 2.

Wiring It Up

Figure 3, the wiring diagram, shows how simple it is to hook it up to your radios.

XCVR “A” speaker output goes to CHNL “A” input; CHNL “A” output (MIC/PTT) goes to XCVR “B” microphone/PTT jack (reverse for the other channel). XCVR “A” should be on your 2 meter repeater channel, or can be on simplex. XCVR “B” can be on your 2 meter repeater channel, or can be on simplex. XCVR “B” can be on any simplex channel, preferably on either 220 or 440 MHz, to prevent desense.

Operation

To use the unit, plug in the appropriate cables to the transceivers. The input/output jacks (J1, J2) of the extender are wired the same, so all you need to make up are the cable connectors going to your transceivers. Refer to your radio’s manual for correct wiring and types of connectors required.

Select XCVR “A” to an active repeater channel; set the volume control on the receiver to about halfway on each radio for initial tests. Monitor on another receiver; set to XCVR “B” transmit frequency, and adjust the 25k pot (R1) to where the circuit keys XCVR “B.”

Now adjust the receiver volume to where the audio has good quality. Again, these values may need to be changed to fit your radio, but they should be correct for most units. Now you can do XCVR “B,” which is the same procedure. The 5-pin DIN jack wiring is shown in Figure 2.

Construction

The circuit can be constructed on a printed circuit board from FAR Circuits (see note at the end of the Parts List). Place the board, along with the associated switches, LEDs and jacks, in a metal box of your choice and mount it in a suitable location near
## ASTRON POWER SUPPLIES
- Heavy Duty • High Quality • Rugged • Reliable

### SPECIAL FEATURES
- Solid state electronically regulated
- Fold-back current limiting protects power supply from excessive current & continuous shorted output
- Crowbar over voltage protection on all Models except RS-3A, RS-4A, RS-5A, RS-4L, RS-5L
- Maintain regulation & low ripple at low line input voltage
- Heavy duty heat sink • Chassis mount fuse
- Three conductor power cord except for RS-3A
- One year warranty • Made in U.S.A.

### PERFORMANCE SPECIFICATIONS
- Input Voltage: 105-125 VAC
- Output Voltage: 13.8 VDC ± 0.05 volts (internally adjustable: 11.1-15 VDC)
- Ripple less than 5mV peak to peak (full load & low line)
- All units available in 220 VAC input voltage (except for SL-11A)

### VS-M AND VRM-M SERIES
- Built in speaker

### RS-7 SERIES
- Separate volt and Amp meters

### RS-5 SERIES
- Separate volt and Amp meters

### RS-1 SERIES
- Separate volt and Amp meters

### SL SERIES
- Low profile power supply

### RS-L SERIES
- Power supplies with built in cigarette lighter receptacle

### RM SERIES
- 19" rack mount power supplies

### RS-A SERIES
- Separate volt and Amp meters

### RS-M SERIES
- Separate volt and Amp meters

## TABLES

### LOW PROFILE POWER SUPPLY
<table>
<thead>
<tr>
<th>MODEL</th>
<th>Colors</th>
<th>Continuous Duty (Amps)</th>
<th>ICS*</th>
<th>Size (IN)</th>
<th>Shipping Wt. (lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SL-11A</td>
<td>Gray</td>
<td>7</td>
<td>11</td>
<td>2% x 7% x 9%</td>
<td>12</td>
</tr>
<tr>
<td>SL-11R</td>
<td>Black</td>
<td>7</td>
<td>11</td>
<td>2% x 7% x 9%</td>
<td>12</td>
</tr>
<tr>
<td>SL-11S</td>
<td>Gray</td>
<td>7</td>
<td>11</td>
<td>2% x 7% x 9%</td>
<td>12</td>
</tr>
<tr>
<td>SL-11R-RA</td>
<td>Gray</td>
<td>7</td>
<td>11</td>
<td>4% x 7% x 9%</td>
<td>13</td>
</tr>
</tbody>
</table>

### POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE
<table>
<thead>
<tr>
<th>MODEL</th>
<th>Continuous Duty (Amps)</th>
<th>ICS*</th>
<th>Size (IN)</th>
<th>Shipping Wt. (lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS-4L</td>
<td>3</td>
<td>4</td>
<td>3% x 6% x 7%</td>
<td>6</td>
</tr>
<tr>
<td>RS-5L</td>
<td>4</td>
<td>5</td>
<td>3% x 6% x 7%</td>
<td>7</td>
</tr>
</tbody>
</table>

### 19" RACK MOUNT POWER SUPPLIES
<table>
<thead>
<tr>
<th>MODEL</th>
<th>Continuous Duty (Amps)</th>
<th>ICS*</th>
<th>Size (IN)</th>
<th>Shipping Wt. (lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM-12A</td>
<td>9</td>
<td>12</td>
<td>5% x 19% x 8%</td>
<td>16</td>
</tr>
<tr>
<td>RM-35A</td>
<td>25</td>
<td>35</td>
<td>5% x 19% x 12%</td>
<td>38</td>
</tr>
<tr>
<td>RM-50A</td>
<td>37</td>
<td>50</td>
<td>5% x 19% x 12%</td>
<td>50</td>
</tr>
<tr>
<td>RM-80A</td>
<td>50</td>
<td>55</td>
<td>7% x 19% x 12%</td>
<td>60</td>
</tr>
<tr>
<td>RM-12M</td>
<td>9</td>
<td>12</td>
<td>5% x 19% x 8%</td>
<td>16</td>
</tr>
<tr>
<td>RM-35M</td>
<td>25</td>
<td>35</td>
<td>5% x 19% x 12%</td>
<td>38</td>
</tr>
<tr>
<td>RM-50M</td>
<td>37</td>
<td>50</td>
<td>5% x 19% x 12%</td>
<td>50</td>
</tr>
<tr>
<td>RM-80M</td>
<td>50</td>
<td>55</td>
<td>7% x 19% x 12%</td>
<td>60</td>
</tr>
</tbody>
</table>

### SWITCHABLE VOLT AND AMP METER
<table>
<thead>
<tr>
<th>MODEL</th>
<th>Continuous Duty (Amps)</th>
<th>ICS*</th>
<th>Size (IN)</th>
<th>Shipping Wt. (lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS-12M</td>
<td>9</td>
<td>12</td>
<td>4% x 8% x 9</td>
<td>13</td>
</tr>
</tbody>
</table>

### SPEAKER POWER SUPPLIES
- VS-M-35M
- VRM-M-35M

---

CS—Intermittent Communication Service (50% Duty Cycle 5min. on 5min. off)

---

CIRCLE 16 ON READER SERVICE CARD
The transceivers. The fuse F1 and the switch S1 are mounted off the PC board on the enclosure box. The cost of this project is less than $50 if all the parts are purchased new; less, of course, if you have a good junk box. Pinouts for various radios can be found in Figure 5 in this article.

Reminders
Remember to wait for the repeater squelch-tail to drop before transmitting through the extender. Be advised: You have just created a remote base, which you must ID as such, per FCC rules.

![Figure 5. 5-pin DIN plug output to various radios.](image)
As a member of the Electronics Book Club . . .

...you'll enjoy receiving Club bulletins every 3-4 weeks containing exciting offers on the latest books in the field at savings of up to 50% off regular publishers' prices. If you want the Main Selection do nothing and it will be shipped automatically. If you want another book, or no book at all, simply return the reply form to us by the date specified. You'll always have at least 10 days to decide. And you'll be eligible for FREE BOOKS through our Bonus Book Program. Your only obligation is to purchase 3 more books during the next 12 months, after which you may cancel your membership at any time.

Publishers' prices shown. All books are softcover unless otherwise noted. If you select a book that counts as 2 choices, write the book number in one box and XX in the next. A shipping/handling charge & sales tax will be added to all orders. © 1993 EBC

Your most complete and comprehensive source for the finest electronics books.

---

Select any 5 books for only $4.95 (Values up to $144.75)

when you join the Electronics Book Club®

YES! Please send me the books listed below, billing me for just $4.95 plus shipping/handling & tax. Enroll me as a member of the Electronics Book Club according to the terms outlined in this ad. If not satisfied, I may return the books within 10 days without obligation and have my membership cancelled.

If coupon is missing, write to: Electronics Book Club, Blue Ridge Summit, PA 17294-0810

Electronics Book Club®
Blue Ridge Summit, PA 17294-0810

Name ______________________
Address ______________________
City/State ______________________
Zip: ______________________ Phone ______________________

Valid for new members only, subject to acceptance by EBC. Canada must remit in U.S. funds drawn on U.S. banks. Applicants outside the U.S. and Canada will receive special ordering instructions. All books are softcover unless otherwise noted. Publishers' prices shown. A shipping/handling charge & sales tax will be added to all orders. © 1993 EBC

STAR1193
The Solar Control-ar
A solar panel charge controller for all seasons.

by Joel R. Donaldson WB5PPV

My home is on wheels. My ham shack is on wheels. I live in an old motor home, often staying for months in remote areas that lack any AC power. I’m no rugged old geezer when it comes to creature comforts, however. My idea of roughing it is having to warm something up on the gas stove, instead of cauterizing it in the microwave. Given this affinity for modern gadgets (and my inability to convert my Yaesu to operate on propane gas), I’ve been forced to come up with alternate ways of obtaining electricity for my comfort and pleasure. My RV came equipped with a big, stupid Onan generator. It uses a little less than a gallon of fuel for every hour of operation, regardless of whether or not it’s powering anything. It’s cranky to start on cold mornings. It interferes with my TV and HF reception. During weekly skeds on 20 meters, I find myself shouting into the microphone to make myself heard over it. It hunts, surges, and revs for no apparent reason. It sets off my smoke alarms, even when it isn’t actually on fire. In short, it stinks. Literally.

After several months of power generation aggravation, I bought a combination inverter/battery charger so I wouldn’t have to run the generator all the time. It’s coolness incar-

![Series control scheme.](image1)

![Shunt control scheme.](image2)

nate! It’s 85 to 90 percent efficient, and completely silent. You have 120 volts AC whenever you want, with the flick of a switch. Yep, I’ll only have to run the generator for several hours a day now, just long enough to recharge the RV batteries, right? Well, not exactly. As it turns out, you can only rapid-charge a lead-acid battery up to about 75 percent of its total capacity. After that, the last 25 percent takes a long time, regardless of how big your battery charger is. Try to save some time by really cranking up the charge current and all you get is a boiling battery with melted plates. Great. Now I can run the generator for two hours to build up the bulk of the battery charge, and then run it for another four or five hours just to top it off. Or I can shut it down after several hours and live with undercharged batteries, right?

Well, not exactly. As it turns out, an excellent method for prematurely ruining a lead-acid battery is to consistently undercharge it. In the process of discharging, the lead plates in a battery are converted to lead sulfate. If the battery is promptly and fully recharged, this sulphation is almost completely driven back into solution, leaving the plates essentially unchanged. However, if the battery is not completely recharged, the sulphation hardens into a form that is eventually not removable with any amount of recharge. When this happens, there is less plate area available in which chemical reactions can occur, and the battery permanently loses capacity. The process continues until the battery can’t hold any charge at all, and . . . it’s toss time!

So much for quick charges with the generator. I really need a scheme that provides a gentle, continuous low-current battery charge over long periods of time, say maybe five to eight hours, something that is quiet, doesn’t stink or guzzle gasoline, is easy to maintain, and doesn’t need to be attended while it’s doing its thing.

Well, you know what the answer had to be. Shortly after I mounted four 53 watt Siemens solar panels on the roof of the RV, I began to search for a good charge controller. I looked at both the store-bought and the roll-your-own types. Most charge controllers don’t exactly teeter on the leading edge of technology, but the way some of them work is still kind of neat. Unfortunately, all of them I looked at suffered from at least one of the following maladies:

- 1. They were expensive.
- 2. They were either incapable of controlling a large number of solar panels (typically being limited to a maximum of 8 to 15 amps), or they wouldn’t work with anything less than a large number of panels.
- 3. They were inefficient, with a significant percentage of the panel array’s total power output being wasted as heat within the charge controller.
- 4. They lacked truly useful metering capabilities.
- 5. They lacked sufficient adjustability, or the adjustments wouldn’t stay put.
- 6. They couldn’t be manually bypassed in case of failure or for routine battery equalization.
- 7. They had little (if any) immunity to strong RF fields.

With these problems in mind, I set out to design my own controller. In addition to avoiding everyone else’s pitfalls, I had to make the final design simple and use readily available parts. Because several hundred to several thousand amp-hours of storage batteries represent a considerable investment, the design also had to be reliable. No one wants to leave their house, RV or repeater site unattended for an extended period, only to later discover that the controller has failed in the “on” position, indefinitely subjecting their batteries, inverter, radios and other appliances to the full 18 to 20 volts produced by their solar panels. Or, just as bad, failed in the “off” position, with the batteries totally Tango Uniform.
ATTENTION
PUBLIC SAFETY ANNOUNCEMENT

Tampering with Motorola’s Communication Technology is Nothing Short of a Crime.

Motorola has been at the forefront of communications technology for more than 60 years. Today, we offer a greater array of communications products than ever before. We are proud of our products and the vital services they bring to our customers which are of unparalleled public importance.

Theft of communications services and so-called High-Tech piracy threaten the entire communication industry’s reputation for reliability. This conduct not only damages the reputation of Motorola, Inc. and the communications industry, but undermines the very integrity of America’s public and private communications services.

Motorola intends to combat this conduct by aggressively maintaining and enforcing its proprietary rights to its hardware and software technology. Anyone who has knowledge of illegal activities or has questions concerning such activities is urged to contact Motorola Inc. immediately at 1-800-325-4036. Contacts will be kept confidential and may be made anonymously.
Solar Panels

- Vref
- Switching Element (transistor or relay)
- Storage Battery Bank

Series Control Scheme

In my survey of what's already out there, I found that one of three different techniques may be used in the typical charge controller to limit the solar panel's output upon completion of battery charge. Each technique has its own advantages and disadvantages.

See Figure 1. The series-regulated approach uses a switch in series (surprise!) with the solar panel output to disconnect the solar panels from the batteries as soon as the desired level of charge is reached. The biggest advantage of this scheme is probably its simplicity. As with the other approaches, the actual switch may be a relay contact, or one or more power transistors. The relay-types cycle on and off at long intervals (from several minutes to several hours, typically), while designs that use power transistors may cycle at rates up to several tens of kHz, à la Pulse Width Modulation.

Shunt Control Scheme

The shunt-regulated approach shorts out the solar panels as soon as the batteries are charged. Solar panels, being essentially constant-current sources, are in no manner harmed by being shorted indefinitely. The output voltage just drops to almost nothing as the current increases only very slightly above its normal value. With a really low-impedance shunt switch, the shorted-out power dissipation can be held to very low levels. Note that a blocking diode or secondary switch is used in conjunction with the shunt switch in order to avoid also shorting out the connected batteries (definitely something to avoid!). Although the additional diode or switch complicates this approach somewhat, it still has the advantage of being a relatively simple scheme to implement.

Diversion Control Scheme

Unlike the previous techniques, the diversion-regulated approach doesn't attempt to prevent energy from reaching the battery as it reaches full charge, but instead siphons off excess energy so as to maintain the desired battery voltage. As the batteries top off, the controller automatically switches a load bank across them, so as to keep the voltage from:

---

AT LAST!

NEW REV. 3.0 SOFTWARE UPGRADE for the NIR-10 IS HERE!!!

The NEW Rev. 3.0 PROM sets are now available from JPS Communications. This update adds a new PEAK function to the unit to provide an additional method of noise removal to the NIR mode. PEAK may be used by itself or along with the NIR mode to effectively reduce or eliminate white/pink noise and other similar types. This markedly improves the NIR-10 white noise reduction without the annoying audio "surging" present in other peaking-type noise reducers. PEAK works by dynamically peaking all coherent signals in the audio passband, reducing the effective bandwidth to the minimum required to pass the information. NOTCH performance has also been enhanced.

The upgrade consists of two plug-in PROMS to replace those presently in your unit. Price of the upgrade is $25.00. If you are a NIR-10 owner and did not receive a card from JPS telling you of the upgrade, please send us your name, call sign (if applicable), address, telephone number, and NIR-10 Serial Number, along with VISA, Mastercard, check or money order if you wish to receive the upgrade.

All units now at dealers and from the factory are Rev. 3.0!

- NIR-10: $349.95
- NRF-7: $249.95
- NF-60: $149.95

120VAC/12VDC Power Pack: only $16.00

TOLL FREE ORDER LINE 800-533-3819

JPS Communications, Inc.  P.O. Box 97757, Raleigh, NC 27624
TECH LINE (919) 790-1048  FAX: (919) 790-1456

CIRCLE 285 ON READER SERVICE CARD

---

Figure 3. Diversion control scheme.
will control them all, as long as the combined current output from all sources does not exceed that of the regulator or the load bank attached to it. The biggest disadvantage of this scheme is probably the load bank requirement, which forces you to figure out what you are going to do with any surplus power produced by the system.

One nice thing about all three of these techniques is that once the batteries have reached a state of complete charge, the excess solar energy does not necessarily have to be discarded but can be instead used to power other lower-priority loads. In the case of the series and shunt regulation schemes, all you have to do is substitute a power diversion switch for the existing disconnecting or shorting switch. For diversion regulation systems you just connect your alternate load in place of the controller’s load bank. Any electrical load will suffice, so long as it is tolerant of frequent disconnects from power. In the case of diversion regulation, the load must also be ever-present, and must be large enough to be capable of swapping the output of the solar panels on even the sunniest of days. Good potential candidates for load banks would include water pumps (you can always stand a little more water in the stock tank as soon as the batteries finish charging), cooling fans (keep the wife and the chicken coop cool) and, in larger solar installations, hot water pre-heating or electrical generation of hydrogen gas (for later use as a fuel).

Note that all three of these regulation techniques are typically implemented with saturated on-off switching. Theoretically, you could incrementally adjust the amount of voltage or current being produced by your panels as the battery charge increased, using pass transistors biased in a linear mode. The biggest practical disadvantage to this technique probably lies in the tremendous amount of heat that would be generated by the pass transistors at any point between saturation and full cut-off. All that heat would have to be dissipated somewhere, and at the very least would result in increased size and cost, due to a rather herky heat sink! So, linear regulation is probably not as well suited to the constant-current nature of solar cells as it is to power sources with essentially unlimited supply currents (like batteries and AC mains). The sole

`Table 1. Meter shunt details (see text).`

climbing any higher. As the load bank starts to overwhelm the output from the solar panels, the battery voltage begins to drop, eventually reaching a point at which the load bank is automatically disconnected. This connection-disconnection process continues as long as the solar panels are producing a surplus of power, thereby preventing overcharge. A big advantage of these controllers is that they don’t care what sort of power source is actually doing the battery charging; all they are concerned with is keeping the battery voltage from exceeding a set value. This makes them useful in situations where solar battery charging is supplemented by other charging sources (like wind chargers or water turbines). No matter how many different charging sources you add to a battery bank, just one diversion regulator..."
exception might be in controllers for very small solar arrays, where heat dissipation could be more easily managed.

Anyway, this survey provided a good starting point for my own design. For the switching element, I considered using relays, power BJTs, and power FETs. A power relay looked good from a cost standpoint (you can buy a fog lamp relay at Walmart for less than $4, and you don't need a heat sink), but the reliability of the contacts would always be suspect. High power FETs are easier to use than BJTs, and are very reasonably priced, so they looked like the best choice. As for the actual circuit configuration, I considered several factors important.

First, the use of a transistor in a series switch arrangement would mean that some power would be wasted in the voltage drop across the transistor when the battery was being charged. This would reduce the efficiency of the charge controller somewhat. Likewise, the use of a shunt switch arrangement would mean that some power would be wasted in the voltage drop across the blocking diode.

Second, the power being dissipated across these components (in either configuration) is significant for rather long periods of time (whenever the sun is shining and the batteries are not fully charged), which could shorten their life expectancy. A diversion regulation scheme avoids these two problems because no switching or blocking device is employed between the solar panels and the batteries, and the diversion load switching device is only operated for brief periods after the battery has reached full charge. This implies good efficiency and reliability. Since no blocking diode or series switch is used, there will be some loss of efficiency with this arrangement, due to nighttime solar panel reverse leakage current (typically 15 mA per 50 watt panel), but this is more than offset by the higher daytime efficiency. So there you have it—an FET-switched diversion regulator it is!

From that point on, the design was pretty straightforward. In referring to the schematic, you'll see that U2 compares the battery voltage with a reference developed by U1, and turns on Q1 as soon as the battery voltage exceeds the level set with R12. Q1 in turn grounds the alternate load (R2), which swamps the output current being produced by the solar panels. Note that since the LM317LZ can't regulate a voltage that approaches its input value (e.g., the battery voltage), it is instead set to a lower reference voltage (approximately 6.5 volts). The R9/R11/R12 pair scale the battery voltage down to a value roughly comparable to this reference. Since the 741 is incapable of output voltage swings completely to ground, CR1, CR2 and CR3 are used to prevent the volt or so of output normally present at U2 from keeping Q1 turned on. In order to easily fine-tune the charge cutoff voltage and to improve the controller's resistance to mechanical vibration, a multi-turn trimmer is used for R12 (10 to 15 turns works nicely). The voltage difference between termination and resumption of battery charging (e.g., the charger's hysteresis) is adjustable via pot R13.

In addition to driving Q1, U1 also directly drives the "BATTERY CHARGED" indicator LED. Note that unlike some other charge controller designs, this LED is not lit until after the battery reaches full charge.

A single International Rectifier 50 amp
power FET is specified in the Parts List; it is available from Digi-Key (701 Brooks Ave., South, P.O. Box 677, Thief River Falls MN 56701-0677; telephone 1-800-DIGI-KEY for a free catalog) for around four dollars. Other smaller FETs can be substituted for lower power handling requirements, or several FETs can be paralleled in extremely large installations. I like using a well-over-sized FET, for reliability reasons.

The metering circuit I chose measures the amount of current produced by the solar panels, and also determines battery voltage. The vast majority of the charging current is borne by R1, while a small portion of it is diverted through the meter. Since the meter uses a 1 mA movement, the voltage drop across R1 never exceeds 50 mV, thereby minimizing power losses and heat dissipation. Physically, R2 consists of a small coil of 14-gauge household wire, the exact length of which is determined by the desired full-scale reading of the meter. I set mine up for a full-scale current of 14 amps, but Table 1 lists the appropriate lengths for some other full-scale values. I chose 14-gauge because it is readily available in most hardware stores. Solid is preferred over stranded.

To read battery voltage, R4, R5, R6, CR5 and CR6 are used in a voltage-scaling circuit that allows the meter to read from approximately 10 volts no-scale to 16.5 volts full-scale. The expanded voltage scale is important because there is typically less than 1 volt of difference between the output of a fully-charged and a fully-discharged lead-acid battery. Any small variations within that 1 volt range would be difficult to read on an analog meter, unless the meter scale was expanded to remove the useless 0 to 10 volt range of readings. (Whether your battery reads 10 volts or something less than 10 volts is immaterial; in either case you have a dead battery on your hands!) On the top end of the scale, the normal charge-cutoff voltage for a lead-acid battery can range as high as 14.8 volts, with equalization being safely performed at up to 16.5 volts (see the sidebar on battery charging). This value sets the desired upper range of measurement. For temperature stability, current is always applied to CR6. This represents a small continuous battery load (less than 20 mA under most conditions), but buys some improvement in meter accuracy.

For ease of construction, a printed circuit board layout has been provided. Almost all of the components carrying low currents mount on it, while the components requiring heavy-gauge wire mount in what ever type of enclosure you desire. I mounted mine in a wall paneling cutout, using the aluminum cover from a bakelite experimenter's box as the front panel. These covers are available without the rest of the box from Digi-Key for under $2. Make sure that the PC board is mounted so that R12 and R13 can be easily adjusted with everything buttoned together.

If a "live" diversion load will not be used

![Small Talk - Micro 1.1 & 2.1 Voice Recorder Identifiers](image-url)

Yupiteru MVT7100 Scanning Receiver
530kHz to 1650MHz with AM/FM/WFM/LSB/USB @ 50Hz

Performance rivaling that of receivers that cost twice as much. Extremely compact and versatile. Features 1000 memory channels, lockout on search and scan, backlighted LCD display, Attenuator, Delay, Hold, Bank lockout, VFO tuning, 1 Year Warranty, & Earphone jack. Size: 6 3/8H x 1 7/8W x 2 1/3D. Wt 14oz. Ground shipping: $5.95 Air Freight: $8.95. Call or Fax Toll Free, 24 hours a day.

SAM AMATEUR RADIO CALLSIGN DATABASE 1994
Look up by CALL, NAME, City, State and Zip Code
Edit or Add Entries, Print Lists or Labels. Comment field for personal notes

Direct interface to many popular logging and BBS programs
Requires MS-DOS, 17MB actual free hard disk, and High Density floppy for install.

SAM 1994 coming in December.
'94 VERSION ONLY $39.95
Semi-Annual Subscription $55.00 Quarterly Subscription $80.00

RT SYSTEMS, INC. POB 8, LACEYS SPRING, AL 35754
1-800-723-6922

Ace Communications
Call 1-800-445-7717
10707 E. 106th Street Fishers, IN 46038
317-842-7115 Fax 1-800-448-1084
in your installation, R2 can consist of 12 volt light bulbs (headlamps for high current applications; #1141 bulbs for smaller installations), or power resistors. I recommend that the load be spread among several individual resistors or bulbs so that if one burns out, the controller will still function (although at some reduction in overcharge protection). Also, if bulbs are used, be sure to pick a bulb with long life (e.g., 1,000 hours for the #1141, versus only 200 hours for the similar-appearing #1156 bulb). Using 24 volt bulbs in a 12 volt system will also greatly extend reliability, although more bulbs will be required. High-power load resistors can be easily built from scratch with nichrome heating wire (available at most hardware stores), and mounted in ventilated metal boxes, tin cans, etc. To calibrate the meter for battery voltage, set R5 and R13 at the middle of their ranges, and switch S2 to the voltage scale. Disconnect any alternate load. Apply +10 VDC to the battery terminals and allow CR6 to warm up for a few minutes before proceeding. Adjust R5 to just below the point at which some meter deflection starts to occur. Gradually increase the voltage at the battery terminals, noting and recording the resulting meter readings. (These readings can be used later in relabeling the meter face, if desired). As you increase the voltage, verify that the meter pegs out at a little over 16.5 volts of input. Next, set the input voltage to the desired battery charge cut-off value, and adjust R12 until the BATTERY CHARGED indicator lights up. There are no adjustments for calibrating the current scale; the current readings can be read off an ammeter connected in series with the positive battery wire, once the controller is installed and hooked up to the panels and batteries. Again, the current readings can be recorded for later use in relabeling the meter face.

During installation, I recommend providing fusing between the charge controller and the batteries, located as close to the batteries as possible. In some larger solar installations, you might want to consider remote-mounting the meter and PC board, if it will save you any appreciable length of heavy-gauge (bulky and expensive) wire. If going that route, simply mount the PC board, S1, S2, F1, and the meter in a box located for viewing convenience, and mount everything else somewhere directly between the solar panels and the batteries. Small-gauge wiring (e.g., telephone cable) can then be used to connect the two boxes.

After the controller has been installed, readjust R12 for proper charge cut-off voltage. The difference between charge cut-off and turn-on voltage is set with R13, and will vary with battery size and loading. Normally, R13 should be adjusted so that CR4 does not cycle more than several times a second under light battery loads, but should never fail to resume charging when battery voltage drops below approximately 13 volts. There is some interaction between the settings for R12 and R13, so several readjustments may be necessary to get the desired charge cut-off and re-sump voltages.

The controller is heavily bypassed for RF interference rejection. For best RF rejection, it is suggested that separate wiring be used to connect the radio(s) to the batteries. A metal enclosure for the controller also helps and, finally, a 100 µF RF choke can be added in series with the fuseholder in particularly stubborn situations.

If you have access to a computer, laser printer, and drawing or drafting software, you can relabel the meter face in a very professional manner. First, recreate the physical dimensions and markings of the old meter face with your drawing program. Next, substitute your recorded voltage and current readings for those of the existing meter face, in the corresponding positions on the meter scale. Finally, use your laser printer to print the new meter face on large adhesive-backed label paper (Avery 5165 or equivalent), and stick the new face over the old one. Very spiffed!

In conclusion, I think you'll find that this controller is the best battery banger for your buck. It's efficient, reliable, and has all the useful tweaks. Whether you're building a mansion in the middle of nowhere, sticking a TNC on top of the local mole hill, or just need a little something to keep your Argonaut's trolling motor battery from boiling dry, this little baby will do the job.
The Solar Control-ar

A Few Words About Batteries

While most other components in an alternate energy system are virtually indestructible and maintenance-free (with the possible exception of wind chargers and water turbines), the selection and maintenance of electric storage batteries can make or break the entire installation. Make your battery selection carefully and maintain it properly and it will serve you well for years. Make the wrong choice or neglect your investment and you will soon have another opportunity to make a wiser battery purchase!

Storage batteries used in most solar power applications are either lead-acid or NiCd. Lead-acid batteries can be cheaply purchased new almost anywhere, while NiCd cells are generally available only as surplus. The big advantages lead-acid cells have over NiCds are that they are more efficient to recharge (only 15 to 20 percent of the charging energy is lost, as compared to 25 to 35 percent for NiCds), they offer better voltage regulation under load, and they are usually cheaper than surplus NiCds. On the other hand, NiCds are much more tolerant of extreme discharges, and are not as prone to permanent damage due to repeated undercharge or long-term storage in a discharged state. Since the vast majority of solar installations use lead-acid batteries, most of the following information will center around them.

Some Battery Basics

The lead-acid battery types that are most common in solar applications are all of deep-cycle design. This is significant, because a deep-cycle design stands up to repeated heavy discharge-recharge usage much better than a battery of ordinary automotive design does. An automotive battery is designed to deliver very large bursts of current for short periods (when starting a car), and then is immediately recharged (by the car's alternator). Most solar power applications require the battery to provide lesser amounts of current, but provide it for extended lengths of time before receiving any recharge. An automotive battery will lose a significant percentage of its full storage capacity after being heavily discharged just one time. It will typically lose 50 percent of its capacity after 20 such discharge-recharge cycles. (For our purposes, a heavy discharge is one that removes all but 20 percent of the battery's original full charge). By contrast, even the lightest duty deep-cycle battery will typically tolerate 200 to 300 such discharge-recharge cycles before reaching a similar state; some of the heavier deep-cycle designs can exceed 10,000 such cycles. It is a common mistake to purchase the "biggest batteries you can get" for a new solar installation, usually meaning size 4D or 8D truck/tractor batteries (which are conventional automotive designs). Regardless of how "heavy duty" a battery is claimed to be, if it isn't a deep-cycle design, it won't last very long in most solar applications.

The maximum storage capacity of a deep-cycle lead-acid battery is usually specified either in amp-hours or in minutes of reserve capacity. The amp-hour value refers to the number of amps a battery will deliver over a specified period of time (generally implied to be 20 hours, if not specifically stated), before the battery has discharged to a useless level (around 10.5 volts). The reserve capacity value specifies the number of continuous minutes the battery can last while delivering 25 amps, before dropping to this same 10.5 volts. As a rule of thumb, for the smaller batteries, you can multiply the number of reserve minutes directly by 0.6 to arrive at an approximate equivalent amp-hour rating for the battery. Therefore, a 30 amp-hour battery (or a battery with approximately 83 minutes of reserve capacity) can be expected to deliver at least 2.5 amps for 20 continuous hours, or at least 1 amp for 50 continuous hours. Note, however, that at current drains much higher than those specified at the 20 hour rate the capacity of the battery starts to decline due to internal losses and chemical inefficiencies at high currents. Consequently, this same battery might only be able to deliver 5 amps for nine hours (45 effective amp-hours), instead of the 10 hours (50 theoretical amp-hours) implied by the battery's amp-hour rating. Bigger batteries can deliver higher currents without incurring this effect.

Like all lead-acid batteries, the life expectancy of a deep-cycle battery is directly dependent upon how heavily the battery is discharged before being recharged. Batteries that are routinely discharged to only 20 percent of their rated capacity have a much shorter life expectancy than identical batteries that are rarely discharged below 50 percent. This same trend applies at the extremes—few batteries that are completely discharged will last for more than a few such cycles, and most batteries that are never discharged below 80 to 90 percent of their capacity will last almost indefinitely (given proper maintenance). The moral: Don't buy a 100 amp-hour battery if you are planning on routinely using all 100 amp-hours between recharges. A good rule of thumb states that a deep-cycle battery should be recharged before 80 percent of the capacity has been drained, with 50 percent being even better. Fifty percent discharge represents a good compromise between battery life expectancy and reasonable battery bank size. Therefore, you would do well to buy at least 200 amp-hours worth of batteries to meet your anticipated 100 amp-hour discharge "budget."

Ambient temperature also has a strong effect on battery performance. Most batteries are rated at around 80 degrees Fahrenheit. At higher temperatures they are capable of greater capacity, but their life span is shortened, due to the acceleration of detrimental chemical reactions. At lower temperatures, they last longer than normal (provided the electrolyte is not allowed to freeze), but their capacity drops. At 32 degrees F, typical capacity is reduced by 35 percent; at 0 degrees F, it is reduced by 60 percent; and at minus 20 degrees F, it is reduced by 80 percent. As a result, batteries that are not temperature regulated should be limited to around 75 to 80 percent of their amp-hour capacity at minus 10 degrees F.
it is reduced by better than 80 percent. Their ability to accept a charge also drops along with the thermometer. In general, the best tradeoff between efficiency and long life occurs when the battery is maintained at around room temperature.

As a battery is discharged, the sulfuric acid solution inside each cell is gradually converted to ordinary water. Consequently, the specific gravity of this solution also drops as the battery discharges; this change can be easily measured with a hydrometer in order to determine the battery’s state of charge. A good battery hydrometer includes a temperature correction scale (specific gravity versus battery charge varies somewhat with temperature), and will often provide readings that are more precise than those obtained with a voltmeter. Specific gravity readings should be taken by inserting the hydrometer suction pipe into the battery cell, squiring the electrolyte into and out of the hydrometer several times (electrolyte agitation improves accuracy), and then reading the hydrometer while the suction tube is still inserted into the cell. Keeping the suction tube in the cell while taking readings minimizes the chance of spilling the electrolyte on feet, knees, or any other exposed appendages. Read the hydrometer scale at the center of the fluid inside the tube, not at the edges. Note that any heavy battery charge or discharge currents drawn just prior to taking specific gravity or voltage measurements will have an adverse effect on the accuracy of the readings. Specific gravity readings are also helpful in determining the overall health of a battery. For example, differences in specific gravity of more than 0.050 between any two individual cells in a battery generally indicate that the battery is headed for problems. By taking specific gravity readings every month or so you can catch battery problems before they cripple the entire system.

Table 2 is helpful in determining the state of charge of a battery, using either a voltmeter or hydrometer. Note that this table is applicable only to the non-sealed wet-electrolyte batteries. For obvious reasons, a hydrometer should never be used on a sealed battery (wet or gel).

What To Buy

Among the deep-cycle variants, the most common type is the RV/Marine, typically sold by hardware and department stores in automotive package (or "group") sizes 24 and 27. Typical ratings for this class of battery are 70 amp-hours (110 minutes) for the size 24, and 105 amp-hours (170 minutes) for the size 27. These batteries represent a reasonable value in smaller solar systems, or in installations below a power premium. However, as deep-cycle designs go, they are lightweight, with relatively short life expectancy in heavy service. This deficiency is primarily due to the use of thin lead plates used in their construction, and the low antimony content of the plates themselves. The next most common deep-cycle version is probably the golf cart/electric vehicle, typically sold through battery supply houses, some wholesale clubs, and an occasional department store (frequently by catalog only). These batteries are all of 6 volt design (you use two in series to get 12 volt banks), and typically cost a tad more per pound than a single size 27 RV/Marine battery. They provide superior service in most solar applications (due to thicker plates and higher antimony content), and probably represent the best value for small to mid-sized installations. Typical ratings are 220 amp-hours, or 400 minutes of reserve capacity.

Industrial (floor scrubber) batteries are probably best described as golf cart batteries on steroids. They are 6 volt, with much taller cases than golf cart batteries. They are typically rated at around 350 amp-hours, and they also make excellent choices for small-to-mid-sized solar applications. They are available from the larger battery supply houses, or may be special-ordered (along with ordinary golf cart batteries) from auto parts stores like NAPA. High-quality deep-cycle batteries for marine applications are manufactured by Surrette and by Rolls, in a variety of sizes. They are of very heavy construction, with very thick, high antimony content plates. Many marine supply houses stock them, and they work very well in solar applications.

For non-mobile installations, really large deep-cycle batteries are often employed. For example, 12 volt electric fork lift batteries are available with typical ratings of 1,000 amp-hours. Life expectancy is around 10 years, and the cost brand-new is under $2,000. Surplus telephone cells are also popular, with ratings of 1,200 to 2,500 amp-hours being commonplace. These cells are sold individually (each cell is 2 volts and weighs between 300 and 500 pounds). Life expectancy is greater than 20 years for new ones.

A good used set will have at least 10 years of life left in it, and is available for around $400 to $800 per 12 volt group. Gel-electrolyte (gel-cell) batteries are becoming cheaper and more popular for solar applications. Available in group 24, 27, 4D, 8D and 6 volt golf cart sizes, they offer very good performance, with virtually zero maintenance. Where ordinary "wet cell" batteries require monthly checks of electrolyte levels, the gel cells are completely sealed, with nothing to replenish. They also offer higher charging efficiency and lower ohmic drop, and provide slightly higher output voltage down to complete discharge. Examples of this class of battery are the Johnson Dynasty, Exide Nautilus Megacycle, and Dryfit Prevailer/Sonnenschein/DeKa brands. Don’t confuse these batteries with the "maintenance-free" wet-electrolyte RV/Marine batteries being sold in some department stores under brand names such as Delco Voyager and GNB Stowaway. Unlike the true gel-cells, these batteries offer little improvement in performance over the standard RV/Marine models.

How To Keep Them Happy

Although routinely overlooked in the battery manufacturers’ literature and in many references, most deep-cycle batteries (with the exception of the gel cell and other totally-sealed varieties) are benefited by a periodic, controlled overcharge, often referred to as an equalization charge. To equalize a battery, the charging is allowed to continue for some time past the point at which the battery is normally considered to be “full,” taking care to avoid excessive battery heating or electrolyte boil-off. In a typical equalization cycle, the battery voltage is allowed to rise to approximately 16 volts, where it is maintained for up to eight hours by adjustment of the charging current. This process helps to mix up the electrolyte, which otherwise tends to “stratify" (e.g., separate into overlapping layers of acid and water). It is also useful in removing some sulfate deposits. When performed properly, equalization doesn’t make the battery boil over, but does produce fairly vigorous bubbling. At the termination of this cycle you can expect to add some water. Most battery manufacturers consider one equalization charge a month to be appropriate for batteries that are in a continuous state of charge and discharge; less often is adequate for batteries that see a lot of standby service. Due to the generation of considerable gas that accompanies this process, equalization should never be performed on a sealed or gell-electrolyte battery. (Because their electrolyte is gelled, stratification is generally not a problem with gell-cells, anyway). Also, most 12 volt appliances will not tolerate 16-plus volts, so remember to disconnect everything before you equalize. Table 3 summarizes the suggested charge and equalization voltages for various batteries.

Finally, remember that lead-acid batteries generate highly explosive gases. The larger the battery bank, the more gas produced. Don’t mount any battery in an unvented location, and avoid any sparks or open flame around the battery (particularly during and shortly after recharging). Making or breaking electrical connections at the battery terminals is particularly dangerous. Battery explosions often shower large areas with hot lead, acid, fine and tin protection, and give the bank plenty of time to "air out" before attempting any maintenance or inspection.

73 Amateur Radio Today • November, 1993 35
The Solar Control-ar

If you are buying new solar panels, you will probably find that models in the 47 to 65 watt range represent the best value (e.g., most watts per dollar), if that size range will serve your needs without overkill. This range is where the sales volume currently lies for large-scale power production (e.g., for homes and small businesses). Excellent quality is the rule throughout the industry, with limited warranties typically ranging from 10 to 12 years. Actual expected life is anyone's guess, but figures of 20 to 30 years are routinely tossed around. There isn't too much standardization in panel sizes among the offerings from different manufacturers, so pick your brand and mounting hardware carefully. Also, the power density (amount of power produced per square inch of panel area) varies substantially from one model and manufacturer to the next. This means that in some applications where space is very limited, Model X might meet performance objectives where Model Y wouldn't. In picking a panel model, you should consider the anticipated temperature operating range of the panels, the efficiency of your charge controller, and your battery maintenance requirements. As the temperature of a solar panel rises, its output voltage drops. If your panels will be located in a very hot climate and/or are mounted in such a manner as to hinder air circulation around both surfaces, you should limit your panel selection to models that offer the highest charging voltages (typically around 17 volts at rated output current). Some of the lower-voltage "self-regulating" panels are designed to be used without a charge controller in applications where the load attached to the battery is anticipated to be constant enough to avoid boiling dry the electrolyte. Since the output voltage of these panels has been intentionally reduced, the likelihood of battery damage is small. Unfortunately, so is the likelihood of ever fully recharging the battery. High temperature becomes even more important if you will be periodically equalizing your batteries, since this process can require better than 16 volts under full load from the panels.

Finally, if the output voltage of your panels is marginal under hot conditions, a charge controller with excessive internal losses may aggravate the problem. Try to pick a controller that has less than 0.5 volts of drop under your maximum anticipated charge current (the controller described in the accompanying article has virtually no internal losses). If you will be buying your panels surplus, you are pretty much stuck with what's available. If possible, obtain permission to return the panels for a refund if an initial test shows that they are producing considerably less than their new rated voltage and current. Look for water leaks in the seams of the panel glass. If the panel has

And a Few More Words About Solar Panels

**Parts List**

<table>
<thead>
<tr>
<th>Resistors</th>
<th>1/4 W 5% (unless otherwise stated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1 = Meter Shunt (see text and note below)</td>
<td></td>
</tr>
<tr>
<td>R2 = Alternate Load (see text)</td>
<td></td>
</tr>
<tr>
<td>R3 = 5.1 ohms</td>
<td></td>
</tr>
<tr>
<td>R4 = 1 ohm</td>
<td></td>
</tr>
<tr>
<td>R5 = 100 ohm single-turn, linear taper trim pot. Bourns series #3323W or series #3382U. Available through Digi-Key.</td>
<td></td>
</tr>
<tr>
<td>R6 = 100 ohm</td>
<td></td>
</tr>
<tr>
<td>R7 = 1K</td>
<td></td>
</tr>
<tr>
<td>R8 = 240 ohm</td>
<td></td>
</tr>
<tr>
<td>R9 = 10K</td>
<td></td>
</tr>
<tr>
<td>R10 = 10K</td>
<td></td>
</tr>
<tr>
<td>R11 = 4.7K</td>
<td></td>
</tr>
<tr>
<td>R12 = 10K multiple-turn linear taper trim pot. Bourns series #3005P or Spectrol series #43P. Available through Digi-Key.</td>
<td></td>
</tr>
<tr>
<td>R13 = 1M single-turn linear taper trim pot. Bourns series #3323W or series #3382U. Available through Digi-Key.</td>
<td></td>
</tr>
<tr>
<td>R14 = 2.2K</td>
<td></td>
</tr>
<tr>
<td>R15 = 10K</td>
<td></td>
</tr>
<tr>
<td>R16 = 470 ohm</td>
<td></td>
</tr>
</tbody>
</table>

| Capacitors |
| C1 = 100µF 25V electrolytic |
| C2 = 22µF 16V electrolytic |
| C3 = 0.1µF ceramic disk |
| C4 = 0.1µF ceramic disk |
| C5 = 0.1µF ceramic disk |
| C6 = 0.1µF ceramic disk |

| Semiconductors |
| CR1 = 2.338±1% 1N914 small signal Diodes |
| CR2 = LED |
| CR6 = 9V, 1W Zener diode |
| CR1 = IRF-Z40 50 amp power MOSFET |
| U1 = LM317, 3-terminal adjustable regulator |
| U2 = 741 single op-amp |

| Meter |
| M1 = 0-1mA |

| Switches |
| S1 = SPST |
| S2 = SPDT |

| Fuse |
| F1 = 0.5A |

| Miscellaneous |
| heat sink |
| enclosure |
| fuse holder |

Drilled and etched PC boards are available for $3.50 plus $1.50 S&H from FAR Circuits, 18N640 Field Ct., Dundee IL 60018.

Note: (Calculating R1): Due to the large amount of current and very low resistance value of R1, this resistor is best built from scratch. R1 is an ammeter current shunt, and physically consists of nothing more than a precise length of 14-gauge household wire. The proper wire length is shown in Table 1. There is nothing unusual about building it—it can be wrapped in a coil, wadded-up, or just left hanging. As shown in the schematic, motor M1 is connected through it with a couple of ordinary hook-up wires. Since the vast majority of current is carried through R1, the wires to the motor can be of most any convenient gauge.

The value for R1 can be determined after the decision is made on maximum current through shunt load R2 and the full scale meter movement current and meter resistance. All current meters have some small value of resistance. If you don’t know that value, you can calculate it with a simple experiment.

Let

\[ R_{ML} = \text{full scale meter movement current} \]
\[ R_{MS} = \text{meter shunt resistance} \]
\[ I_M = \text{maximum load current into the shunt} \]
\[ R_M = \text{resistance of the current meter} \]

Take a variable resistor that has a value of 2 X 12 volts/ohm.

If the I_M current is 1 mA, then the variable resistor should be greater than 12 kΩ or approximately 30 kΩ. Connect the meter and variable resistor (adjusted to maximum resistance) as shown in Figure 6. Slowly adjust the resistor until the meter is reading full scale (1 mA in this example). Now measure the very small voltage drop across the meter with a DVM. This voltage drop divided by the full-scale current meter reading will be the meter resistance R_M.

Now the value of R1, the shunt resistor, can be determined for the full scale current meter with the calculated meter resistance of R_M:

\[ R_1 = \frac{R_{ML}}{I_M} - R_M \]

Continued on page 38
The JRL-2000F is the world's first MOSFET HF linear amplifier, designed using the same high technology found in JRC's professional high-power radio transmitters. Featuring a heavy-duty power amp that incorporates 48 RF power MOSFETs to ensure low distortion and clean output up to 1,000 watts (100% duty cycle, 24 hour) SSB/CW, plus a high-speed automatic antenna tuner with memory capacity of 1820 channels for instant QSY. Plus a high efficiency switching power supply (80V-264V) with power factor correction to suppress AC line currents, an automatic antenna selector for up to four antennas and a wireless remote control unit.
bare wires for electrical connections; you'll still need to install the proper switchgear and protective equipment. It's a good idea to consult an electrician before proceeding with any installation work.

The Solar Control-IT

SCARED OF THE CODE?

IT'S A SNAP WITH THE ELEGANTLY SIMPLE MUSE TUTOR ADVANCED EDITION FOR BEGINNERS TO EXPERTS BEYOND Morse Code teaching software from GUTE is the most popular in the world—and for good reason. Your learning will be faster with the most modern teaching methods, including fixed-rate and standard code, on-screen flashcards, random characters, words, and phrases. Choose your own pace to learn Morse Code.

- Get the software and arrange the lessons. The Morse Tutor Advanced Edition is approved for CEX exams at all levels.
- Morse Tutor is great! The Morse Tutor Advanced Edition is even better—and it's in a user-friendly color. Order yours today.

For all MS-DOS computers (including laptops).

Available at dealers, thru GST or send $29.95. To 3 $19 (CA residents add 7.5% tax).

GUTE, P.O. Box 3405, Dept. MS,
Newport Beach, CA 92666
Specify 51/2- or 3/2-inch disk (price includes 1 year of free upgrades)

CIRCLE 193 ON READER SERVICE CARD

Slow Scan Television

doesn't have to be expensive anymore

Quality Color SSTV

is easy and affordable with Pasokon TV

Pasokon TV

$229.95

Send and receive all popular modes. Hardware interface fits inside computer.

New — SSTV Explorer $94.95

Small receive-only interface plugs into serial port.

Both require IBM PC/AT or compatible, 286 and above CPU, color VGA display. MS-DOS. Price includes free shipping to U.S.A. Write or call for complete details.

Absolute Value Systems

115 Stedman St., #7
Chelmsford, MA 01824-1823
(508) 256-6907

Uncle Wayne's Bookshelf

Your One-Stop Shopping Headquarters

In stock and ready to ship direct to you

Reference Manuals, Shortwave Handbooks
ARRL Books, Antenna Handbooks, UHF/VHF,
Books For Beginners, Code Tapes and Software For The Computer

Turn to pages 94 & 95 to see our current selection

Don't delay — Call Today

Our order department is just a phone call away

800-234-8458

CIRCLE 322 ON READER SERVICE CARD

CIRCLE 76 ON READER SERVICE CARD
Ramsey Electronics FX-146 Transceiver Kit

O.kay, you're a typical ham and like to fire up the old 'o' soldering iron once in awhile. Let's say you just found $175 stashed away for a rainy day or the next trip to the Dayton Hamvention. (Sometimes they are one and the same!) What would you buy? Let's see, how about a 4 watt, diode-programmable, packet-ready 2 meter synthesized transceiver kit? And it has to have a snazzy-looking cabinet kit with knobs. Well, it should also be able to work with virtually any speaker/mike on the market! And the receiver coverage should be broadband to pick up NOAA weather signals.

Kinda picky, aren't you? Good thing that John Ramsey of Ramsey Electronics thinks the same way you do, and makes the FX-146 transceiver kit!

Overview

Yes, the FX146 is a pretty neat piece of work, and a proud successor to the original FTR-146 kit, introduced in 1991. For your money, you get a state-of-the-art radio with a professionally-screened G10 circuit board that's easy to put together, easy to test, and works very well on the air. Belts and whistles have been kept to a minimum, with the emphasis on a well-thought-out design employing the Motorola 145152 phase-lock-loop synthesizer chip and your everyday, garden variety 1N914 diode for frequency selection (see Photo C).

The concept behind this radio is simple, but clever: Build your own 2 meter radio, and while you do you'll learn how all of the parts and circuitry work. Should repairs be required, you won't hesitate to open the cover and "dive in" to fix it. What's more, you'll take more pride in this radio precisely because you built it yourself. (And, of course, let's not forget that you saved a few dollars along the way!)

I bought my FX-146 at Dayton '93 strictly on impulse—it was, after all, a rainy day—so after a brief discussion with Tom Hodge WA2YTM at the Ramsey booth, my wallet was lighter and my carry-all bag somewhat heavier. Tom figured it would take me about three evenings to put the kit together and get it on the air. (Note to novice builders: The term "evening" is a standard measurement among kit builders that has about as much relevance today as "fur-length per fortnight." A more realistic appraisal of the time required to build this kit might be six to eight hours, depending on how methodically you work.)

When you first open up the kit package, you'll notice all of the parts and the circuit board neatly sorted into clear ziplock bags. All parts are clearly identified, and all ICs are wrapped in foil for static protection.

If you bought the chassis and knob kit, it too is packaged carefully to minimize scratching. But the best part of the kit is the instruction manual, which answers every possible question you could have as you proceed with assembly.

This manual is over 130 pages long and contains detailed parts lists, assembly instructions, schematics, a parts overlay, and a good deal of what I call "pep talk"—additional material not usually found in kit instructions which is designed to motivate you to want to build the kit and have fun while doing so. In some cases this is nothing more than illustrating how simple the step-by-step procedure is.

The manual also provides a good many helpful notes and tables on how synthesizers work, how to select the right antenna, and how to select and program your desired channels. I've built quite a few kits over the past 25 years, so believe me when I tell you the manual can make or break a kit! The standard for me has always been the Heathkit manuals, and the FX-146 manual compares favorably with any I've seen from Benton Harbor.

Construction

Kit assembly is fairly simple. I suggest locating a number of half-pint plastic deli containers to hold all parts as you proceed. Another useful trick is to double up a piece of masking tape, stick it to your work surface and use it to hold loose components until needed. Many of the parts supplied are already attached to taped rolls, such as the 1N914 diodes and many small capacitors and resistors. A low-wattage iron (say, 40 watts) as well as a pair of diagonal cutters and small pliers will suffice as your tool kit for most of the assembly.

Like the aforementioned Heathkit manuals, Ramsey employs the double-check system during assembly. You locate the part, install it, solder and then "check off" the corresponding box next to that instruction. After you finish a section of the board, you go back, inspect your work and check off again to confirm you did the step correctly. It is a simple idea, but it really works! Even experienced kit builders such as myself find this system very helpful.

Before you begin each section, there is a thorough description of the circuit and how it works—sort of a mini-tutorial on the fly. After reading these sections, you then proceed to actual assembly. Ramsey's approach is to divide the construction into 11 stages. As you finish each stage, you can perform a short test to make sure everything was done correctly. This will do wonders for your confidence as you proceed to the next section, and should a problem develop it can be isolated and fixed quickly.

Once all of the stages have been tested (with the exception of the RF amplifier), you'll need to load up at least one diode matrix into a channel. I found the easiest way to do this was to raise up the edges of the PC board on two wooden blocks about three inches above my workbench. This allows you to drop all of the diodes through their PC mounting holes and solder the cathode ends to the U-shaped buss bar. Once you've done this, flip the board over and solder the anode ends to the PC board traces.
Clip excess leads off carefully. One word of advice when doing this: Make sure you solder the cathode-to-buss connections carefully. It might even be advisable to bend the diode leads into a hook and hang them over the buss wire before soldering. I had a few cold connections and certain channels wouldn't work when selected.

Performance
The FX-146 works surprisingly well, given the simple design. Front-end sensitivity is claimed to be less than 0.35 \( \mu \text{V} \) for 12 dB SINAD, and my tests showed this figure to be closer to 0.30 \( \mu \text{V} \). Adjacent channel rejection is specified to be down 6 dB +/- 7 kHz, and -60 dB +/- 15 kHz, which is pretty tight. An option included with the kit will improve front-end performance even more for those in high-RF-density urban areas, although I haven't found it necessary yet.

The squelch threshold is specified at 0.25 \( \mu \text{V} \), and again I found this to be somewhat lower. Squelch hysteresis performance is good, but I found the loud "pop" objectionable each time the squelch was broken or reset. This is caused by the "gating" of the audio output IC, a LM380 linear device. A call to the factory resulted in a modification to change C48 from a 0.001 disc to a 10 \( \mu \text{F} \) electrolytic, ostensibly to filter out this pop when the IC turned on. The fix made a slight improvement, but the pop is still somewhat annoying.

The FX-146 is set up to select any of 12 preprogrammed channels, the theory being that most users of synthesized radios rarely use more than 10 to 12 memory channels to begin with. This is certainly true in my case, as I use a Kenwood TM221A with 10 memories for day-to-day 2 meter operation. Actual channel selection uses a conventional 12-position single-pole switch to send 5 volts to the desired channel buss. It's not sexy, but sure is simple and reliable! Synthesizer lock-up...
was quick and reliable on every channel (except where I made a couple of cold solder joints).

On-air reports were good. Initially, I was told my audio had a fairly noticeable hum which disappeared when I replaced the ICOM HM-9 speaker/mike with an HM-54. Transmitted audio quality was excellent, and there's plenty of headroom on the microphone gain control although there is no separate deviation control. The FX-146 uses true direct frequency modulation, by the way.

Output power is specified in the 4 to 6 watt range, but try as I might, I couldn't squeeze more than 3.5 watts out of the FX146 anywhere in the band. (I used a Bird 43 with 10C and 5C slugs plus a Bendix 50 ohm termination to make these measurements.) Note that the driver and final RF stages use lumped, HI-Q tuning coils and trimmers (Photo D), and once you've peaked up the trimmers you'll see a fall-off in power if you move up or down the band more than half a megahertz. Still, this power level is more than adequate for most contacts through a repeater, and with an omni-directional antenna or small beam, you'll get out a good distance.

Overall, the FX-146 represents an excellent value for the money. Its performance is on a par with any other 2 meter transceivers on the market today (other than the squelch pop), and it is easy to assemble and test... thereby making it easy to troubleshoot later if repairs are needed. If you really want to "build it yourself," you'd be hard pressed to beat this kit for fun and utility.

THE POWER STATION

The POWER STATION is a 12V x 6.5 AmpHr gel-cell battery complete with voltmeter, wall charger and a cord for charging via automobiles. It will power most HT's at 5 Watts for 2-4 weeks (depending upon how long-winded you are). Also VHF, UHF, QRP, or HF mobiles such as the KENWOOD TS-50 (at 50W). There are no hidden costs, all you need is your mobile, HT power cord or cigarette lighter adapter.

The POWER STATION provides 12V from a cigarette plug and has two recessed terminals for hardwiring. A mini-phone jack with regulated 3V, 6V, or 9V output can be used separately for CD players, Walkmans, etc.

THE POWER STATION can be charged in an automobile in only 3 hours, or in the home in 8 hours. The charger will automatically shut off when the battery is completely charged, so you can charge it even when it has only been slightly discharged, (unlike Ni-Cads that have memory). Our charging circuit uses voltage sensing circuitry, other brands are timed chargers which always charge the battery a full cycle, this damages their battery and shortens its' life if it only needs a partial charge. The POWER STATION has a voltmeter that shows the exact state of charge of the battery, not worthless idiot lights that tell you "YOUR BATTERY IS NOW DEAD." The voltmeter can even be used to measure voltages of other sources.

To order, send check or money order for $49.95 + $8.50 for shipping, along with your shipping address and telephone number to:

Joe Brancato
THE HAM CONTACT
P.O. Box 3624, Dept. 73
Long Beach, CA 90803

CA Residents Add 8 1/4% Sales Tax. Canadian Residents Please Send U.S. Money Order A $7.10 Shipping.

If you wish more information please send a SASE to the above Address. For DD orders, call (810) 433-5960, outside of CA call (800) 933-HAM4 and leave a message.
Azden AZ-61 6m FM Transceiver

Advanced features in the palm of your hand.

The 6 meter band is brimful of excitement for every ham, from the new no-code Technician to the seasoned Extra Class. But don’t get the wrong idea—even though 6 meters is exciting, there’s still plenty of elbow room in the sparsely-occupied spectrum from 50 to 54 MHz.

FM is the predominant mode on 6 meters. There should be no FM operation below 50.30 because this area is reserved for the SSB and CW weak-signal operation found in large multimode mobile and gas station equipment. Remember: No FM below 50.30 MHz!

A good way to get started in 6 meter FM communications might be to pick up a good hand-held transceiver. And while you may think that a measly 3 or 4 watts output won’t do much on the 6 meter band, keep in mind that this is the same amount of power output found in 2 meter handhelds.

One unique characteristic of the 6 meter band is it allows small hand-held transceivers to work distant repeaters just as far as on 2 meters, and will sometimes give you real FM excitement during periods of ionospheric sporadic E band openings. You may find yourself working through a repeater 1,200 miles away, thanks to brief skywave band openings. And keep in mind that sporadic E band openings are not dependent on the 11-year solar cycle. You can count on 6 meter skywave activity during the summer and fall seasons. And while it may only last for a few minutes to a few hours, hand-held operation gets exciting—especially if you are hooked into an outdoor antenna.

The Azden AZ-61 6 meter hand-held transceiver is available direct from the manufacturer: Azden Corporation, 147 New Hyde Park Road, Franklin Square NY 11010 (516/328-7500). Attn: Sid Wolin K2LH, Manager. The Azden line of amateur radio equipment has been around as long as the synthesized 2 meter transceiver, and is now available direct from New York.

"A good way to get started in 6 meter FM communications might be to pick up a good hand-held transceiver."

This Azden looked perfect for the Southern California 6 meter Club. They were searching for a quality hand-held 6 meter transceiver that they could order in quantity. The unit was perfect for them.

Unlike the 2 meter version, the Azden 6 meter handheld offers no oddball duplex split—it is set for +/- 500 kHz, with frequency steps at 5 kHz, 10 kHz, or 20 kHz. You will also quickly discover that receiving channels in the VFO and memory mode are slightly different for the 6 meter unit than what is described in the 2 meter owner’s manual.

The Azden 6 meter handheld is packed with all the usual accessories, including the 8"-long flexible rubber antenna, sturdy belt clip, and the large 12 volt, 600 millamp hour, rechargeable battery. The battery is shipped uncharged from the manufacturer, so you will need to drop it in its included pull-out desk charge stand and let it cook for at least six hours before turning on the juice. The charger puts out 300 milliamps, and the transformer is housed in the plug-in assembly, hoggling an adjacent 110 VAC receptacle beside it if you plug it into a power strip. And be assured that this charging base setup is unique to Azden’s line of handhelds, and there is zero chance that it is interchangeable with any other handheld from any other manufacturer. Why won’t manufacturers ever standardize their batteries or chargers?

On the top of the handheld is a 12-volt DC input receptacle, with the center-pin positive. Watch out—even though you may already have a mobile 12 volt hand-held plug that looks similar to this jack, make absolutely sure that your 12 volt plug has the center hole as positive. Some other handheds run positive on the outside of the plug, not the inside hole.
New Amateur Publications

Radio/Tech Modifications 5A & 5B
Expanded RX/TX Modifications & alignment controls

Vol 5A for Kenwood, Icom & Scanners

Vol 5B for Alinco, Standard, Yaesu, CB's & others

$19.95 each

Federal Government Frequency Assignments

A must for scanner listeners

$24.95

North American Shortwave Frequency Guide

.5 - 30 MHz listing of all shortwave activity, listed in frequency order.

International Broadcasts from around the world. Military and Public services. All broadcast modes. The most handy reference book for the band scanner.

Artsci inc
P.O. Box 1848
Burbank, CA 91507
(818) 843-4080
Fax (818) 846-2298

$19.95

CIRCLE 276 ON READER SERVICE CARD

ID-8 Automatic Morse Station Identifier

Compatible with Commercial, Public Safety, and Amateur Radio applications. Uses include Repeater Identifiers, Base Station Identifiers, Beacons, CW Memory, Keys, etc. Great for FCC ID Compliance.

- Minimum in size. 1.185" x 1.12" x 0.35".
- Neatly fit inside.
- All connections made with miniature plug and socket with color coded wires attached.
- CMOS microprocessor for low voltage, low current operation: 6 to 20 VDC unregulated at 6mA.
- Low distortion, low impedance, adjustable squarewave output: 0 to 4 volts peak to peak.
- Crystal controlled for high accuracy.
- Transmitter PTT output (to key transmitter while ID is being sent), is an open collector transistor that will handle 80 VDC at 300mA.
- Field programmable with SUPPLIED keyboard.
- Confirmation tone to indicate accepted parameters plus tones to indicate programming error.
- All programming is stored in a non-volatile EEPROM which may be altered at any time.
- Message length over 200 characters long.
- Trigger ID with active high or low.
- Memory ID with active high or low, will hold off ID until channel is clear of traffic.
- Generates repeater courtesy tone at end of user transmission if enabled.
- Double sided tape and mounting hardware supplied for quick mounting.
- Operating temperature range: -50 degrees C to +65 degrees C.
- Full one year warranty when returned to the factory for repair.
- Immediate one day delivery.

Programmable Features

- Eight programmable, selectable messages.
- CW speed from 1 to 99 WPM.
- ID interval timer from 1-99 minutes.
- ID hold off time from 0.99 seconds.
- CW tone frequency from 100 Hz to 3000 Hz.
- Front porch delay interval from 0 to 9.9 seconds.
- CW or MCM operation.

$89.95 each
programming keyboard included

CIRCLE 10 ON READER SERVICE CARD

Yaesu

FT-530
New 2M/440

FT-5200
2 Meter/440 Mobile

FT-411E, 2 Meter
FT-811E, 440MHz
FT-911E, 1.2GHz
FT-415, 2 Meter
FT-815, 440MHz
FT-26, 2 Meter
FT-76, 440 MHz
FT-23R, 2 Meter
FT-33, 220 MHz
FT-470, 2M/440MHz

FT-416
New 2 Meter
FT-916, 440 MHz

FT-2400
2 Meter Mobile

FT-212RH, 2 Meter
FT-712RH, 440MHz
FT-7400H, 440 MHz
FT-912RH, 1.2 GHz
FT-6200, 440/1.2GHz

FT-1000
FT-767GX
FT-747

Orders & Price Checks
800-729-4373
Nationwide & Canada

Local Information
812-422-0231
Fax 812-422-4253

Communications Specialists, Inc.
426 West Taft Avenue • Orange, CA 92865-4196
Mon-Fri: 8AM - 5PM
Sat: 9AM - 3PM
Central Time

P.O. Box 6522
220 N. Fulton Avenue
Evansville, IN 47719-0522

Store Hours
MON-FRI: 8AM - 5PM
SAT: 9AM - 3PM

Warranty Service Center For:
ICOM, KENWOOD, YAESU

For Service Information Call
(812) 422-0252
Monday - Friday

Terms:
Prices Do not Include Shipping, Price and Availability Subject to Change Without Notice. Most Orders Shipped The Same Day.

Credit Card ICU's Welcome

Terms: Prices Do not Include Shipping, Price and Availability Subject to Change Without Notice. Most Orders Shipped The Same Day.

Credit Card ICU's Welcome

CIRCLE 131 ON READER SERVICE CARD
Reverse polarity means instant destruction to the 12 volt DC input circuitry to this handheld.

During our testing, we discovered that the 12 volt input circuit does not charge the attached battery. This was not a surprise—some handheld manufacturers provide a 12 volt regulator for mobile charging, but others don’t. We did find that there is a small “buffer” circuit off the external 12 volt line to help minimize alternator noise that sometimes creeps through on transmit. On this unit, we judged this circuit as average. If you have an aggressive 12 volt alternator, you’re going to hear it over-transmit on the Azden—as you would on any inexpensive handheld.

Operating: Read the Book First

The Azden 6 meter handheld is not easily operated without a thorough review of the instruction book. Most seasoned hams can figure out the simple operation and memory channel steps of most handhelds without a book—except for maybe the Kenwood 78—but with this Azden, you must read first.

To enter a frequency like 52.525 MHz, first hit the “VFO” key, then enter “2,” “4,” (Del), “5,” “2,” “5,” and the unit continues to blink for about a second until it locks on. If you don’t hit the “4” key you won’t be able to exit this function button. The unit will not take numbers after your last futile keystroke. After 10 seconds, it figures that you need some help, and goes back to the last valid frequency entered. Remember: Read the book before operating.

Once the set accepts the valid frequency entry, it reads out “52.525” and does a nice job of capturing any signal out there on frequency. The receiver was plenty sensitive down to 0.05 μV, and with dual conversion was light enough to offer excellent selectivity from other stations slightly higher and slightly lower in frequency. The Azden 6 meter handheld utilizes a hard-squelch circuit, and marginal signals will cause the squelch to clamp with a noticeable “pop” as an internal transistor clamps the audio off. But if you accidentally forget and turn down the volume, this hard squelch “pop” might get your attention in a quiet room—there may be someone on channel trying to get through. Few handhelds offer “soft squelch,” and in strong signal areas where most operating is through repeaters, the hard squelch in this unit is perfectly acceptable.

Audio output and fidelity from the internal speaker are excellent. If you plug in the optional external speaker/mike, you’ll have more than enough volume to hear any call to you (if the speaker/mike is anywhere near your ear). Good news: Many of the generic speaker/microphones have the same exact plug complement that the Azden accepts. Some of the external crossband speaker/microphones run a little hot on transmit modulating number 9 key. This allows you to select no offset simplex, minus 500 kHz offset down, or plus 500 kHz offset up. No oddball offsets are available on this unit.

To encode a subaudible tone, you hold the function button again and push the zero key. This activates the “PROG” program display, and you cycle with the pound key (#) past “T SO” tone squelch decode, and TO “Tone” for tone encode. Cycle up to the desired tone by exact tone frequency, and then wait approximately five seconds for the unit to time out of the program mode, and get you back into the VFO display mode. Now depress the function button again and the “3” key, and this brings up the word “Tone,” indicating CTCSS encode each time you transmit.

Now, memorize this package into any one of 20 + 20 memory channels by holding the “ENT/MW” pound key until you hear a beep. There are several other options that you could program on each memory channel, too: you do read the instruction manual, the operating and programming is easy.

This IS an advanced-feature handheld, so it takes about an hour of programming in order to get the “feel” for how frequencies, offset and tone get remembered.

About the only thing I found a problem with was slow synthesizer lock time which all but eliminates the capability of cycling through frequencies with the up or down arrow looking for activity. As soon as you press the up and down arrow frequency slew button, the receiver blanks out until you release the button. You could electronically scan the 6 meter band for activity, but I like to go into the manual mode, and search down at the cordless telephone frequencies near 46 MHz and 49 MHz and see what all I can pick up. (Cordless is legal...) Lots of excitement here!

So, I like it. I like the Azden AZ-61 handheld a lot. Just be sure to read the instruction manual first!
Comet's best-selling 2m/70cm base antenna. Featuring the Comet exclusive GIC system for maximum gain and stable resonant frequencies. Choose from a family of great products all pre-tuned in single, dual and tri-band fixed station antennas. Gain is 8.5-11.9 dB.

Holiday value $185.95

CA-2x2MAX

Also shown CA-2x4FX (middle)- Dual band for 2m/70cm. Gain is 4.5-7.2 dB.

Many other models available.

5% off all prices on this page!

Comet mobiles

Comet offers a new 585 and S87 NMO-style dual-band antenna. They'll make a great styling and performance to match. Use the S87 for more compact installations and the 585 for those hard-to-reach locations.

- B-20 dual band standard and NMO mount 2.1/4.6/6.0 dB $49.95
- SB7NMO dual band NMO mount 2.1/3.0/5.5 dB $55.00
- FL-675 dual band premium construction 2.1/4.5/7.2 dB $92.55
- CA-2x4 SR dual band open coil construction 3.8/6.2 dB $69.95

Comet offers a wide variety of stylish antennas, mounts, duplexers and cable assemblies.

Comet Whips

Dual band whips for your HT will extend your range. Comet makes a version for most every need.

- CH-726C 2m/70cm center lead $57.95
- SH-55 New 2m/70cm $32.95
- CH-72S chrome base 2m/70cm $45.95

Many more to choose from!

Comet's best-selling 2m/70cm base antenna. Featuring the Comet exclusive GIC system for maximum gain and stable resonant frequencies. Choose from a family of great products all pre-tuned in single, dual and tri-band fixed station antennas. Gain is 8.5-11.9 dB.

Holiday value $185.95

CA-2x4FX (middle)- Dual band for 2m/70cm. Gain is 4.5-7.2 dB.

Many other models available.

5% off all prices on this page!

Comet mobiles

Comet offers a new 585 and S87 NMO-style dual-band antenna. They'll make a great styling and performance to match. Use the S87 for more compact installations and the 585 for those hard-to-reach locations.

- B-20 dual band standard and NMO mount 2.1/4.6/6.0 dB $49.95
- SB7NMO dual band NMO mount 2.1/3.0/5.5 dB $55.00
- FL-675 dual band premium construction 2.1/4.5/7.2 dB $92.55
- CA-2x4 SR dual band open coil construction 3.8/6.2 dB $69.95

Comet offers a wide variety of stylish antennas, mounts, duplexers and cable assemblies.

Comet Whips

Dual band whips for your HT will extend your range. Comet makes a version for most every need.

- CH-726C 2m/70cm center lead $57.95
- SH-55 New 2m/70cm $32.95
- CH-72S chrome base 2m/70cm $45.95

Many more to choose from!

Comet's best-selling 2m/70cm base antenna. Featuring the Comet exclusive GIC system for maximum gain and stable resonant frequencies. Choose from a family of great products all pre-tuned in single, dual and tri-band fixed station antennas. Gain is 8.5-11.9 dB.

Holiday value $185.95

CA-2x4FX (middle)- Dual band for 2m/70cm. Gain is 4.5-7.2 dB.

Many other models available.

5% off all prices on this page!

Comet mobiles

Comet offers a new 585 and S87 NMO-style dual-band antenna. They'll make a great styling and performance to match. Use the S87 for more compact installations and the 585 for those hard-to-reach locations.

- B-20 dual band standard and NMO mount 2.1/4.6/6.0 dB $49.95
- SB7NMO dual band NMO mount 2.1/3.0/5.5 dB $55.00
- FL-675 dual band premium construction 2.1/4.5/7.2 dB $92.55
- CA-2x4 SR dual band open coil construction 3.8/6.2 dB $69.95

Comet offers a wide variety of stylish antennas, mounts, duplexers and cable assemblies.

Comet Whips

Dual band whips for your HT will extend your range. Comet makes a version for most every need.

- CH-726C 2m/70cm center lead $57.95
- SH-55 New 2m/70cm $32.95
- CH-72S chrome base 2m/70cm $45.95

Many more to choose from!

Comet's best-selling 2m/70cm base antenna. Featuring the Comet exclusive GIC system for maximum gain and stable resonant frequencies. Choose from a family of great products all pre-tuned in single, dual and tri-band fixed station antennas. Gain is 8.5-11.9 dB.

Holiday value $185.95

CA-2x4FX (middle)- Dual band for 2m/70cm. Gain is 4.5-7.2 dB.

Many other models available.

5% off all prices on this page!

Comet mobiles

Comet offers a new 585 and S87 NMO-style dual-band antenna. They'll make a great styling and performance to match. Use the S87 for more compact installations and the 585 for those hard-to-reach locations.

- B-20 dual band standard and NMO mount 2.1/4.6/6.0 dB $49.95
- SB7NMO dual band NMO mount 2.1/3.0/5.5 dB $55.00
- FL-675 dual band premium construction 2.1/4.5/7.2 dB $92.55
- CA-2x4 SR dual band open coil construction 3.8/6.2 dB $69.95

Comet offers a wide variety of stylish antennas, mounts, duplexers and cable assemblies.

Comet Whips

Dual band whips for your HT will extend your range. Comet makes a version for most every need.

- CH-726C 2m/70cm center lead $57.95
- SH-55 New 2m/70cm $32.95
- CH-72S chrome base 2m/70cm $45.95

Many more to choose from!
**ICOM**

**IC-229H**
This feature-packed mobile is perfect for car, packet or portable use. Its tiny size lets it squeeze into most any open space. The memory DTMF microphone, CTCSS encode, 21 memories and great price make this a hard value to pass up.

**Holiday value $369.95**

**IC-3230A**
Get ahead with dual band superior! This compact transceiver is loaded with many attractive functions for complete dual band capability, including cross band-repeat functions. Like a mono band transceiver, it fits anywhere in any vehicle. It has 35 memories, DTMF memory microphones, an easy leisure and much more.

**Holiday Value $555.33**

**IC-2iA**
This ultra-slim transceiver is designed for maximum portability and convenience. Even with its NCO battery pack attached, this transceiver can fit in your shirt pocket or hand bag. CTCSS, clock and 100 memories are standard features.

**Holiday value $299.95**

**IC-2410H**
This radio can simultaneously receive 2 frequencies in the same band. Combine this breakthrough with simultaneous dual band receive capability, speech processor, DTMF and you have a list of features found nowhere else. Step ahead with Icom!

**Holiday value $699.95**

**IC-W2A**
A return to design fundamentals has produced something truly unique in dual-band FM transceivers. Even though it is the smallest in its class, it is packed to the limit with features to expand your fun out-of-doors, on the road, or at home.

**Holiday Value $479.95**

**IC-R100**
Bring the world to your car. Now you can enjoy a wider world of broadcasting. VHF air and marine bands, AM, FM, WFM modes, emergency services and many more— in your vehicle. Fully covers all the stations worth hearing in the 500 kHz - 1.8 GHz range.

**Holiday value $649.95**

**IC-W21AT**
This new dual-band handheld transceiver offers unsurpassed performance and this kind of innovative features amateurs have come to expect from Icom. From the unique new whisper function and auto-output power selection to many other trend-setting features, the W21AT is so impressive you'll want to experience for yourself. This radio sports 70 memories, pager, CTCSS and many other features.

**Holiday Value $499.95**

**FREE!**
Icom hat with any radio purchase from this page!

**ICOM**

Satellite City Now

Radio City

2663 County Road J, Mounds View, MN 55112
Metro: (612) 786-4475 • Nat'l. Watts: 1-800-426-2891 • FAX: (612) 786-6513
Store Hours: M-F, 10:00 am - 8:00 pm, Sat., 10:00 am - 5:00 pm
Phone Hours: M-F, 8:00 am - 8:00 pm, Sat., 10:00 am - 5:00 pm

Prices subject to change without notice.
Expires 12-31-93

CIRCLE 153 ON READER SERVICE CARD
The beauty of the all-mode IC-275H from Icom is that it gives you the best of both worlds—accessibility to the far-flung reaches of the earth combined with tremendous simplicity. At just the touch of a few switches you can contact places in the world you’ve always dreamed of visiting.

IC-475H: 70cm all mode
IC-575H: 6m all mode

Performance with easy-to-use features. With a full-featured front panel and a large fluorescent display, this radio was designed to be used. Wide dynamic range, full duty cycle heat sink, 99 memories, DDS and high speed antenna tuner will expand your fun.

IC-765
Holiday value $2,339.95

This advanced transceiver features DDS, dual antenna ports, dual VFO display, 101 memories, internal antenna tuner, built-in keyer and 105 dB dynamic receive range. Join the DX scene with the latest design.
<table>
<thead>
<tr>
<th>Model</th>
<th>Holiday Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TS-50S</td>
<td>$1049.95</td>
<td>Enjoy high performance communications and go-anywhere convenience with the world's smallest 100w mobile HF transceiver. It opens up a whole new world for the amateur radio operator. It can be mounted in a vehicle, taken on a DX-pedition, or even permanently installed as a base station transceiver.</td>
</tr>
<tr>
<td>SMC-33</td>
<td>$53.95</td>
<td>Kenwood's ST-70 shortwave receiver is a companion unit for the TS-50S/AT.</td>
</tr>
<tr>
<td>SP-31</td>
<td>$69.95</td>
<td>Kenwood's SP-31 speaker for use with the TS-50S/AT.</td>
</tr>
<tr>
<td>TS-850S/AT</td>
<td>$1329.95</td>
<td>A radio that can star in virtually any role with its 100w transmission capabilities on all nine amateur bands. Compact, lightweight construction makes this HF transceiver particularly suited for DX-ing. Rugged reliability is matched with leading-edge electronics—automatic antenna tuner, Kenwood's AIP system for improved dynamic range, DDS for fine tuning and the optional DSR-100 digital signal processor.</td>
</tr>
<tr>
<td>TS-140S</td>
<td>$879.95</td>
<td>The perfect entry-level HF transceiver. All-mode performance is enhanced by numerous user-oriented features such as 31 memories, a dual-mode noise blanker with level control, CW full &amp; semi break-in, built-in speech processor and its light enough for DX-peditions and mobile use.</td>
</tr>
<tr>
<td>TR-751A</td>
<td>$629.95</td>
<td>To meet the over-growing demand for all-mode operations on the move, Kenwood has developed a compact, lightweight transceiver that performs with proficiency. While providing the full-featured convenience of much larger rigs—including dual digital VFOs, all-mode squelch and semi break-in—this model is designed to function as well in your vehicle as it does in your shack.</td>
</tr>
</tbody>
</table>
Radio City offers factory authorized warranty service for Icom, Kenwood, Yaesu and Sony.

KENWOOD

State of the art, and then some. Demonstrating the full potential of an all-mode transceiver equipped with advanced electronics. Kenwood’s high-quality TS-790A breaks new ground in terms of both features and performance. And when equipped with the optional 1200 MHz unit, it offers tri-band coverage for maximum versatility. Supporting its dual-frequency receive capability are separate readouts and controls for main and sub bands, and even full-duplex cross-band operation is possible.

Holiday Value

$1779.95

TH-78A

Price Blowout

Compact and confident, it sets exciting new standards for portable communications combining simplicity of operation with a multiplicity of features. In addition to built-in DTSS and paging functions, it provides a dual-frequency transceive capability, wide band receive, a sliding keypad cover, and many other features. While supplies last.

Holiday Value

$426.93

Kenwood SP-23

Holiday Value

$799.95

Kenwood Accessories

They make great stocking stuffers!

Holiday Value

$759.95

TM-742A

New VHF/UHF tri-band with third band optional. This new transceiver has all the features and advantages of the TM-741 plus these enhancements: direct frequency entry, the unit can separate into three pieces (requires remote cable kit), CTCSS encode is built in, and it can be controlled remotely with DTMF signals from any transceiver. Also available in a tri-band model (the TM-942A).

Holiday Value

$1879.95

TM-732A

Attuned to the fast-moving world of mobile communications, this dual-band transceiver offers a host of advanced features in a compact design. The detachable front panel has a high-visibility LCD display to keep you informed of operational status.

Holiday Value

$609.95

TH-28A

This state of the art HT has numerous features - the ability to store both alphanumeric and frequency data in non-volatile memory, AM aircraft, alphanumeric message paging - in addition to DTSS and pager functions - plus switchable dual-band receive. As an added bonus the number of memory channels can be increased to 240 (option).

Holiday Value

$309.95

TM-241A

This 2 meter FM mobile provides the user-friendly operation the amateur radio operator expects from Kenwood. It comes complete with extra-large display, DTMF microphone, wide band receive and illuminated switches. For the experienced operator, an additional feature is available which allows you to connect to as many as 4 mobile transceivers by remote control.

Holiday Value

$374.95

Kenwood Microphones

Kenwood TH-28

Kenwood Accessories

They make great stocking stuffers!
**FT-1000**

Fun for fun, but you can be very serious with this heavy duty competitor. Dual receivers, 500 watt output, 100 memories and 108 dB dynamic range gives you the performance edge. This radio will help you collect more points in a contest and add more cards to your DX collection. The specs tell the story, but it's the ride that's exciting.

*Holiday Value: $3899.95*

**FT-290**

Portable or mobile, this 2 meter all-mode transceiver delivers fun and function. The 25 watt linear amplifier clips in place of an optional battery case to extend your operating horizon.

*Holiday Value: $559.95*

- FT-690 6m transceiver $669.95
- FT-790 70 cm transceiver $669.95

**FT-840**

This new transceiver delivers the fun and performance you're looking for while staying on a budget! It has 100 watt output, 100 memories, DDS, IF Shift, FET front end and a general coverage receiver, all for a low price.

- FC-10 Matching antenna tuner, external
- FC-800 Remote antenna tuner

*Holiday Value: $799.95*

**FT-747GX**

Perfect portable proportions in a full-featured 100 W transceiver. This radio gives rugged lightweight performance in your car, boat or cabin. Just right for home, too!

*Holiday Value: $729.95*

**FT-736R**

Satellite and all-mode 2m/70cm work gets exciting with this full-feature transceiver. Linked tuning, 12 uplink memories, 100 general purpose memories, and room for 2 optional modules offering band extensions for 6m, 220MHz, or 1.2 GHz operation.

*Holiday Value: $1719.95*

**FT-990**

Based on the acclaimed performance and easy operation of the FT-1000, the new FT-990 combines the basic technical features of that top-of-the-line model with several new advances in both transmitter and receiver circuitry, resulting in a spectacular performer at a reasonable price. Digital filter, 99 memories, wide dynamic range and much more!

*Holiday Value: $2059.95*

**FT-890AT**

A fine blend of high performance features borrowed from the FT-1000 and the FT-990 are combined in this affordable transceiver. Pass band tuning, variable notch filter, variable noise blanker and VOX dress up this 100W rig. This model includes a built-in antenna tuner to expand your mobile fun. Great for base operation also.

*Holiday Value: $1319.95*
If you need a custom cable for packet and don't have time to make it, let us do it for you. C.A.P. and M.A.R.S. mods are also done here for authorized hams.

**FT-5200**
The removable front panel lets this dual binder fit any installation. It features 50w out on 2 meters, 35w out on 70 centimeters, 32 memories, CTCSS encode and PAG mode.

**Holiday value $629.95**

**FT-530**
The newest member of the dual band family. This handheld sports auto tone search, 82 memory channels, automatic power off, built-in VOX, dual in-band receive feature, built-in cross band repeat function and much more.

**Holiday value $449.95**

**FT-416**
This new VHF handheld transceiver provides the latest features: auto tone search, automatic battery saver, automatic power off, 41 memories, CTCSS encode/decode, DTMF paging, backlit key pad and display and a choice of two colors (black or grey).

**Holiday value $345.95**

**FT-2400**
This rugged military-grade 2 meter mobile provides wide band receive, 3 power output levels, a lithe keypad and 26 memories. Join the fun!

**Holiday value $336.28**

**FT-7400**
Has the same great features as the FT-2400 but is designed for the 440 band.

**FT-5100**
This dual band mobile features 100 memories, cross band repeater, backlit key pad, built-in duplexer and a small footprint. Dual watch capability rounds out this 50/55 watt VHF/UHF transceiver. Packet ready.

**Holiday value $599.95**

**FT-2200**
This compact, full-featured mobile comes with 49 memories, 10 DTMF autodial memories, A.R.S., CTCSS encode and digital squelch as standard features. Power output ranges of 5, 25 and 50 watts let you select just the right amount of power. The lithe keypad and microphone make night use a breeze.

**Holiday value $369.95**

**FT-411**
This full-featured handheld provides hours of fun on a small budget without compromising on quality. Check out the extra board receive, 49 memories and dual VOX.

**Holiday value $295.95**

**FT-470**
High tech performance is the name of the game with this full-featured dual band handheld. The durable construction lets you take it anywhere and enjoy reliable operation. The unit is equipped with CTCSS, 42 memories, 4 VFOs and 10 auto dialer memories.

**Holiday value $409.95**
Is your Ham radio as close as your telephone with Ham Link. The keypad on your phone becomes your remote control to your radio. Change bands and frequencies, tune up or down, switch modes (AM/SSB/FM/CW), scan, run split VFO or virtually any other radio feature you have. This option allows you the use of a high-speed keyer at the user end.

Iso-Loop
Model 10-30 HF
Holiday value $319.95
Perfect for amateurs living in areas with antenna restrictions. This omnidirectional antenna features high Q, high efficiency and high fun.

Ham Link
Holiday value $239.95
Your radio is as close as your telephone with Ham Link. The keypad on your touch tone phone becomes your remote control to your radio. Change bands and frequencies, tune up or down, switch modes (AM/SSB/FM/CW), scan, run split VFO or virtually any other radio feature you have. If CW is your thing, you can use the ARE-80 CW Link with your Ham Link. This option allows you the use of a high-speed keyer at the user end.

IT-1 Automatic Tuner
Holiday value $249.95
This automatic antenna tuner is designed for the Iso-Loop and makes tuning a snap. Features include a 12 button keypad, 16 segment LED bar, 8 memories and serial interface.

DSP-1232
NEW
DSP-2232
Take a last trip to the future with these digital signal processing (DSP) multi-mode data controllers. AEA has the most advanced and adaptable data controllers on the market today: the DSP-1232 with two switchable ports and the DSP-2232 with two simultaneous ports. The capabilities for both are endless. Now supplied with PACTOR.

PK-88
This HF/VHF packet TNC is your best value in packet radio. The PK-88 is loaded with unique operating features and backed with proven hardware and software design.

PK-232MBX
This controller combines all the amateur data communication modes into one comprehensive unit. Over 65,000 have been sold worldwide. Now with PACTOR!

PK-900
This next generation of multi-mode controller is made in the USA with a front panel designed for you. Every dual port radio/RTTY. PACTOR, CW, fax and more!

PC Pakratt for Windows
This is the first and only data controller program for Microsoft Windows® on the market today! It works with the entire family of data controllers, including the new PK-900 and DSP-2232. It can run two AEA TNCs simultaneously and supports 16 PACTOR controllers. The system also supports HP LaserJet and Epson compatible printers.

AEA FAX
AEA Fax is a multi-intensity gray scale facsimile receiving system for the IBM and compatible systems that allows you to copy grey scale fax images from the HF bands with your short-wave receiver. An on-screen tuning scope eats in optimum reception. You need an IBM PC, XT, AT or compatible with at least 640K, DOS 2.1 or higher and 1 serial port. The system also supports HP LaserJet, Epson compatible printers.

A new generation of multi-mode controller is made in the USA with a front panel designed for you. Every dual port radio/CW, PACTOR, RTTY, fax and more!

PK-900

PK-232MBX

PK-88

SWR-121

Holiday value $349.95
This handheld programmable HF antenna analyser presents a graphic image of your antenna performance. Download this data for future reference.

IT-1 Automatic Tuner

Holiday value $249.95

Now with PACTOR!

PK-900

PK-232MBX

PK-88

SWR-121

Holiday value $349.95

PK-88

PK-900

PK-232MBX

PK-88

PK-900

PK-232MBX
**New Satellites**

The flight of Ariane V-59 was originally scheduled for September 1st. The primary payload, SPOT-5, encountered technical difficulties requiring a launch slip to late September. If all goes as planned, six smaller satellites will be mounted on a ring at the base of SPOT-3. They include Stella, Heathsat, PoSat-1, Itamsat-A, KitSat-B and Eyesat-A. Two of the satellites are purely commercial, two contain both commercial and amateur payloads, and two are dedicated to amateur radio service.

The ejection sequence has SPOT-3 separating first, followed by Stella, KitSat-B, PoSat-1, Heathsat, Eyesat-A and Itamsat-A. The OSCAR (Orbiting Satellite Carrying Amateur Radio) numbers associated with the new satellites are currently under discussion since Arsene has not yet been given the name Arsene-OSC-A24. If Arsene is given a number, the suggested OSCAR numbers for the new hamsats are: KitSat-OSC-A25, PoSat-OSC-A26, AMRAD-OSC-A27 and Itamsat-OSC-A28. The expected orbit of the new satellites is 300 km high with an inclination of 38.7 degrees. This is identical to that of the microsats, OSCARs 14-19.

Stella and Heathsat are the commercial secondary payloads. Stella is a German geodetic satellite and Heathsat is a test platform for small ground-station activity in support of efforts by VITA (Volunteers in Technical Assistance) and Satellite. It is a digital system that operates at 9.6 and 38.4 kbps (kilobytes per second).

The combination amateur/commercial satellites include PoSat-1 and Eyesat-A. PoSat comes from the Portuguese organization LNETI. The satellite's purpose is to provide experience to Portuguese nationals for the construction and operation of satellites.

PoSat-1 was built at the University of Surrey in England by members of the UoSAT team and a group of four engineers from Portugal. The satellite carries an earth-imaging camera capable of 200 meter resolution, a CCD (charge-coupled device) camera as a star sensor, a cosmic-ray detection experiment, a Trimble GPS (Global Positioning System) receiver and a DSP (Digital Signal Processing) experiment with two Texas Instruments processors. PoSat-1 will support 9.6 and 38.4 kbps operation on the amateur band frequencies. The primary amateur activity will likely involve the imaging experiment. Note Table 1 for details.

Eyesat-A is the first commercial satellite built on a microsat bus structure. It was manufactured by Interferometics, Inc. of Vienna, Virginia. The amateur radio portion of this satellite was produced in cooperation with AMRAD, an experimentally-oriented organization in the Virginia suburbs of Washington, D.C. The satellite is capable of digital communication speeds from 300 to 19.2 kbps on the amateur bands. Although Table 1 shows operation only up to 9.6 kbps, onboard experiments can be initiated for operation above this. A crossband voice repeater with 70cm uplink and 2 meter downlink is also a possibility.

KitSat-B and Itamsat-A are the two satellites dedicated to amateur-radio service to be carried aloft on the Ariane V-59 mission. Both satellites promise to be extremely popular additions to the current fleet of digital hamsats.

KitSat-B is the second satellite from KAIST (Korean Advanced Institute of Science and Technology). While the first one, now known as KitSat-OSCAR-23, was built at the University of Surrey and is based on the Surrey satellite frame, KitSat-B is a completely Korean effort. This represents an important phase in the technology transfer between Surrey and KAIST. The new KitSat carries many of the same type payloads as K-O-23, but has advancements in imaging capability and data transfer speed. More information on the scientific components of KitSat-B can be found in the June "Hamsats" column. Operating frequencies are shown in Table 1.

Itamsat-A was built by AMSAT-Italy and incorporates modifications and advances to the original microsat design. These upgrades have been used to modify designs for additional hamsats under construction in other parts of the world. While data communications rely primarily on the PSK (phase-shift keyed) modulation techniques of the current microsats, a 9.6 kbps system using FM up and down has been incorporated for compatibility with the highly successful UoSat and KitSat designs now in orbit.

**Future Satellites**

In addition to those hamsats scheduled for the V-59 launch, UN-AMSAT from Mexico and RS-15 from Russia are ready and waiting for their flight to space. CEsar-1 from Chile, SUNSAT from South Africa, HUTSAT from Finland, Sedsat from the U.S., Guervin/1Techsat from Israel and the International Phase-3-D project are under construction.

Details of these efforts and discussions concerning operations via the current group of operational hamsats were a significant part of the 1993 AMSAT-UK Colloquium. The meeting was held at the University of Surrey in late July and early August. Many well-known satellite designers and builders attended and presented papers detailing current and future efforts. Nearly 140 delegates from six continents exchanged views and stayed in touch with current findings and advancements relating to the new and future satellites.

Dick Jansson WD4FAB from AMSAT-NA detailed progress with the structural design of Phase-3-D. Viktor Kudielka OE1VKW described the causes for the eventual decay of...
AMSAT-OSCAR-13’s orbit and the need for caution planning the path of Phase-3-D. Other noteworthy talks included one on radio astronomy, descriptions of the transmitters and receivers to be carried on Phase-3-D and Mode “S” (2.4 GHz receive) efforts by James Miller G3RUH.

Table 2 shows the new designations relating to satellite frequency bands to be used on Phase-3-D. The satellite will use a matrix of separate transmitters and receivers and thus does not call out transponders that use specific uplink and downlink combinations. Thus Mode “B” (70cm up and 2 meters down) would be called Mode “UV” where the first letter describes the uplink and the second is the downlink. Innovative additions to Phase-3-D include a 5.654 GHz uplink, a 40 watt 10 GHz downlink, a new digital system called RUDAK-3 from Germany and a Japanese three-camera system with digital downlinks. All the transmitters for the new satellite are designed for much easier reception on earth.

James G3RUH gave a live demonstration of A-O-13 Mode “S” reception with his 60cm dish to show how easy microwave reception can be. A complete description of the construction of the small dish with the helix feed was printed in the March/April issue of The AMSAT Journal. He also presented his 16-turn, 2.4 GHz helix used for direct A-O-13 “S” reception without a dish. Tests have proven that the small antenna is an adequate performer when used in conjunction with a low-noise preamplifier and a good converter system. James reminded those attending his talk that the effective radiated power at 2.4 GHz for A-O-13 is only 5 watts. Signals from Phase-3-D at 2.4 GHz should be somewhere between 5-20 kilowatts. This 30-36 dB signal increase means that the small helix is significant overkill. A quarter-wave whip (about an inch long!) should work just fine for Phase-3-D.

Support for Phase-3-D

All the incredible capabilities slated for Phase-3-D come at a price. This will be the largest, most comprehensive and expensive amateur radio satellite to date. The program needs money in addition to the donated parts and labor. AMSAT-NA has been promoting the project and raising funds for several years. A special contribution program based on yearly donations over a five year period started in 1991. With a minimum contribution of $36.92, AMSAT will reply with a special Phase-3-D certificate with one sticker. Additional donations of at least $36.92 each, bring more endorsement stickers to fill out the years from 1991 through 1995, when AMSAT hopes to launch Phase-3-D. AMSAT can be contacted via phone at (301) 589-6062 or by mail at 850 Sligo Ave. #600, Silver Spring MD 20910.

The American Radio Relay League launched a program in June with a mailing to all ARRL members briefly describing the Phase-3-D project and proposing an ARRL goal to raise $300,000 from League members. Every contribution to Phase-3-D made through the ARRL is acknowledged with a unique QSL to serve as a permanent confirmation of support. The ARRL can be reached at 225 Main Street, Newington CT 06111. Be sure to mark any donations to the attention of Phase-3-D.

---

**Table 1. Frequency plans for the V59 hamsats.**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Frequency</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Downlink</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AMSAT-A</td>
<td>435.867/435.822 MHz (435.867 MHz primary)</td>
<td>1200/4800/9600 baud</td>
</tr>
<tr>
<td>Uplink</td>
<td>145.875/145.900/145.925/145.950 MHz</td>
<td></td>
</tr>
<tr>
<td>KITSAT-B</td>
<td>435.175/436.500 MHz</td>
<td>9600 baud</td>
</tr>
<tr>
<td>EYESAT-A</td>
<td>436.800 MHz</td>
<td>300-9600 baud (19.2 kbps downlink possible)</td>
</tr>
<tr>
<td>POSAT</td>
<td>435.250/435.275 MHz (435.250 MHz primary)</td>
<td>9600 bps (38.4 kbps likely)</td>
</tr>
</tbody>
</table>

**Table 2. New satellite mode designations for Phase-3-D.**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Frequency</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>145 MHz Band V</td>
<td>1.2 GHz</td>
<td>5.6 GHz</td>
</tr>
<tr>
<td>435 MHz Band U</td>
<td>2.4 GHz</td>
<td>10 GHz</td>
</tr>
</tbody>
</table>
Wayne is mad as hell...
...and he doesn't want you to take it anymore!

Declare War!
On Our Lousy Government
Fed up with the mess in Washington? The mess in your state capital.
Poverty, crime, our failing schools? Wayne Green has solutions.

Clever solutions.
Wayne Green's unique reasoning is intriguing—
even delightful. Whether you are horrified by his proposals or you embrace them, it is impossible to ignore the basic lesson he presents: It is time to bring logic—
not emotions—to bear on America's dilemma. His spin on America in the 90's helps us to understand how simple the seemingly complex issues
are. All it takes is looking at them from an entirely
new viewpoint.

Now available in one complete volume, Declare War is full of thought-provoking ideas and solutions
to some of the most difficult problems facing our
country today. Regular price: $12.95

Special Offer For ARRL Members only: $10.00 (plus $2.00 S&H)

CALL 208-852-0830 for Appointment

KENWOOD SPECIALS

<table>
<thead>
<tr>
<th>Model</th>
<th>Special Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>TS-950SDX</td>
<td>$150.95</td>
</tr>
<tr>
<td>TS-950SD</td>
<td>$150.95</td>
</tr>
<tr>
<td>TS-850AT</td>
<td>$130.00</td>
</tr>
<tr>
<td>AT-50</td>
<td>$120.00</td>
</tr>
<tr>
<td>TR-55</td>
<td>$120.00</td>
</tr>
<tr>
<td>TR-8400</td>
<td>$120.00</td>
</tr>
<tr>
<td>R-2000</td>
<td>$120.00</td>
</tr>
<tr>
<td>VFO-700S</td>
<td>$120.00</td>
</tr>
<tr>
<td>P-SS0</td>
<td>$120.00</td>
</tr>
<tr>
<td>HMC-1</td>
<td>$120.00</td>
</tr>
<tr>
<td>MC-55</td>
<td>$120.00</td>
</tr>
<tr>
<td>TH-22A</td>
<td>$120.00</td>
</tr>
<tr>
<td>TH-29A</td>
<td>$120.00</td>
</tr>
<tr>
<td>BC-6</td>
<td>$120.00</td>
</tr>
<tr>
<td>LH-3</td>
<td>$120.00</td>
</tr>
<tr>
<td>LH-4</td>
<td>$120.00</td>
</tr>
<tr>
<td>LH-5</td>
<td>$120.00</td>
</tr>
<tr>
<td>MB-4000</td>
<td>$120.00</td>
</tr>
<tr>
<td>EB-2</td>
<td>$120.00</td>
</tr>
<tr>
<td>EB-3</td>
<td>$120.00</td>
</tr>
</tbody>
</table>

Order Toll Free: 800-234-8458

How to Get Started
In Packet Radio

Enter the exciting world of Packet Radio today with How To Get Started In Packet Radio. Dave Ingram, K4TWJ, wrote this beginner's guide to Packet Radio in an
easy-to-understand manner. It starts with a non-technical description of packet radio, followed by chapters that include getting started, setting up your station,
networks, BBSS, portable and high-frequency operation and even a Packet Radio Equipment Survey. There's also an appendix that includes circuits for interfacing equipment.
Join the most exciting and rapidly growing area of ham radio today! Order your copy of How To Get Started In Packet Radio book for only $9.95! (plus $2.00 S&H).

Call Today (208) 852-0830
ROSS DISTRIBUTING COMPANY
78 S. State Street, Preston, Id. 83263

Inquiries (206) 869-8052

CIRCLE 223 ON READER SERVICE CARD

P.O. Box 598, Remond, WA 98073
New Spectra Plus! Examine audio signals in real time, or record and post-process from WAV files. View time-series, spectrum, color spectrogram, and/or 3D surface plots in separate, independent windows. Spectra Plus gives full control over FFT size, sample rate, scaling, gain, and averaging period. Point and click to make all measurements, mark frequencies, and print results. Spectra Plus features advanced options such as triggering, smoothing window, overlap processing, and more. Available for Windows 3.1 and any compatible 8- or 16-bit sound card. No programming required.

Price: $199, Intro Special, $129. Demo Disk, $45 (credit toward purchase) Spetral Lite (Spectra Pro for 2 MHz), $39. VISA, MasterCard, Check or Money Order or Pioneer Hill Software 2440 Mason Road PO BOX 807 Concord, Mass. 01742 Ph: (508) 263-3472 FAX (508) 263-3472

The no-hole, On-Glass® mobile antenna that installs in 15-minutes.

- Capacitive coupling establishes highly tuned circuit through glass with no measurable signal loss.
- No ground plane: Full halfwave design—performance equal to practical 5/8 wave installations.
- DUO-BOND™ mounting for firm, fast, waterproof bonding. Removable without damaging car or antenna.
- No holes: No vehicle damage; fast, easy cable routing.
- Models for 2 meter, 220 MHz and UHF amateur bands.

Available from your dealer...
1-800-634-8132

The antenna specialists co.
30500 Bruce Industrial Parkway
Cleveland, OH 44139-3996
216/349-8400. Telex: 4332123, Fax: 216/349-8407

SPECTRUM INTERNATIONAL, INC. Post Office Box 1084, Dept. SA Concord, Mass. 01742, U.S.A.
Phone: (508) 263-2145 Fax: (508) 263-7008

CIRCLE 311 ON READER SERVICE CARD
**RTTY LOOP**

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore, MD 21208

## Magnet Circuit Correction

I hate to do this, but I am going to ask all of you to take your seats, get out your notebooks, and turn back a few sections to the notes you look on this column a few months ago. You didn’t take any notes? Shame on you, now you’ll have to go get the magazine itself. Why do I ask such a thing? Because there is a mistake in a schematic, and I don’t want anyone tripping over it.

In the August 1993 edition of "RTTY Loop," I printed a selector magnet circuit designed by Bob Roehrig, K9EU. Unfortunately, somewhere along the line, a part of the diagram entered the great bit bucket in the sky. The corrected portion is shown in Figure 1. Without the missing resistors (R7 and R8), the keyboard would shoot out the 120 volt supply. So, get out your notes or magazine, and pencil in the correction NOW! You never can tell when you might decide to use this versatile circuit, and I’d hate to see you run a perfectly good power supply.

### Digital Communications Terms

Moving right along, here’s a letter from Bob Workman, WA2ZZN of Atlantic Beach, North Carolina, which typifies the confusion which besets the ham entering digital communications.

There are computer programs which simulate a TNC, and there are TNCs which require some kind of terminal, and there are terminal units which are needed by TNCs or programs to work. Bob needs clarification of this whole confusing mess of terms.

We need to begin somewhere, so let’s start with some information encoded in digital pulses. These may be off a loop supply from a mechanical teletypewriter or from a computer. These individual letters or characters need to be formed into the packets needed for packet radio communications. This is the function of the device commonly called a TNC, or Terminal Node Controller. Having formed those packets, the next step is to impress the packets of data onto a radio signal. This may be done by some form of frequency shift keying, either audio frequency shift keying (AFSK) or radio frequency shift keying (FSK)—the former being used in VHF, the latter on HF. Reception is accomplished by receiving the frequency shifted signal, taking the audio output and converting it to off-digital pulses through a demodulator or terminal unit, and then allowing our TNC to disassemble the packets and reproduce the desired communication.

Since conventional RTTY has no need for packet assembly or disassembly, a TNC is not used for this mode, only a terminal unit for reception. Some of the terminal units which have gained popularity in recent years are the HAL Communications ST-5, ST-6, ST-5000, and ST-6000; Fleisher TU-170; and many, many others.

While many hams use TNCs which are small circuit boards external to the terminal or computer, there are programs available for many computers which can create a TNC in software. For these systems, all you need is a radio interface, which may be affected by a terminal unit originally designed for RTTY only.

Conversely, there are many controllers on the market which integrate the TNC and terminal unit—let’s call that a modem to more accurately reflect the transmit (modulate) and receive (demodulate) capability of these devices—into one box. Popular units from MFJ, Kantronics, and AEA can be seen in ads in this magazine.

Now, in the near future I hope to run information on modifying the Fleisher TU-470 to run with some of the software TNCs. The clear answer is that it can be, and is being, done by many hams. This may well represent one of the most economical ways to get onto packet and, with some of the programs around, RTTY and even AMTOR, too! Thanks for the question, and good luck with the endeavor.

### Model 42

Having corrected one, and answered one, now it’s time to toss it out to you guys. I have a letter here from Eugene Matthews, W0UAU from Topeka, Kansas. He writes, “I just acquired an almost new Model 42 Teletype (RO) machine, with power supply. I cannot find anyone who knows anything about this Model 42. I want to use this for hard copy. I need to know what connections to use to hook it up so it will print. Also, what current and voltage does this machine take to operate the selector magnets? The power supply is transistorized and must be 12 VDC output. What is the speed of this machine?”

Well, Eugene, the Model 42 is the end of the Baudot line, as far as I know. With a mod matrix output, it was able to accept TTL, current loop, or RS-232 interfacing. I believe that tape equipment was also available for this model. There was also a Model 43, which was the ASCII version of the Model 42. Buffered versions of this machine were available that could run at higher speeds.

I have no diagrams or specifics on the Model 42 or Model 43, but, somehow, I trust that someone out there in 75-land will share some with us, real soon! Watch future columns for the information, as soon as it surfaces.

Along these lines, folks, here’s a question from me to all of you. I have been looking, very unsuccessfully, for the round, six-pin mike connector for my Sanetc HT-1200 transceiver to try to get it up onto packet. If anyone has located a connector, and wiring information for this antique, I would appreciate hearing from you!

Feel free to contact me for this, or any other related (or non-related) matter at the address above, or on CompuServe at 75036.2501, Delphi at MarcWA3AJR, or America Online at MarcWA3AJR. I look forward to your comments and questions, and yes, the various software collections are still available. Send an SASE for the list, or inquire via Email and I’ll Email a response back to you. A look at that Fleisher modification next month, and maybe a look way, way, back, too! Suspense? I can’t stand it. Just don’t let your subscription to 75 laps! You might miss RTTY Loop!"
More on the Boyd Sweeper

In the September column we looked at the Boyd Electronics RF sweep generator kit. This low-cost device provides CW, Symmetrical Sweep and Video modes. The CW mode operates like a regular signal generator, i.e. it outputs a single frequency for each setting of the 2-30 MHz frequency control. The symmetrical sweep mode is a variable-width swept frequency mode; the width of the sweep portion is a function of the front panel settings. The video mode sweeps the entire RF range for every cycle of the sawtooth sweeping signal. In the original column I promised to discuss in the very next month's column adding circuits that make the generator better. I didn't exactly lie, but other things came up that prevented me from putting that column together on time. This month, we'll keep that promise.

Three obvious improvements for any sweep generator project, including the Boyd unit are: an external step attenuator, a frequency translator for lower frequencies, and a marker generator.

The step attenuator is needed because the sweep generator outputs a rather large signal level (up to 10.0 dBm) and too large for easy testing of receivers and amplifiers in most cases. While the signal level will work well with some tuned circuits and filters, it is inappropriate for nearly any application that has amplification associated with it. A step attenuator (Photo A) provides switch-selectable levels of attenuation that can be in or out of the circuit as needed. In addition, the step attenuator will provide a swamping effect between the signal generator and the circuit under test in case the impedance of one or the other is not 50 ohms, or varies somewhat.

A frequency translator is needed because the sweep generator doesn't cover frequencies below 2 MHz. This limitation does not affect all hams because the IF frequencies in our HF rigs tend to be 8.83, 9.0 or 10.7 MHz well within the range of the Boyd RF sweeper. But for those who need to sweep circuits below 2 MHz, including the once-standard 455 kHz IF frequency (used on Collins mechanical filters, even today), we need to be able to translate the sweep generator's output to a lower frequency. We need a double-balanced mixer (DBM) and a crystal oscillator.

The marker generator is a standard crystal oscillator that allows known frequencies to be injected into the circuit for the purpose of calibrating certain spots on the band. For example, if you use a 9.0 MHz IF in your receiver, you might want to have a 9.000 MHz crystal oscillator to mark the spot on the oscilloscope presentation of the sweep signal.

Step Attenuator

A step attenuator such as Photo A consists of several stages of pi-pad resistor networks, each of which can be switched into or out of the circuit with a DPDT switch or relay (Figure 1). Table 1 shows the values of resistors needed in the pi-attenuator for various popular levels of attenuation. Alternatively, if you want the attenuator to be a little more precise, then use Mini-Circuits AT-series fixed attenuators. These devices are designed to fit onto printed circuit boards and perf boards on the standard 0.100-inch corner holes. The type number, AT-x, is formed by replacing the "x" with the level of attenuation desired: e.g. AT-1 is 1 dB, AT-6 is 6 dB, AT-10 is 10 dB, AT-12 is 12 dB, and AT-20 is 20 dB.

In order to obtain higher orders of attenuation, one need only series connect several lower order stages. For example, to obtain 40 dB attenuation, cascade two 20 dB attenuators, or a 20 dB and two 10 dB attenuators.

In some cases, you might want to use a barrel attenuator. These attenuators are in-line, fixed attenuators that have a male coaxial connector on one end and a female coaxial connector on the other. They can be placed anywhere in the transmission line from the signal source to the circuit under test, although in most cases the preferred location is right at the signal generator output. The attenuator male connector is attached to the RF output connector of the signal generator, while the coaxial transmission line to the load is connected to the female connector on the attenuator. These devices are also available from Mini-Circuits, but at somewhat higher than the printed circuit variety.

One thing that you must do when building a multistage step attenuator is to use real good shielding between successive stages. Any signal leakage around the circuit degrades the attenuation value selected.

Figure 1. Switchable attenuator stage (see Figure 1 for values).

Number 11 on your Feedback card

Joseph J. Carr KA4IPV
P.O. Box 1099
Fall City VA 22041

The RF sweeper input signal is fed to pin no. 1 of the DBM, which is its RF input. This signal must be kept below +1 dBm or the mixer might suffer harm. A series -3 dB attenuator is used to reduce the signal level. Even if the signal level is below the +1 dBm level, some people like to use the attenuator anyway because it provides a "swamping" effect against impedance variations. In the cases, a 1 dB attenuator can be used. Keep in mind that, for situations where the impedances are constant and the signal level is within range (below -1 dBm), the attenuator is optional.

The local oscillator circuit is a standard crystal oscillator circuit with an output amplifier to boost the signal level. Ordinary NPN silicon transistors can be used (2N2222, 2N4411, 2N3904, etc.). The mixer likes to see local oscillator signals in the +7 dBm range for proper conversion, which means, at 50 ohms, 5 mW power level or a peak-to-peak voltage of 700 mV. The crystal chosen should be anything in the 2 to 10 MHz region, so long as you can adjust the sweep generator to be within the difference frequency of the lowest sweep generator output frequency. I chose a 7 MHz crystal because it is one of the standard "microprocessor clock" crystals available at low cost from local parts sources. Crystal suppliers can make any exact frequency you need, or you can use one of the crystal clock standard frequencies, or a 3.579 MHz color TV "color burst" crystal...all at low cost.

The output filters can be easily made from toroidal coil forms or, if you prefer, standard coils obtained from parts suppliers. If you opt to use the toroidal cores, then use T-50-2 (RED) cores. These devices have an AL value of 49, so the following turns counts will suffice:

<table>
<thead>
<tr>
<th>L1, L2</th>
<th>L3, L5</th>
<th>L4</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.14</td>
<td>4.9</td>
<td>8.5</td>
</tr>
</tbody>
</table>

The capacitors in the filter should be either silver mica or NPO ceramic devices, with the latter being preferred over
Figure 2. Circuit for a frequency down translator.

Q1, Q2, Q3
2N2222
2N4401
2N3904
Or Similar

+12 VDC
the former. Because the values of the capacitors are not standard in all cases, combinations of two or three capacitors can be used to achieve the desired value.

The output RF amplifier is the MAR-1 device by Mini-Circuits, and is connected in the standard configuration for that part. Note that there are input, output and two ground terminals, but no V-terminal. In this style of amplifier, the DC power is fed to the MAR-1 through the output terminal.

[Note: I have a small stock of MAR-1 devices, and printed circuit boards for a 1 to 500 MHz broadband amplifier based on the MAR-1 device. The MAR-1 is priced at $4.95 each postpaid, while the boards are $7 each (order board MAR-1D.PCB). The two together, i.e. the MAR-1 chip and the MAR-1D.PCB board, are available for $10. The boards (but not the chip) can also be ordered from FAR Circuits (18N640 Field Court, Dundee IL 60118) for the same price.]

They sell other 73 PCBs as well. If you need more than a few MAR-1 devices (i.e. 20 or more), then you can get them at a lot cheaper direct from the factory because you will go over the minimum order value. My price includes shipping and handling, and is offered as a convenience to readers more than anything else.

Marker Generator

A marker generator is a crystal oscillator on a standard frequency that is used to identify points on the swept curve seen on the oscilloscope. Any reasonably accurate signal generator can be used as long as the method of combining the signals is provided. Two approaches are taken: either the resistor "star" combiner (Figure 3) or the hybrid combiner (Figure 4). The star resistor combiner can be made for any practical number of inputs. Each resistor must be 1/8th the system impedance, where "n" is the number of ports. For this circuit, the system impedance is 50 ohms (standard for RF circuits), and there are three ports, so each resistor is 16.66 ohms. As a practical matter, selected 18 ohm carbon composition resistors will suffice. Use an ohmmeter to find the 18 ohm, 5% resistors that are closest to 16.7 ohms. The hybrid combiner is based on a ferrite toroid. Use 12 turns on an FT-23-72 ferrite toroid. Alternatively, write to Mini-Circuits for their catalog of RF parts, and select a commercially-made hybrid combiner.

### Table 1

<table>
<thead>
<tr>
<th>Attenuation (dB)</th>
<th>Resistance values in Ohms (Ra)</th>
<th>Ra (Ω)</th>
<th>(Rb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$79.95 + 5%</td>
<td>79.95</td>
<td>60.0</td>
</tr>
<tr>
<td>2</td>
<td>$79.95 + 5%</td>
<td>79.95</td>
<td>60.0</td>
</tr>
<tr>
<td>3</td>
<td>$79.95 + 5%</td>
<td>79.95</td>
<td>60.0</td>
</tr>
<tr>
<td>5</td>
<td>$79.95 + 5%</td>
<td>79.95</td>
<td>60.0</td>
</tr>
<tr>
<td>10</td>
<td>$79.95 + 5%</td>
<td>79.95</td>
<td>60.0</td>
</tr>
<tr>
<td>20</td>
<td>$79.95 + 5%</td>
<td>79.95</td>
<td>60.0</td>
</tr>
</tbody>
</table>

---

**CABLE T.V. CONVERTERS**


1-800-826-7623

B & B INC.

3584 Kennebec, Eagan MN 55122

---

**VECTOR FINDER**

Hand-held phase sense antennas for VHF direction finding. Uses any FM XCVR. Compass gives direction. Arms fold for storage. Type VP-142 covers both 2-Meters & 220MHz. Other models available. Write or call for more info.

$5.50 Shipping & Tax (VP-142)

CA. Add Tax $1.30 99

RADIO ENGINEERS 5-13-1319

3941 MT. BRUNDAGE AVE.

SAN DIEGO CA 92111

---

**SLOW SCAN TV**

With the Sound Blaster!

Next Copy 3,12,24,36 sec. B&W, 36 & 72 sec. Color (in B&W), Society 1 & 3 (2 mm) with your Sound Blaster compatible sound card.

Requires PCE, VCA 640-440-286 colors, and Sound Blaster compatible card.

ONLY $49.00 - Shipping $5 Illinois residents $2.95 tax

Harlot Technologies

VISA 6911 Aliva Dr. Dept. 52 - Rockford, Illinois 61108

CIRCLE 187 ON READER SERVICE CARD

---

**SYNTHESIZED ORP CW TRANSCEIVER KIT**

*Superhet single side band receiver.* FULL QSK.

*Synchronized to 100 Hz.*

*RT = + - 500 Hz.*

*IF = 10 MHz.*

*9 VDC powered.*

*Integrated printed circuit board.*

*3.25" X 5.25" X 8.25." 6 5/8 lbs.

*Silentkey encoder.*

*Skewledged P.C.B.*

*GUARANTEED TO WORK.*

*5 watts out.*

*Complete - just add key, power & antenna.*

20 Meter Kit or 40 Meter Kit $286.95

Optional adj. speed Keyer $20.00

Shipping & Handling: Illinois residents add 5% sales tax

To Order Call

S & S ENGINEERING 14720 BROWN RD. SMITHBURG, MD 21783

FAX (301) 415-0661

---

**CABLE T.V. CONVERTERS**


1-800-826-7623

B & B INC.

3584 Kennebec, Eagan MN 55122

---

**SLOW SCAN TV**

With the Sound Blaster!

Next Copy 3,12,24,36 sec. B&W, 36 & 72 sec. Color (in B&W), Society 1 & 3 (2 mm) with your Sound Blaster compatible sound card.

Requires PCE, VCA 640-440-286 colors, and Sound Blaster compatible card.

ONLY $49.00 - Shipping $5 Illinois residents $2.95 tax

Harlot Technologies

VISA 6911 Aliva Dr. Dept. 52 - Rockford, Illinois 61108

CIRCLE 187 ON READER SERVICE CARD

---

**SYNTHESIZED ORP CW TRANSCEIVER KIT**

*Superhet single side band receiver.* FULL QSK.

*Synchronized to 100 Hz.*

*RT = + - 500 Hz.*

*IF = 10 MHz.*

*9 VDC powered.*

*Integrated printed circuit board.*

*3.25" X 5.25" X 8.25." 6 5/8 lbs.

*Silentkey encoder.*

*Skewledged P.C.B.*

*GUARANTEED TO WORK.*

*5 watts out.*

*Complete - just add key, power & antenna.*

20 Meter Kit or 40 Meter Kit $286.95

Optional adj. speed Keyer $20.00

Shipping & Handling: Illinois residents add 5% sales tax

To Order Call

S & S ENGINEERING 14720 BROWN RD. SMITHBURG, MD 21783

FAX (301) 415-0661

---

**SLOW SCAN TV**

With the Sound Blaster!

Next Copy 3,12,24,36 sec. B&W, 36 & 72 sec. Color (in B&W), Society 1 & 3 (2 mm) with your Sound Blaster compatible sound card.

Requires PCE, VCA 640-440-286 colors, and Sound Blaster compatible card.

ONLY $49.00 - Shipping $5 Illinois residents $2.95 tax

Harlot Technologies

VISA 6911 Aliva Dr. Dept. 52 - Rockford, Illinois 61108

CIRCLE 187 ON READER SERVICE CARD

---

**SYNTHESIZED ORP CW TRANSCEIVER KIT**

*Superhet single side band receiver.* FULL QSK.

*Synchronized to 100 Hz.*

*RT = + - 500 Hz.*

*IF = 10 MHz.*

*9 VDC powered.*

*Integrated printed circuit board.*

*3.25" X 5.25" X 8.25." 6 5/8 lbs.

*Silentkey encoder.*

*Skewledged P.C.B.*

*GUARANTEED TO WORK.*

*5 watts out.*

*Complete - just add key, power & antenna.*

20 Meter Kit or 40 Meter Kit $286.95

Optional adj. speed Keyer $20.00

Shipping & Handling: Illinois residents add 5% sales tax

To Order Call

S & S ENGINEERING 14720 BROWN RD. SMITHBURG, MD 21783

FAX (301) 415-0661
ULTIMATE MODIFICATION BIBLE
MOST COMPLETE. MOST CT. IN T. THE (1) 930 AM. 
OVER 1250 FM RADIO CIRCUITS. 
OVER 690 TV SCHEMAS. 
OVER 50 COMPLETE CB/AM/FRS CIRCUITS. 
OVER 24 2 IN/STEREO CIRCUITS. 
OVER 540 CB/AM/FRS CIRCUITS. 
OVER 50 SAT. TV CIRCUITS. 
OVER 90 VHF/UMF CIRCUITS. 
OVER 1300 RADIO CIRCUITS. 
KDC SOUND 1-800-256-9895 
5 PINE MEADOW 
CONROE, TX 77302 
$29.95

THE FAMED 2 METER
A.S.A. 9209
+9 db Co-Linear "MultiWave" Base Station Double 5/8 over 1/4 wave delivers up to +9 db gain. All fiberglass & solid aluminum construction. Fits masts up to 1-1/2". 2 Meter Base Station 10' length.

Made
in
USA
$32.43
(SIC RES. 5% SALES TAX)
CHECK IN ADVANCE OR C.O.D.
ALSO AVAILABLE IN 220 & 440

"Service is the Reason For Our Success"

ASA
Model 9209
+9db

BATTERIES
BUY DIRECT FROM US, THE MANUFACTURER!

SPECIAL
FOR THE
MONTH OF NOVEMBER
10% OFF
ON ALL
MASTERCHARGER I & II
Replacement Battery Packs
LOOK FOR DECEMBER'S SPECIAL OF THE MONTH
MONTHLY DISCOUNTS APPLICABLE TO END-USERS ONLY

BY AMERICAN, BETTER PRICE AND QUALITY
The SG2000 HF transceiver is type accepted for commercial and marine service masts with traditional U.S. commercial radio quality (and of course it can be used on the haul bands also). While the Japanese radios have 2 final transistors that drain to put up 100 watts on the low bands and only 75-85 watts on ten meters, the SG2000 has 4 large transistors that load along at 150 watts on ALL THE BANDS (INCLUDING 10 METERS) Some of the SG2000 features are: 1) A control head removale (no special kit necessary) up to 100' away from the rig, perfect for automobiles and boats. Up to 8 heads can be utilized and used as intercoms also. 2) The largest display of any HF transceiver. 3) 644 pre-programmed memories and 100 user programmable memories. 4) Operates from -50 (-54c) to 155 (-85c). You want quality right? Here is what EVERY SG2000 must endure before they're shipped from the factory: 1) They're factory aligned, 2) EVERY SG2000 is keyed down at full power (CW 150 Watts) into an open antenna for about 10 seconds, then connected to a stored antenna and keyed down for an additional 10 seconds. 3) EVERY SG2000 is put in the "BURN-IN" rack and keyed down for 24 hours non-stop at full power CW. Don't try that with the foreign radios. 4) EVERY SG2000 is then re-checked for alignment and put in the "TOUGHER RACK" where they are keyed on and off every 10 seconds for 24 hours. 5) The SG2000 is then re-evaluated and all control functions are verified to ensure that the microprocessor is up to spec. THEN AND ONLY THEN IS THE SG2000 ALLOWED TO LEAVE THE FACTORY.

The bottom line is price, you know how expensive commercial rigs are normally, until DEC 01 we are selling the SG2000 BELOW DEALER COST at only $1,585.00 each! That's a $400.00 savings! We guarantee the best price.

The SG230 SMART-TUNER is the best HF auto tuner at any price, and to promote a product that is made in the USA, we're offering it at the guaranteed best price of only $549.00! WHY THE SG2307 BECAUSE: When you tune an antenna at the base you are resonating the antenna, instead of just matching the coax to the radio as with other tuners such as the AT50, etc. The result YOUR SIGNAL GETS OUT MUCH BETTER. The Kenwood AT50, AT450 and other similar tuners can only match 3:1 mismatch (YES only 3:1) so forget matching anything but a fairly decent antenna. The SG230 can match from 0.5 Ohm to 10 kilohm antennas (up to a 200:1 mismatch), so it can easily match random wires, dipoles, rain-gutters, shopping cart handles, etc. The result MORE POWER.

To order, send check or money order with $8.50 for shipping, along with your shipping address (sorry no U.S. Post Office Stamps, UPS will not deliver) and Telephone number.

Joe Brancato
THE HAM CONTACT
PO Box 3624, Dept 73
Long Beach, CA 90803
CA Residents Add 8 1/4% Sales Tax. Canadian Residents please send U.S. Money Order + $17.10 for shipping.
If you wish more information please send a SASE to the above address. For COD orders, call (310) 433-5860, outside of CA call (606) 933-1044 and leave a message.

BATTERY CHARGERS

YAESU/MAXON
FNB-2 10.8v @ 600 MAH
FNB-3A 9.5v @ 1200 MAH
FNB-4 12v @ 750 MAH
FNB-4A 12v @ 1000 MAH
FNB-10(S) 7.2v @ 1150 MAH
FNB-12(S) 12v @ 600 MAH
equivalent to FNB-11 (2" shorter)
FNB-17 7.2v @ 600 MAH
*Same size case as FNB-12
FNB-25 7.2v @ 600 MAH
FNB-26 7.2v @ 1000 MAH
*FNB-26S 7.2v @ 1200 MAH
*FNB-26A 9.5v @ 800 MAH
*Same size as FNB-26A case
FNB-27 12v @ 600 MAH
**FNB-27S 12v @ 800 MAH
**FNB-27A 12v @ 600 MAH
**FNB-27B 12v @ 800 MAH
**FNB-27C 12v @ 1000 MAH

By simply changing adapter cups the MASTERCHARGER® will charge any Yaesu, Motorola, Icom, Kenwood, Alinco etc. 2-Way Radio Battery

MASTERCHARGER I & II

Sold in the U.S.A. in small quantities. AGE 23 1/2. Made to order only.

Prices and specifications subject to change without notice.

W & W ASSOCIATES
800 South Broadway, Hicksville, N.Y. 11801
WORLD WIDE DISTRIBUTORSHIPS AVAILABLE. PLEASE INQUIRE

In U.S. & Canada Call Toll Free (800) 221-0732 • In NYS (516) 942-0011 • FAX: (516) 942-1944

CIRCLE 384 ON READER SERVICE CARD

CIRCLE 191 ON READER SERVICE CARD

CIRCLE 18 ON READER SERVICE CARD

CIRCLE 151 ON READER SERVICE CARD

CIRCLE 151 ON READER SERVICE CARD

73 Amateur Radio Today • November, 1993 61
Radio Direction Finding

Understanding of signal characteristics than an S-meter alone, particularly when hunting among tall buildings or hills that bounce and scatter 2 meter signals.

"Homing In" covered theory and advantages of polar displays in detail with actual trace photos in October 1992. KK6CU's home-brew mobile implementation of the scheme was featured in the following issue, complete with motorized quad and storage scope indicator. Now two T-hunters from Santa Barbara, California, have found a way for penny-pinching linkers to have a polar display and motorized beam without the expense of a storage monitor and the hassle and noise of RF slip rings.

Look! No Slip Rings!

Tom King K6GSO works in marine electronics at the Santa Barbara harbor. Kerry Provancha K6EOS enjoys mechanical engineering challenges. Together, they created the RADAD, which stands for "Radio Detection And Direction" (see Figure 1). As passers-by admired it at a recent ham radio swap meet, I interviewed them and they eagerly told me how it came about.

K6EOS: "We were looking for a long persistence phosphor cathode ray tube (CRT) display, rather than a storage scope, because a storage scope needs to be cleared all the time."

K6GSO: "I happened to get some junk marine radars. The magnetron transmitting tubes had crooked or the high voltage boards had gone up in flames. They're economically unrepairable for marine service because I can't get tubes or power supplies a reasonable cost. Fortunately, those parts aren't needed for RDF."

K6EOS: "Of course, the microwave transmitter, receiver, and horn antennas were of no use, but we retained the rest of the radar essentially intact. We changed the antenna drive motor because we wanted different rotation speeds (see Photo A)."

K6GSO: "Sometimes we want to paint the RDF picture slowly and sometimes fast, depending on what the hider is doing. So we used a 360° reader, which is available."

HOMING IN

Motorized Beams, Santa Barbara Style

One reason that VHF hidden trans- mitter hunting is a growing activity for ham clubs is that it's inexpensive to get started. You can go on loxhunts or T-hunts (as these events are called) with the 2 meter radio you have now, if it has an S-meter.

A quad, yagi, or other radio direction finding (RDF) antenna is cheap, especially if you make it yourself from PVC pipe and wire or from scrap TV antenna tubing. Add an RF attenuator made from some toggle switches, carbon resistors, and copper-clad board, mount the beam on your car, and you're set. Such a setup is more than adequate to win many hunts, with practice.

However, like participants in any other sport, T-hunters are always looking for an advantage over the competition. Decades ago, they discovered that a polar display of signal strength versus direction gives a much better

Amateur Radio Language Guide

- Hundreds of phrases, especially for the ham radio operator
- Vol. 1 - French, Spanish, German, Japanese, Polish
- Vol. 2 - Swedish, Italian, Portuguese, Greek, Norwegian
- Vol. 3 - Russian, Danish, Czech, Korean, Hawaiian
- Vol. 4 - Chinese, Dutch, Finish, Romanian, Vietnamese
- Vol. 5 - Hungarian, Arabic, Phelipino, Turkish, Indonesian

Send $10 per volume U.S., $12 outside U.S. to:
ROSE, P.O. Box 796, Mundelein, IL 60060-0786

Speak To The World

CIRCLE 134 ON READER SERVICE CARD

CIRCLE 330 ON READER SERVICE CARD

Microprocessor Based Development Systems

DTMF Decoder $89.95

DTMF-1. Decodes, stores and downloads DTMF to PC. The heart of a complex DTMF controller system.

Fox Hunt TX Controller $69.95

FC-1. Controls 2 IDs, ID interval, delay start time. Programs from PC.

68HC11 Microcontroller $59.95

SBC 2. Develop your own microprocessor project! Programs in assembly completely from PC.

All are low power CMOS, <30 ma, 5 volts DC. Small size, 3.1" x 3.4". Complete documentation included. Add $2.50 for shipping, MD residents add 6.5% tax, Pre-paid or COD only.

LDG Electronics
1445 Parran Road
St. Leonard MD 20685
410-586-2177

CIRCLE 382 ON READER SERVICE CARD

CIRCLE 381 ON READER SERVICE CARD

MAKE CIRCUIT BOARDS THE NEW, EASY WAY

WITH TEC-200 FILM

JUST 3 EASY STEPS:
• Copy circuit pattern on TEC-200 film using any plain paper copier
• Iron film on to copper clad board
• Peel off film and etch

Convenient 8½ x 11 size
With Complete Instructions
SATISFACTION GUARANTEED
5 Sheets for $3.95 10 Sheets only $5.95

$1.50 postage

NY Res. add sales tax

The MEADOWLAKE Corp.
Dept. TE P.O. Box 497
Northport, New York 11768

CIRCLE 249 ON READER SERVICE CARD

CIRCLE 248 ON READER SERVICE CARD

CIRCLE 198 ON READER SERVICE CARD

CornerBeam?

S9R = 1.21x across the band
Gain of a 1.5 ft Yagi
No-dimension over 7 ft
40 dB Front-to-Back Ratio
60° Half-power Beamwidth
Mount directly to mast
Vertical or Horizontal Polarity

22½" dia x 23½" od x 70 cm x 115. Dual 144/449 $165

Weights only 10 lbs. Add $11 Shipping & Handling. Info $1.

AntennaWest
Box 50062 Provo UT 84605
Order HotLine
801-373-8225

CIRCLE 580 ON READER SERVICE CARD

Quality Microwave TV Antennas

WIRELESS CABLE ~ FTS ~ MMOD ~ Amateur TV
Ultra high Gain 50dB-+ ~ Tunable 1.8 to 2.7 GHz
50-Channel Dish System $169.95
35-Channel Dish System $149.95
20-Channel Dish System $124.95
Optical Commercial Grid Antenna (not shown) Add $100.00
• Yagi Antenna, Components, Custom Tuning Available
• Call or write (804) for "FREE" Catalog

PHILLIPS-TECH ELECTRONICS
P.O. Box 8633 - Scottsdale, AZ 85252
(602) 947-7700 ($1.00 Credit all phone orders)

CIRCLE 249 ON READER SERVICE CARD

CIRCLE 248 ON READER SERVICE CARD

CIRCLE 198 ON READER SERVICE CARD
K6OS: "We compare receiver S-meter voltage with the ramp voltage. The comparator triggers a one-shot to produce pips, replacing the radar pulse. It pulses the CRT cathode negative for 1.5 microseconds. The S-meter voltage compared against the ramp determines how far out on the screen from the center you get pips. The resolver tells where on the azimuth circle to put the pips."

K6OS: "So at 200,000 pips per second, it looks like a continuous line is being drawn on the screen."

K6SOX: "Right. Full scale on the S-meter equals maximum deflection to the edge of the screen. The interface was done with one LM393 quad op amp IC."

K6OS: "What about your antenna design?"

K6SOX: "We went through about a half dozen iterations of the antenna."

K9OS: "We tried to make one that would fit inside the radar’s plastic radome so there would be no wind-loading. But it was a negative gain antenna without a decent pattern. It would probably work on 450 MHz, but not on 2 meters."

K6OS: "So you made a full-sized 2 meter beam to get good sensitivity?"

K6SOX: "Yes. We solved the rotatory joint problem by using an AEA half-wave whip antenna as the fixed-mounted driven element. The directors and reflectors rotate around it. It gives a beautiful pattern."

K6OS: "There are no slip rings. The driven element mounts on a BNC that never rotates, so it’s noise-free (see Photo D). The coax goes right up through the center of the waveguide where the output radius is used. The antenna is a three-element yagi, made of a PVC pipe upright and crossbar. Two directors and a tringal reflector rotate around the driven element. It’s all painted stealth black and sits on a rack that bolts to the car-top carrier (see Photo E)."

K6OS: "We solved the tringal reflector used for a better pattern or for mechanical balance?"

K6SOX: "Both. We had a single reflector at first. When we changed to the tringal reflector, the lobes on each side dropped by 5 dB and the back lobe completely disappeared. We measured 0.7 dB more gain, too."

K6OS: "Now the antenna was mechanically balanced almost perfectly."

K6OS: "But we discovered that mechanical balance is not the same as wind-load balance. Even with the triple reflector, when we were going down the road at 40 MPH, it would stall. We then added a small fin on the back. Now we can drive up to 55 MPH with no problems."

K6OS: "How do you shrink the display size as you close in?"
Figure 1. The RADAD is made from a defunct marine radar display unit and rotary coupling assembly, added to a 2 meter receiver, attenuator, and PVC pipe yagi.

KA6SOX: "With an RF attenuator, it's based on the offset attenuator in QST for November 1992. We changed the offset to 1 MHz and use a crystal-controlled oscillator, plus better shielding."

KK6OS: "The continuously variable electronic attenuator has been the biggest single improvement to the whole system. It makes it easy to keep the display on screen. Before that, we used a switchable resistive attenuator, which was hard to use because of the large step sizes."

KOOV: "Tell me about hunts in Santa Barbara."

KK6OS: "We have all kinds, including mileage hunts (lowest odometer miles wins), time hunts (first finder wins), and combination time/mileage hunts. The hider decides. Most are time only. We hunt on the fourth Saturday night of the month on 146.565 MHz."

KA6SOX: "A few months ago, the hiders wove the antenna inside a volleyball net at the beach. They used RG-174 coax, painted the color of the volleyball tape along the bottom. It was then painted yellow along the pole all the way down into the sand, where the transmitter was buried, running about 50 watts. I'm pretty sure the vertical pole was a non-tuned reflector. We found the general area easily, and the hiders were sitting right there roasting winners. The big problem was finding the antenna and the radio."

KA6SOX: "Some T-hunts in Santa Barbara have become absolutely insane. They're not like Los Angeles All-Day hunts, where the T is miles and miles away. But dirty tricks by the hiders are allowed. They do all kinds of weird things, like swinging beams and hiding multiple Ts."

KK6OS: "I started it, I guess. On one hunt, we synchronized two transmitters. When one came on, the other one went off, and so on. They were on two different mountaintops. We were trying to screw up the Doppler users so they would get an indication that wasn't this way, then that way. My former T-hunt partner has the control box for the synchronized T's and he likes to use it. Other hams have come up with their own schemes for doing it too."
KYO: “Have you won any hunts with the RADAD?”
KYS: “I won with it in June, so I hid in July. When I hid, I used the spinning RADAD antenna in a parking garage downtown. I set the antenna at the floor at a middle level of the garage, rotating at 20 RPM. I transmitted 5 watts SSB modulated with a pulsed 500 Hz tone, a quarter second on, then a half second off. I was trying to make the Doppler RDFs go wacky. It didn’t do that, because one guy found us in 15 minutes. But another hunter ended up miles away in the wrong direction from where we started, and three teams gave up without finding us.”

KYO: “So your system does a great job finding tough T’s, right?”
KYS: “It’s still experimental. We don’t consider it to be a breakthrough, but it’s quite a step forward in distinguishing what is a signal reflection and what is not, which the Doppler cannot do when the two are equal in level. However, it requires a skilled operator to interpret it.”

KYO: “Up here in Santa Barbara, hunters often pulse the signal. If they picked just the right pulse rate and our antenna was going at just the wrong speed, the CRT screen became useless. On a couple of hunts, I wasulling my hair out. I could not get a reading, because they were pulsing exactly three times for every rotation of the unit. Since then, we changed the motor control to a 0 to 140 RPM. With the long persistence P7 CRT at night, you can see 15 to 20 traces superimposed at 140 RPM.”

KYO: “What radar models do you recommend for readers who want to make their own RADAD?”
KYS: “Models 2600 and 2800 are the best. Raytheon designed and imported them, but they were made by Japan Radio Corporation. They’re also known as the Mariner’s Pathfinder. They were produced between 1970 and 1976. Raytheon sold 35,000 of the 2600s worldwide, and around 8,000 of the 2800s.”

KYO: “Are these radars available?”

KYS: “Sure, but who knows how many are still in service and how many are at the bottom of the ocean! They have longer service life than most radars of the 70’s because they don’t have a rotating yoke assembly to fail. There are probably 35 or 40 still in use on the thousand or so boats in the harbor. I saw a used one being installed on a boat about three weeks ago.”

Let’s Try It

After the swap meet, I rode along as Tom and Kerry demonstrated the RADAD on a beginners’ hunt sponsored by the TRW Amateur Radio Club. The system worked smoothly and quietly, giving excellent scope patterns. In just a few minutes, we arrived at a parking lot where the hidden signal was super-strong. None of us had brought “sniffing” equipment, so I tuned to the third harmonic of the hidden T signal with my dual-band handheld, got a bearing by body shielding, and started walking. Five minutes later, I tracked down the antenna 15 feet up in a tree.

Tom and Kerry have found a simple, yet elegant scheme for feeding a continuously rotating beam. Waterproofing is easy and there are no slip rings to make noise or cause losses. The main disadvantage is that only vertically polarized yagis can be fed in this manner, a problem in areas where hiders are allowed to use horizontal polarization.

You can’t buy a RADAD, but if you’re a knowledgeable builder, you can assemble a similar system. With careful scrupling, you’ll preserve your T-hunting gasoline fund. It’s time to hit the swap meets and make friends with your local marine electronics tech!
The Invention Connection

In the July 1992 edition of 73 Amateur Radio Today, I wrote a column called "Invention Versus Innovation." I discussed different techniques a teacher can use in the classroom to help children develop inventive thinking skills. Amateure radio in the classroom allows the teacher to bring out the very best in creativity and analytical skills in the students. I received an excellent response to this column from other teachers who shared their experiences with me after following some of the suggested activities.

One of the interesting letters I received was from William L. Enter, Sr., KB5NUJA, founder and past president of the "Invention Development Society, Inc." He points out that inventing is a prized human trait. It sets one apart from others in a unique way. Few people develop their ideas to the practical stage and still fewer to the patenting stage. Congress created the Patent Office in 1836, yet the five millionth patent was granted only last year. William holds three U.S. patents and has invented at least 58 electronic circuits. Says he has there are many opportunities for young minds to benefit from an invention program. "We could use some new electronic circuits," says William.

He has been working with the Oklahoma Student Inventors Exposition since April 1982. This program is designed for grades K-12. Statewide participation has annually been as high as 4,428. The organization teaches teachers how to teach thinking skills and problem-solving skills to their students. The students learn to do analytical thinking and creative problem-solving on a daily basis in all subject areas. The children are then required to research their community for an unmet need and to invent something which serves that need. They must produce a novel response that solves the problem at hand. Their inventions must be a simple, elegant, aesthetic solution to a real everyday problem. Kindergarten tend to do better than 12th graders. I bet that most of the teachers reading this column recognize why that is so.

One of the necessary traits to being truly creative or inventive is to have a mind-set that is basically uninhibited. Younger children seem more apt to have that.

There is a National Creative and Inventive Thinking Skills Conference every year, held in a different city each time. If you would like more information about the conference or about the Oklahoma Student Inventors Exposition, contact Ms. Betty Wright at (405) 677-3131. She is a Regent for Osca Rose State College in Oklahoma City and has a TV show called "Matt Counts." She teaches gifted and talented children in the Oklahoma City schools. The "Guidelines" brochure for the contest is free to Oklahoma teachers; $1 postpaid for out-of-state orders. There is a price reduction for 10

CABLE TV DESCRAMBLERS
Best Prices in the U.S.A.!
Guaranteed to Work!

JERROLD PANASONIC
Scientific Atlanta Pioneer

The Newest & the Latest
DM IT B A - all Jerrold Impulse & Starcom series
SA 3- D F A - all Sci. Atlantas incl. 8536, 8536+, 8580, Drop-field
PN-3 A - all Pioneer systems
also
FTB3, SA3, T ZPC1 45G
24 HOUR SHIPMENTS
30 DAY MONEY BACK GUARANTEE
FREE CATALOG & INFORMATION

1-800-772-6244

U.S. Cable TV, Inc. Dept: K73113
4100 N. Powerline Rd. Bldg. F-5 Pompano Beach. FL 33073

NO FLORIDA SALES!

CIRCLE 102 ON READER SERVICE CARD

CABLE TV SHOPPERS

ORDERS: 1 (800) 231-3057
1 (713) 729-7300 or 729-8800
FAX 1 (713) 729-4766
New and Used Meters, Tubes, Transformers, Filter Capacitors
And More
FREE List Call

Madison Electronics
12310 Zavalla Street
Houston, TX 77065

CIRCLE 25 ON READER SERVICE CARD

ONV SAFETY BELT CO.
P. O. Box 404 • Ramsey, NJ 07446
800-345-5634
Phone & FAX 201-327-2462

ONV Safety Belt With Seat Harness
$89.95

OSHA
We Ship Worldwide
Order Desk Open 7 Days/Week

ONV Tool Pouch $15.95
Add $4.00 For Handling VISA/M/C CHECK
ONV Belt W/O Seat Harness
$74.95

CIRCLE 102 ON READER SERVICE CARD

CIRCLE 121 ON READER SERVICE CARD

PCRC

Speaks for Itself

• Full Duplex Autopatch
• 911 Emergency Access
• Reverse Autopatch
• Voice Mail
• Voice ID’S
• BSR X10
• Voice/Tone/DTMF Paging
• Scheduler
• Links
• Programmable Courtesy Tones
• Hardware Logic I/O
• HF Remote Control
• Morse Code Practice
• Remote Base

PCRC2 Combines the power of your XTI/AT Platform with a high quality play and record voice digitizer creating the ultimate repeater controller. $ 695

CIRCLE 198 ON READER SERVICE CARD

CAN YOUR ANTENNA SOFTWARE DO THIS?

Easy to use Quickyagi does this and everything else that you'd expect from a high performance yagi optimizer and design program, and does it with blazing speed!

RAJ Enterprises (602) 849-6785
4508 N. 48th Dr. Phoenix, AZ 85019

Quickyagi

CIRCLE 419 ON READER SERVICE CARD

919

Performance is based on a 15° Vertical Gain

Dan's 3-5$500 for orders outside USA
Add 3.00 S/H for orders outside USA
US Check or MO • 3.5 or 5.25 DC only
Ask for add $5 Mac
SAGE for info
more. The organization has a 501(c)3 tax-exempt status.

The Teacher's Role

William Enter has volunteered to speak with anyone who has questions (405) 376-2362. When he says he believes as I do that the teacher is the one who must set the environment for youngsters to feel free to explore, to experiment, to question, and to discover. It takes a special kind of teacher to get the point across to children that it's okay to be wrong or to fail at something once in awhile. What's important is that burning desire to keep on trying and to experiment with new ideas.

There are three great quotes that are good to use with children in a classroom setting. It's always fun and enlightening to ask the kids to explain the meaning of the quotes:

"A child is someone who will take over what you have started"—Abraham Lincoln.

"Imagination is more important than knowledge, for imagination embraces the world"—Albert Einstein.

"Man's mind, when stretched over a new idea, will never return to its original size"—Thomas Jefferson.

I've been teaching "Introduction to Amateur Radio" to sixth, seventh and eighth graders for more than 13 years now, and I'm always amazed at the creative and inventive projects the children do in the radio program. I often invite guest speakers in to my classes. Many hands that we speak with on the air are more than willing to come to the school and share their experiences with the kids about things they have built or created in their shack. It's a great motivator!

Please write and let me know if your class has a future Edison in it. Let's share ideas that are successful; ideas and activities that motivate children to be creative are what we're all looking for. You can always get good ideas on the "CG All Schools" net with Gordon West WB6NOA and myself on Tuesdays and Thursdays at 12:30 EST on 28.903 MHz, after 10 minutes try us on 21.325 MHz. We'll be listening for you!

*Photo A. The Honorable Governor (Oklahoma) David Walters issues "Governor's Commendations" to the top eight winners and their teachers of the 1993 Oklahoma Student Inventors Exposition.
**Low Power Operation**

Michael Bryce W8BVGE
2225 Mayflower NW
Massillon OH 44646

Small, crystal-controlled transmitters like the Ryan Communications exciter described the other month are great fun. Crystal control does have one drawback, however: You're stuck on one frequency.

At first I was working on a simple VFO for the Ryan exciter. After a few days on the bench, my simple VFO became rather complex. My Ryan exciter is on 30 meters, so the need for a wide frequency swing seemed like overkill. A better, and perhaps simpler way, to move around the 30 meter band was to swing the crystal's frequency—a VXO. The Ryan exciter’s oscillator will not allow VXO operation as is, so I tried several different variable capacitors in series with the crystal, with lackluster results. I then tried building a completely new and different oscillator on a small piece of perfboard. I really did not want to make major changes to the Ryan exciter, so I built a second board containing the VXO.

The oscillator is broadband, thanks to T1. An 2N5179 will develop more than enough umph to drive the Ryan exciter. If you don’t have a 2N5179, a metal case 2N2222A will work fine, too. The output of G1 goes to the broadband transformer T1. The primary of T1 consists of 20 turns of #26 enamel wire on an FTF3743 core. The center tap is at 13 turns from the collector end of T1. The secondary has four turns of #26 wound over the entire core. Don’t bump this secondary winding all up on one end of the core—spread the turns over the entire core.

The resistors on the output of T1 place a slight load on the oscillator. A 0.01 pF capacitor couples the output from the oscillator into the Ryan exciter. You can use any variable capacitor for C1 as long as you don’t go over 50 pF. Use a quality variable capacitor for C1 as you’ll be running this circuit back and forth through its range a great deal. A double-bearing capacitor would be grand, but they are kind of hard to find. Check with K4TOJY Components (P.O. Box 7870, Jackson WY 83001) for his list of variable capacitors.

The crystal used for the VXO should be a fundamental crystal in an HCPS0U holder with a parallel resonant frequency of 20 or 30 pF. Don’t get high tolerance crystals—tolerance of 0.01% is fine for the VXO. Crystals mounted in the FT-43 holders do not work well with VXO circuits.

There are two methods of getting the oscillator to talk to the Ryan exciter. Either one will work, and both require some changes or additional circuitry to work.

The best method is to re-work the crystal oscillator of the Ryan exciter to work with the new oscillator, I tried to couple the new oscillator into the base of the Ryan exciter. This will work if you’re really into milliwatts (I was only able to get about 300 milliwatts from the exciter).

To get full exciter output you’ll need to change some components in the Ryan oscillator. The first step is to change the 820k resistor on the base of the oscillator transistor, 2N4124, to 10k. Remove the 270 pF capacitor from the base of this transistor. These two changes now make the oscillator on the Ryan exciter into a buffer/amplifier. You can still key the exciter as usual by grounding the emitter of the 2N4124. Connected this way, the output of our VXO, coupled to the base of the 2N4124 on the Ryan exciter, will provide operation exactly like a crystal-controlled exciter.

There is one catch in running the VXO and Ryan exciter this way: You have to keep the external VXO running all the time. You key the Ryan exciter by grounding the emitter lead of the 2N4124. This normally keys the crystal oscillator. Since we’ve changed the oscillator into an amplifier, the external VXO must run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously. There are two fixes to this problem. First, just key the Ryan as usual. There is another oscillator you can use to control the oscillator. The second oscillator will run continuously.

Thurline Directional Wattmeter—

The worldwide standard in directional wattmeters.

- Accurate within +/−5% of full scale reading.
- Measures forward or reflected power in coaxial transmission lines under any load condition.
- Power range from 100 mW to 10kW, frequency range from 0.45 to 2300MHz.
- Utilizes Bird’s “QC” quick change connectors for interchangeable field operation without recalibration.
- Built-in remote-reading capability.
- Peak reading version available.

Call or write today for more details on the industry Model 43 wattmeter and to receive a complete Bird catalog.

30033 Aurora Rd., Cleveland, OH 44139 U.S.A. • (216) 240-1200
TLX: 708888 Bird Elec UD • FAX: (216) 249-5426
WESTERN REGION OFFICE: Ojai, CA • (805) 646-7255

**“FIBERWHIPS”**

Mobile HF Antennas

**ASA**

MODELIMTR MI-7Z

HFA 6 50.0-54.0
HFA10 28.0-29.7
HFA12 24.8-24.99
HFA16 20.0-21.01
HFA17 18.1-18.6
HFA20 14.0-14.35
HFA30 10.1-10.15
HFA40 7.0-7.3
HFA75 3.5-4.0

**MADE IN U.S.A.**

$16.50 EACH

• +60% Gain

(50 Residues Add 3% Sales Tax)

Check in Advance or C.O.D.

HEAVY GAUGE NICKEL-CROME BRASS FITTINGS 336 n 772 POWER APPROX. 8" LENGTH AVAIL. IN BLACK

ASA PO Box 3461 Myrtle Beach, SC 29578
1 - 800 - 722 - 2681

CIRCLE 176 ON READER SERVICE CARD

CIRCLE 18 ON READER SERVICE CARD

68 73 Amateur Radio Today • November, 1993
Getting Started in TCP/IP, Part 2

Last month we started a series of articles on TCP/IP over ham radio, including how to do it. The first installment explained what TCP/IP is and why it has advantages over the more familiar AX.25 "packet" protocol that is found on most hams today. Let's take a look at what you need to set up a working TCP/IP station and where to get it.

TCP/IP (Transport Control Protocol/Internet Protocol) is a way of moving various sorts of data in various sorts of packages. Associated with IP are a number of protocols for moving mail, bulletin boards, and data files—as well as ways of connecting or real-time discussions. We'll explore all of these in this series. First, let's look into what is needed to connect to the world of IP. What do you need to do this?

The "native" packet radio protocol VX.25 is usually built right into the firmware of a ham radio for "packet." The TNC (Terminal Node Controller) has a small processor and some firmware in ROM (Read Only memory) that can talk right to a dumb terminal and radio. All that is needed to connect the pieces together is the appropriate cables and the station on the other end.

While TCP/IP uses pretty much the same pieces as an AX.25 station, the bits get switched around a bit. The AX.25 station frequently reprograms a computer as the dumb terminal, and the software may require that a handshaking protocol be used at any time. There is no "handshake" communication required.

As you might guess, multi­tasking is very CPU-intensive as well. This means that an IP station PC will be happier with a faster CPU. The simple rule is: the faster the better. Slower CPUs will produce various sorts of errors when they are loaded down with IP activity. Remember that the IP station must listen to you and the radio at the same time as it does its housekeeping. The station's use determines this load. A full-service host will run reasonably well on a 286/12 computer, but much better on a 386/25.

Some programs and data files need to be run on UNIX so that they are not too large. You could conceivably run an IP station on a floppy-based machine. On the other hand, even a small hard disk is a big improvement. Also, if you intend to run a full-service host, you will probably want to offer files for FTP (File Transfer Protocol) download. You'll need someplace to keep these.

The TNC

A TNC for IP station use does not need to be anything special. Basic IP operations at 1200 baud can be done with any TNC that offers KISS mode operation. The least expensive boxes, like the PK-88 from AEA, do fine at this speed. However, if you are in a high activity area, or want to have a TNC available to "backbone," you'll want to consider fancier options.

Most activity in digital ham radio world today runs at 1200 baud. This is the normal data rate for AX.25, and is standard on just about every TNC you can buy. Higher data rates are generally more desirable, but 1200 is entrenched. The backgrounds, though, usually run at 9600 baud or faster. There is a trend to faster user port speeds with a considerable contingent proposing a just right to 9600 baud. How does this affect your choice of TNC? Just keep this in mind, and think about something that can be upgraded to a higher speed, even if you don't do it now.

The Radio

As far as radio choice is concerned, IP adds nothing to the requirements. A good choice for packet is a good choice for IP. When looking for a radio, keep these requirements in mind:

Choose something modern. With used radios being just fine, it should be a newer model if possible. Digital radio requires the radio to switch from receive to transmit very frequently. The delay in going between modes is called "switchover" time. This delay needs to be as short as possible to ensure good performance.

Choose something powerful. Though you can use a handheld for packet or IP, it is a risky proposition. For a radio LAN (Local Area Network) to work right, every station (called a node in LAN terminology) must be able to hear every other. With a low-powered station on the net, disruption and unreliable connections are likely. The power requirement varies with the particular LAN. The further the nodes are spread geographically, the more powerful the transmitter needs to be. If you are thinking about using an amplifier on a handheld, consider this: It may not switch fast enough to work at higher speeds. Even COR (Cariner Operated Relay) style transceivers usually work at 1200 baud, but higher speeds are not always possible.

Choose something sensitive. This is just the flip side of the power­ful. With a good "ears" your receiver and transmitter will work better. You need an omnidirectional antenna, not a beam. Remember, all the other stations have to be able to hear you for things to work right. A beam is only appropriate in a limited number of cases. Put the antenna up as high as you can and use good coax—remember that loss goes way up with frequency.

The Software

The rest of the articles in this series will discuss installing, configuring, and maintaining JNOS—a full-service variant of KA9QI NOS. The executable is for MS-DOS­based machines, and is frequently updated by the author, Johann WG7J. I chose to use this implementation for several reasons:

It is popular.

It is widely available.

It has a stable working version with very few bugs.

It has all the features needed for a full-service host.

It will work as an Internet gateway. It has a reasonably good user interface.

I am using it here. JNOS offers all of the host and client services currently available for amateur TCP/IP. For the end user, it offers a decent user interface, a split­screen terminal for AX.25 connects, POP mail (more on this later), and up to nine concurrent sessions with hot key switching. For the PBBS operator, JNOS offers superb mail connectivity (normal packet mail plus SMTP and POP servers), excellent security.

My choice of JNOS should not be considered as disparaging any other implementation. There are lots out there, and all have strengths and weaknesses. Each implementation is slightly different, so I had to choose just one. If you have a machine for which JNOS is unavailable, don't feel you can't use the system and compile a version—or you can find something else that works. While another implementation will not be identical, above the detail level you will still find the information presented here useful.

Getting JNOS

We will be working with JNOS version 1.07b. I will offer two ways to get it but, with a little ingenuity, I am sure you can find it elsewhere. First, if you have anonymous FTP access to the Internet, you will find the MS­DOS executable and source at:

    ucsd.edu

    In the directory:

    /hamradio/packet/tcpip/jnos

    The files are:

    jnos107b.exe (executable)
    jnos107b.zip (source)
    jnosdoc.zip (documentation)

Get the executable and documentation files. If you want to compile a special version, get the source. (NOTE: If you don't know what "FTP" is, don't worry—just go on to the next option.)

The second way to get the files is from the 73 BBS. Be warned that the BBS can only do 2400 baud, so this will take awhile. The 73 BBS can be reached at:

    603-924-9343 (SN1)

When you connect, follow the instructions and provide the requested information. When you get to the main menu, choose "F" for file area, and "9" for packet. The executable and documentation will be there.

Next Month

. . . . we'll actually install the software and start to configure it. While it is not a trivial operation, I imagine many of you will be on the air at that point. In the meantime, you might just try getting on the air without my help. Don't worry about this. The does can be confusing and the setup is not intuitive. Good luck! 73 de N1EWO.

Jeffrey Sloman N1EWO
P.O. Box 636
Franklin IN 46131

Digital Amateur Radio
The NBEWV R/C Plane

Thanks to the ever-shrinking size of ATV transmitters and TV cameras, a number of enterprising ATVers have been successful in flying their systems onboard modest-sized R/C aircraft. This month I'd like to share some of the innovations that Larry Hillier NBEWV of Beloit, Ohio, has designed into his R/C plane.

Starting out with plans for a Hobby Lobby Trainer (800-foot wingspan), Larry built his plane from scratch, eventually adding wing tanks (half-gallon fuel capacity) to his current plane to allow for extended flight. The original model was powered with a four-cylinder Enya 120 engine, but has been replaced with a 1.6 hp Zenoah 23 two-cycle gas engine (essentially a converted chain saw engine). This new engine allows him to use an inexpensive gas/oil mixture instead of the very expensive glow fuel common to most R/C planes.

Larry has had some very long-range contacts using the plane as a repeater. Several stations as far away as West Virginia (over 100 miles away) have worked through the plane during some recent flights. Since the confusion as to the operation of a simplex repeater, Larry now operates the repeater with an output on 144.34 but has the input 600 kHz up on 144.94.

The Antenna System

Since he has a variety of transmitters onboard the plane, Larry had a real challenge deciding where to place his antennas to reduce interference to his R/C receiver. He finally mounted an Old Antenna Labs Mini-Wheel antenna (in the rear corners of the plane) just below the tail. The 2 meter antenna consists of four radials strung along the fuselage and into each wing. The driven element is a 5/8-wave length of piano wire that dangles just below the landing gear. This flexible piece of wire simply scrapes harmlessly along the ground during takeoff and landing, but pops out directly under the plane during flight.

After making the maximum separation for the antennas, Larry mounted the camera (without the antenna) on the airframe near the tail of the plane. This serves as a backup camera as far as possible. He also shielded the R/C receiver. The final configuration had the ATV transmitter in the tail of the plane, the R/C receiver in the middle and the 2 meter simplex repeater in the front. He can now fly the plane so far from him that it is mere speck in the sky without any loss of control due to interference.

Long Duration Flights

Larry often flies his R/C ATV plane right around sunrise and sunset. He has received numerous reports of excellent video from stations all over northeast Ohio. Many of the reports come in via the onboard simplex repeater. There's nothing like creating your own 500-foot tower to increase your ATV range.

Now that he has a half-gallon tank, he can fly for upwards of 1.7 hours. His most recent duration attempt flew for 1.2 hours and still had 2 ounces of fuel left! At the end of September (the month this column was written), Larry plans to fly his plane over a 60-mile path from near Warren, Ohio all the way up to the shore of Lake Erie. He will follow along underneath the plane while riding in the back of a pickup truck with a TV set and R/C transmitter. He plans to keep the plane in sight (both visually and via ATV) through the flight. Since the plane is capable of 55 mph airspeed, there should be more than enough fuel for the whole flight.

Larry is planning another R/C ATV at this plane. One will be a seaplane which the engine mounted above the wings. There will be a movable nosecone that will contain the camera and will allow the camera to pan up and down (similar to the Concord’s nose seal.

Ham Television

Bill Brown WB6ELK
C/O 73 Magazine
70 Route 202 North
Pentwater, MI 49449

The NBEWV R/C Plane

Thanks to the ever-shrinking size of ATV transmitters and TV cameras, a number of enterprising ATVers have been successful in flying their systems onboard modest-sized R/C aircraft. This month I'd like to share some of the innovations that Larry Hillier NBEWV of Beloit, Ohio, has designed into his R/C plane.

Starting out with plans for a Hobby Lobby Trainer (800-foot wingspan), Larry built his plane from scratch, eventually adding wing tanks (half-gallon fuel capacity) to his current plane to allow for extended flight. The original model was powered with a four-cylinder Enya 120 engine, but has been replaced with a 1.6 hp Zenoah 23 two-cycle gas engine (essentially a converted chain saw engine). This new engine allows him to use an inexpensive gas/oil mixture instead of the very expensive glow fuel common to most R/C planes.

Larry has had some very long-range contacts using the plane as a repeater. Several stations as far away as West Virginia (over 100 miles away) have worked through the plane during some recent flights. Since the confusion as to the operation of a simplex repeater, Larry now operates the repeater with an output on 144.34 but has the input 600 kHz up on 144.94.

The Antenna System

Since he has a variety of transmitters onboard the plane, Larry had a real challenge deciding where to place his antennas to reduce interference to his R/C receiver. He finally mounted an Old Antenna Labs Mini-Wheel antenna (in the rear corners of the plane) just below the tail. The 2 meter antenna consists of four radials strung along the fuselage and into each wing. The driven element is a 5/8-wave length of piano wire that dangles just below the landing gear. This flexible piece of wire simply scrapes harmlessly along the ground during takeoff and landing, but pops out directly under the plane during flight.

After making the maximum separation for the antennas, Larry mounted the camera (without the antenna) on the airframe near the tail of the plane. This serves as a backup camera as far as possible. He also shielded the R/C receiver. The final configuration had the ATV transmitter in the tail of the plane, the R/C receiver in the middle and the 2 meter simplex repeater in the front. He can now fly the plane so far from him that it is mere speck in the sky without any loss of control due to interference.

Long Duration Flights

Larry often flies his R/C ATV plane right around sunrise and sunset. He has received numerous reports of excellent video from stations all over northeast Ohio. Many of the reports come in via the onboard simplex repeater. There's nothing like creating your own 500-foot tower to increase your ATV range.

Now that he has a half-gallon tank, he can fly for upwards of 1.7 hours. His most recent duration attempt flew for 1.2 hours and still had 2 ounces of fuel left! At the end of September (the month this column was written), Larry plans to fly his plane over a 60-mile path from near Warren, Ohio all the way up to the shore of Lake Erie. He will follow along underneath the plane while riding in the back of a pickup truck with a TV set and R/C transmitter. He plans to keep the plane in sight (both visually and via ATV) through the flight. Since the plane is capable of 55 mph airspeed, there should be more than enough fuel for the whole flight.

Larry is planning another R/C ATV at this plane. One will be a seaplane which the engine mounted above the wings. There will be a movable nosecone that will contain the camera and will allow the camera to pan up and down (similar to the Concord’s nose seal.

Ham Television

Bill Brown WB6ELK
C/O 73 Magazine
70 Route 202 North
Pentwater, MI 49449

The NBEWV R/C Plane

Thanks to the ever-shrinking size of ATV transmitters and TV cameras, a number of enterprising ATVers have been successful in flying their systems onboard modest-sized R/C aircraft. This month I'd like to share some of the innovations that Larry Hillier NBEWV of Beloit, Ohio, has designed into his R/C plane.

Starting out with plans for a Hobby Lobby Trainer (800-foot wingspan), Larry built his plane from scratch, eventually adding wing tanks (half-gallon fuel capacity) to his current plane to allow for extended flight. The original model was powered with a four-cylinder Enya 120 engine, but has been replaced with a 1.6 hp Zenoah 23 two-cycle gas engine (essentially a converted chain saw engine). This new engine allows him to use an inexpensive gas/oil mixture instead of the very expensive glow fuel common to most R/C planes.

Larry has had some very long-range contacts using the plane as a repeater. Several stations as far away as West Virginia (over 100 miles away) have worked through the plane during some recent flights. Since the confusion as to the operation of a simplex repeater, Larry now operates the repeater with an output on 144.34 but has the input 600 kHz up on 144.94.

The Antenna System

Since he has a variety of transmitters onboard the plane, Larry had a real challenge deciding where to place his antennas to reduce interference to his R/C receiver. He finally mounted an Old Antenna Labs Mini-Wheel antenna (in the rear corners of the plane) just below the tail. The 2 meter antenna consists of four radials strung along the fuselage and into each wing. The driven element is a 5/8-wave length of piano wire that dangles just below the landing gear. This flexible piece of wire simply scrapes harmlessly along the ground during takeoff and landing, but pops out directly under the plane during flight.

After making the maximum separation for the antennas, Larry mounted the camera (without the antenna) on the airframe near the tail of the plane. This serves as a backup camera as far as possible. He also shielded the R/C receiver. The final configuration had the ATV transmitter in the tail of the plane, the R/C receiver in the middle and the 2 meter simplex repeater in the front. He can now fly the plane so far from him that it is mere speck in the sky without any loss of control due to interference.

Long Duration Flights

Larry often flies his R/C ATV plane right around sunrise and sunset. He has received numerous reports of excellent video from stations all over northeast Ohio. Many of the reports come in via the onboard simplex repeater. There's nothing like creating your own 500-foot tower to increase your ATV range.

Now that he has a half-gallon tank, he can fly for upwards of 1.7 hours. His most recent duration attempt flew for 1.2 hours and still had 2 ounces of fuel left! At the end of September (the month this column was written), Larry plans to fly his plane over a 60-mile path from near Warren, Ohio all the way up to the shore of Lake Erie. He will follow along underneath the plane while riding in the back of a pickup truck with a TV set and R/C transmitter. He plans to keep the plane in sight (both visually and via ATV) through the flight. Since the plane is capable of 55 mph airspeed, there should be more than enough fuel for the whole flight.

Larry is planning another R/C ATV at this plane. One will be a seaplane which the engine mounted above the wings. There will be a movable nosecone that will contain the camera and will allow the camera to pan up and down (similar to the Concord’s nose seal.
Larry Hillier N8EWV with his eight-foot wingspan model airplane. This plane includes a live camera ATV system as well as a simplex 2m FM repeater.

The KD8PE ATV Repeater

If you are traveling through northeastern Ohio and would like to talk with Larry N8EWV about his ATV plane, you can usually find him, as well as the local Youngstown/Salem, Ohio, ATV group, working through the KD8PE ATV repeater during their weekly ATV net every Thursday evening at 9 p.m. local time. The KD8PE ATV repeater is located on a 190-foot tower in Beloit, Ohio (439.25 MHz input/426.25 MHz out). They use 144.34 MHz for their ATV talk frequency. Also, a number of the ATVers in the area monitor the high profile 146.865 (600) repeater.

Snow free line of sight DX is 90 miles - assuming 14 dBi antennas at both ends. 10 Watts in this one box may be all you need for local simplex or repeater ATV. Use any home TV camera or camcorder by plugging the composite video and audio into the front phono jacks. Add 70cm antenna, coax, 13.8 Vdc @ 3 Amps, TV set and you’re on the air - it’s that easy!

The KD8PE ATV Repeater

If you are traveling through northeastern Ohio and would like to talk with Larry N8EWV about his ATV plane, you can usually find him, as well as the local Youngstown/Salem, Ohio, ATV group, working through the KD8PE ATV repeater during their weekly ATV net every Thursday evening at 9 p.m. local time. The KD8PE ATV repeater is located on a 190-foot tower in Beloit, Ohio (439.25 MHz input/426.25 MHz out). They use 144.34 MHz for their ATV talk frequency. Also, a number of the ATVers in the area monitor the high profile 146.865 (600) repeater.

Subscribe to 
73 Amateur Radio Today
Call 800-289-0388
ABOVE & BEYOND

VHF and Above Operation

C.L. Houghton WB6ISP
San Diego Microwave Group
6345 Badger Lake Ave.
San Diego CA 92119

Microwave Construction Practices

Let's continue where we left off last month when we covered the construction of a basic SSB system. This month I would like to continue with the construction of some basic elements. I will be going into detail on construction techniques for successful projects, describing some useful tools. A lot of questions need to be answered for those just starting a project—but not all can be anticipated. However, with luck, this column should put some of the construction detail questions to rest.

Let's start by discussing some tools and equipment necessary for modifying (or performing brain surgery on) some of our microwave circuitry. Most of these tools must be small or miniature due to the compactness of most microwave circuitry. A basic bench setup consists of diagonal pliers, long-nosed pliers, and various screwdrivers. The soldering iron should actually be a good soldering station. By that I mean a temperature-controlled soldering iron. That's one key pointer for good construction: a low-voltage soldering station.

It pays to search out the nearest "beauty junk box," which is usually found close to the bathroom mirror. What we're searching for are a couple of small pairs of tweezers. I procured mine from the local drugstore in the cosmetics section. The ones from Revlon are the best, but they carry a good price tag. I selected one that had a large, stout hand-hold section and then formed down into a small narrow end section, with a total length of about six inches. They worked well for selecting components and positioning them on the PC boards.

An alternate method is to just dump the component onto the PC board, then try to position it into place with a toothpick, using shuffle-board action. It's not the best but it will work in a pinch. I prefer the tweezers. Part of my trick in using them with very small components lies in the PC board preparation. Here I am talking chip resistors and capacitors and other small surface-mounted parts. Next, I will cover semiconductors and the method used to place them on a PC board.

Positioning Small Components

The real question is: How do you successfully hold a squirming chip resistor or capacitor on a PC board when it's only 0.050" square? Their small size makes them hard to position in place for soldering. Well, that's partly where the tweezers come into play, but the secret is PC board preparation. If the board is homemade, proceed like the ones you or I make, then you need two preparation steps before soldering. This is not 100% necessary but it can make it easier to place chip components on PC boards. Besides, it doesn't hurt to make the photo that the traces will be populated.

Once the rosin is applied, use a soldering iron with a small amount of solder and gently rub the solder onto the trace. You will notice that using rosin helps the solder flow, so don't need to use as much. As you move the soldering iron, add solder where necessary to fully coat the trace. In this way the PC board will become fully coated with a very thin layer of solder on the traces and ground surfaces. This will give your PC board resistance to oxidation and help in the soldering of chip components.

I can't stress this enough: Use solder sparingly. A very small amount can be spread across the trace with the aid of some excess rosin. Leave the excess rosin on the board at this time as it is somewhat sticky and will hold a part once it's positioned on the board. If you want, resolder the trace on top of the solder with a light coat of rosin to help hold chip components.

You probably will have to try several of these methods out and find which ones you like best. It's an individual thing.

Chip components are soldered on the trace at one end of the chip. First wet the trace with solder in front of the part. Use a small amount of solder then with a toothpick in the other hand hold the part in place and draw the molten solder pool just in front of an edge of the part up to and over the top of the chip component. Use a sweeping motion over the top of the part. Inspection with a magnifying glass should show a good solder joint looking like a ramp up to the shoulder of the chip component (see Figure 2). Until the part moved, re-solder and reposition it before soldering the other end of the component. Once one end of the component looks OK, solder the opposite end of the part to complete installation. Do the same for all components that you need to install, except the diodes and transistors (IEFTs). Don't worry about the mess rosin at this time.

When you are ready to mount your diodes and FETs some special precautions are necessary. For most diodes this is not a problem; however, for some signal diodes and expensive Schottky types precautions don't hurt. The diodes and FETs should be handled with proper static precautions taking care not to destroy these parts before installing them in a circuit. There is no need to fret about static-sensitive components as the precautions for using them are not too demanding. Mounting them with grounded work station will remove static voltage.

Removing the Rosin

When the other components are mounted it's time to remove the rosin which looks quite sloppy on the board. Removing rosin is important because it can have a detrimental effect on the board. It can de-tune the microwave stripline and cause excess losses. It is

PC Board
Stripline Side
Dots = Gold Metallization Over Ceramic Case Of FET

PC Board
Ground Side Of PC Board

Figure 1. Insert the FET and solder the gold metallization to the bottom of the PC board and to the top source traces. You want to take the shortest possible path to ground to find the lowest possible source lead impedance.

72-73 Amateur Radio Today • November, 1993
also attract the most undesirable material and stick to it, further detuning your circuit.

The best method to remove this grungy (rosin) is to use a smallumber's acid brush dipped in alcohol. These brushes are available in most hardware stores for about 20 cents each. Wash the PC board with water. Dip the brush in rubbing alcohol and apply it to the PC board on a light slope to allow the liquid to run off the bottom of the board. Continue to apply with a rubbing motion with the brush, dipped in alcohol frequently, until all the rosin is removed. For small PC boards, hold the board above a glass ashtray, using it for a container for the alcohol. Use a small amount of alcohol; a capful or two is sufficient. Alcohol is flammable so keep it away from heat sources. You might need a second rinse to give the board a very clean appearance. Once the board is clean, air dry it or wipe it dry with a rag before mounting the semiconductors and FETs. Always use the grounded static-free work station for this operation.

Other Tools
Now, here are some of other tools to get, besides the tweezers: magnifying glass or eyepiece, some toothpicks, liquid rosin, plumbers' small acid brushes, small diagonal cutters, plus long-nosed or needle-nosed pliers and a good temperature-controlled soldering station. Add to these items a good selection of X-acto handles and blades that will be used in the tuning and cutting of PC board traces to make modifications to the stripline circuitry. These modifications are very necessary to microwave circuitry, and are done with X-acto knives. In this phase of modification you will be cutting traces and trimming them with the knife blades. In microwave work these are our variable inductors and capacitors that are formed by traces on the PC board. When you make cuts, hold the knife firmly and do not push hard on the Teflon PC board—Teflon microwave substrate is very soft and light pressure is all that is necessary. Be sure the DC power is off when doing any trimming on PC boards.

Toothpicks are used to make tuning tools. Glue small bits of copper on the ends of several toothpicks and when they're dry they can be moved about active amplifiers to give you an idea of where to solder permanent copper straps to the stripline. These toothpick tools are quite simple—just don't touch two adjacent leads together because a short is a short, and will most likely smoke a component.

The Static-Free Work Station
At this point, let's describe the static-free work station where we will assemble and mount the static-sensitive components. This can sound quite impressive, but actually it is very simple and easy to construct. The main difference is that all construction is done on a sheet of scrap metal or circuit board used for a common ground surface, to which all components and tools are grounded. This removes any static buildup from your work area. No dragging your feet on a carpet before going to work at the station! Sparks are not permitted. If you

PCB / Schematic CAD - from $195
EASY-PC - For single sided and multilayer boards to 17" x 17". Phenomenally fast and easy to use. Over 17,000 copies sold. EASY-PC Professional for boards up to 32" x 32" at .001" resolution, 16 layers. Schematic capture and netlist extraction — integrates seamlessly with PULSAR and ANALYSER III. Demo disc available.

Logic Simulation - from $195
PULSAR and PULSAR Professional - Full featured digital logic simulators. Allow you to test your designs quickly and inexpensively without the need for sophisticated test equipment. PULSAR can detect the equivalent of a picosecond glitch occurring once a week! Demo disc available.

Analogue Simulation - from $195
ANALYSER III and ANALYSER III Pro. Powerful linear circuit simulators have full graphical output, handle R's, L's, C's, Bipolar Transistors, FET's, Op-Amp's, Tapped Transformers and Transmission Lines etc. Plots Input and Output Impedances, Gain, Phase and Group Delay. Covers 0.001 Hz to >10GHz. Demo disc available.

For info, write, fax, call or use Inquiry #
Number One Systems Ltd. 1

REF: 73, HARDING WAY, ST.IVES,
HUNTINGDON, CAMBS., ENGLAND, PE17 4WR.
Telephone: 011-44-480-461778 Fax: 011-44-480-494042

CIRCLE 1 ON READER SERVICE CARD
CIRCLE 292 ON READER SERVICE CARD

A COMPREHENSIVE LINE OF INSTRUMENTS TO MEASURE ELECTROMAGNETIC FIELD RADIATION

WALKER SCIENTIFIC, INC.
Rockdale Street
Worcester, MA 01603 U.S.A.
Tel: (508) 852-3674 / 853-3232
Toll Free: 1-800-962-4638
FAX (508) 856-9931

73 Amateur Radio Today • November, 1993 73
fear the worst, do your construction on a moist day, a minimum static day. Still use the ground work location.

Your work station pad (a sheet of copper or conductive metal) is where we place the circuit to be worked on (the PC board). Adjacent to the area reside the temperature-controlled soldering iron, tools, and your! Sure be to use a resistive conductive wrist strap and not a direct connection to your wrist. Usually these wrist straps have a built-in resistor in the clip lead portion with a resistance of a half megohm or so for a safety factor. The high resistance is so that current can be dangerous to you if you will not flow. It will remove static and bleed it off to ground: discharge it. The purpose is to remove static and not carry current to light you up.

Don’t fall into the trap of “cheating” by touching and holding the grounded work station with your finger while trying to perform the operation. This is not recommended—it is asking for trouble. Use the wrist strap and its protective series resistance. It is there for your protection.

**Copper PC Board Stock About 12" Square**

Any Metal Sheet OK. Serves As Common Ground Work Station

Clip Lead To PC Board Foil Common Ground

Ground Work To PC Board Common Ground

[Diagram of construction of grounded work station]

**Figure 4. Construction of grounded work station. Notice that the soldering iron, work piece, and your wrist are all common grounded to prevent static from destroying sensitive FETs.**

**Soldering Iron Grounds**

The only major tool purchase should be a temperature-controlled soldering station. Most used ones or even many new ones do not have a ground connection brought out to a clip lead. They are grounded in some cases; always check. If you do not have a ground clip lead it can be added to the low voltage portion of the iron. These are operated from 110V AC and converted to a low voltage in the base unit. Usually it converts to around 2V to 3V to heat the iron element.

To add a ground connection to this type of iron, make a connection from the barrel of the iron at a low temperature point, or better still through the iron’s ground lead to the transformer’s base. Usually it can be made in the transformer base unit and brought out for connection to the work station.

This clip lead connection is used to remove static from the metal portion of the low voltage iron so as not to harm the semiconductor when you solder it. If you have a high-voltage iron, one that works and heats from

**QUALITY THAT'S AFFORDABLE**

Tri-Ex is pleased to announce the reduction in price on the most popular models of quality Tri-Ex towers for the Amateur radio enthusiast. The overwhelming acceptance of the listed models has made it possible for Tri-Ex to pass on substantial savings to our valued customers.

**LM-470**

Was $3,945
Now $3,658

**LM-354**

Was $1,865
Now $1,300

All towers are complete with rigid concrete base mount and rotator mounting plate. Tri-Ex prints and calculations provided with tower are compliant with 1991 Uniform Building Code (U.B.C.) Engineering design to 1991 U.B.C. - 70 MPH

**Tri-Ex® TOWER CORPORATION**

7182 Rasmussen Ave. • Visalia, CA 93291

Unsurpassed Quality since 1954

**CIRCLE 22 ON READER SERVICE CARD**
110 VAC directly, this can be made to work as well. What you have to do is unplug the iron just before each soldering operation (with the same type ground clip). Prior to attaching a ground clip on this type of iron verify its AC leakage voltage, a safety factor.

We are doing this to see if the tip is insulated from the heating unit, which is a 110 VAC element. Sometimes the insulation breaks down and allows AC flow through this defect. It's a safety item and should be checked every so often. Be careful and use insulated est leads for the AC voltage check. I have checked similar irons and good ones will show very low voltage readings, less than a volt or so. However, I have found some that were almost direct connections to 110 VAC due to cracked insulation in older irons. Check to be sure for safety and semiconductor survival.

Mounting Semiconductors

Mounting the semiconductor is easy easy. Mount the diodes first. On any small glass-ledged diodes be careful not to bend the leads too close to the package for soldering as the case can crack on this type of diode using mounting. Just bend the leads to the position you want them and allow a little slack in the leads about 1/8" case. Use the tweezers to see a heat sink and grounded installation tool when soldering. Prior to mounting FETS, all PC board preparation such as cutting mounting holes or source ground "C" straps should be complete.

Follow the FET mounting instructions. If they state to mount the FET upside-down you need to cut (with the X-acto knife) a 0.1-inch square hole to position the FET into. In this case, the ground side of the PC board is soldered to the gold of the FET for minimum source inductance (see Figure 1). If the FET is mounted right-side-up, most likely "C" straps are being used and the circuit allowances were made for some slight inductance. In some cases I have even seen right-mounted FETs that is, the opposite lead has been trimmed off and the remaining source lead is connected to ground with an additional short section of solid wire. This is a stabilizing technique (degeneration) and is used at frequencies lower than 3 GHz. The "C" straps and minimum inductance are requirements, particularly at 10 GHz. In 10 GHz amplifiers that we have constructed, the minimum inductance or shortest lead length was found to be the best solution to achieving maximum gain and uniform operation at 10 GHz. Both using the "C" straps and mounting over metal devices upside-down can achieve the same results: stage gain.

"Check the details on construction for the project you plan to duplicate. Use their recommendations."

- Packet Radio -
Portable & Affordable!

Model BP-1
Packet Modem
Made in U.S.A.

- Simple Installation
- No External Power
- Smart Dog™ Timer
- Perfect For Portable
- Assembled & Tested
- VHF, UHF, HF (16M)

Whether you're an experienced packeteer or a newcomer wanting to explore packet for the first time, this is what you've been waiting for! Thanks to a breakthrough in digital signal processing, we have developed a tiny, full-featured, packet modem at an unprecedented low price. The BayPac Model BP-1 transforms your PC-compatible computer into a powerful Packet TNC, capable of supporting sophisticated features like digipeating, file transfers, and remote terminal access. NOW is the time for YOU to join the PACKET REVOLUTION!

$49.95
Just...

Packet Radio Today • November, 1993 75

INTRODUCING THE UNIVERSAL M-400
A totally new concept in code / tone readers!

- Baudot
- SITOR A/B
- ASCII
- SWED-ARG
- FAX
- POCSAG
- GO LAY
- ACARS
- DTMF
- CTCCS (PL)
- DCS (DPL)

Forget the limitations you have come to expect from most "readers". The self-contained Universal M-400 is a sophisticated decoder and tone reader offering an exceptional range of capabilities. The SWL will be able to decode Baudot, SITOR A & B, FEA-C, ASCII and SWED-ARG. Weather fax can also be decoded to the printer port. The VHF-UHF listener will be able to copy the ACARS VHF aviation teleprinter mode plus GOLAY and POCSAG digital pager modes. Off-the-air decoding of DTMF, CTCCS (PL) and DCS is also supported. The M-400 can even be programmed to pass only the audio you want to hear based on CTCCS, DCS or DTMF codes of your choosing. The M-400 can run from 12 VDC or with the supplied wall adapter. The American-made Universal M-400 is the affordable accessory for every shortwave or scanner enthusiast.

Only $399.95 (+$6 UPS)

FREE CATALOG
This huge 100 page catalog covers everything for the shortwave, amateur and scanner enthusiast. Request it today!
ASK KABOOM

Number 18 on your Feedback card

Your Tech Answer Man

Michael J. Geier KB1UM
C/o 73 Magazine
Route 202 North
Petersborough NH 03458

Let's Mobile

Last month, we were talking about mobile operation. Before we continue, I'd like to pass along a fix for a problem I ran into.

A Detective Story

At a recent hamfest, I picked up a used Kenwood MC-85 desk microphone. It's a nifty microphone which has a condenser mike, built-in compressor and outputs for three separate rigs. I mentioned my purchase to a good friend who used to own one, and he warned me that the mike was very sensitive to RF feedback and, thus, poor for HF. I figured his must have had some kind of problem and proceeded to wire the cable up for my Yaesu FT-200.

I keyed up and it worked great! I got several good reports and apparently no RF feedback problems. I was happy. The next night, I had a sked with a friend, and he reported that he sounded terrible, with lots of RF feedback. A quick listen on another receiver confirmed his report: The thing was a disaster. What had happened in the preceding 24 hours?

Ah, Sweet Ground

Usually, when you have an RF feedback problem you have a lousy ground connection somewhere. Finding it isn't always easy, though. In fact, I've had some tough times with these kinds of problems. But not this time. The thing gave itself away when I noticed that grabbing the mike's metal gooseneck, which also encloses the mike element itself, caused extra RF feedback pops and noises. Yet, touching the rest of the metal housing did not have any effect. Now I knew. The gooseneck was not properly grounded to the housing. Upon opening the unit, I discovered that it is built in two pieces. The PC board is mounted and grounded to a metal frame which then screws to the housing. The gooseneck is screwed directly to the housing. So, if the screws holding the frame to the housing are even a little bit loose, the ground between the gooseneck and the PC board gets funny. The cure was easy: I added a ground wire directly from the gooseneck's nut to the PC board's frame. Voila, no more RF feedback! If you have an MC-85, you might want to add this wire, especially if you have had any feedback problems.

Back To The Car

Out of the shack and back into the car, OK, you've installed your HF rig; you've run your fused, heavy-duty power cable from the battery to the radio; and you've installed and wired your antenna. You turn it on and, hey, it works! Sounds nice and clear, too. But wait, you haven't tuned the engine on. Uh-oh. But then it sounds like garbage. Noise and static out the wazoo. Unfortunately, when you are running a multikilovolt ignition system a few feet from a device designed to detect a fraction of a microvolt of RF, you're gonna have some problems. Is it possible to get decent reception in the car?

You Betcha

It'll never be as noise-free as a good, quiet home station, but you can get good results in the car. As an example, my Mazda RX-7 used to have an S-7 to S-9 static level, even with the rig's noise blanker on. (It should always be on.) I just assumed that was the best I could do and was resigned to living with it. Consequently, I rarely operated HF in the car. A few months ago, the car started running poorly, so I decided to give it a tuneup. I changed the plugs, wires, rotor and distributor cap. Hey, my noise level went down to S-3! And my car ran great, too, ignition problems, and especially bad plug wires, can really drive the noise level up.

Other Sources

There are lots of other noise sources in an automobile. Any poorly joined body parts can make electrical noise as they rub with the car's motion. Even wheel bearings can make noise! There are too many potential problems and solutions to cover here, so, if you have a really stubborn static problem, get a book devoted to mobile radio installations.

There are two big noise sources which keep cropping up: fuel injectors and the car's computer. Some makes and models have particular problems which are known to the manufacturers, and a call to the dealer may bring forth an internal memo on the subject. Then again, it may not. Some injectors and computers are just noisy and there's nothing you can do about it. Sometimes, though, the manufacturers have replacement parts or modifications which greatly reduce the noise. Some will even do it for free.

Warning!

As you can see, it is very common for your radio to be QRMed by your car. You must test your car to see if you can QRMed your car! Today's cars are electronically sophisticated; virtually all use computers to control the engine. Some also use them to generate the dashboard displays, control the cabin environment, and various other things. Some of these computers are quite sensitive to RF, and a few can actually be destroyed by your transmitter, even if it is only a 25 watt VHF rig! If your car misfires or otherwise misbehaves when you key up, you are probably crashing the computer, so you should investigate the problem before you cause some expensive damage.

Honest, Officer, I Didn't Mean It

I remember using my 100 watt HF rig in my old car, which was a 1984 Oldsmobile Cutlass. Once, while tooling around in the Vermont mountains, I saw this huge log look like something along under cruise control. Normally, I watched the speedometer carefully, even when I used the “autopilot.” This time, though, I got distracted and never looked down. Suddenly, it seemed like I was going nowhere fast. So, I ended up doing 85 and still accelerating at the maximum rate. Yikes! I reset the cruise control and everything was fine. And I never got to do that again. But I have no doubt that my transmitter caused it. Thank goodness I didn't catch a ticket; I would have never explained that one.

There have been many reports circulating on packet radio regarding Toyota Camry computers being destroyed by RF. In fact, several hams reported having to repair cars over $1,000, because the damage wasn't covered under warranty. Apparently, there was an internal memo stating that radios over 10 watts output shouldn't be installed in those vehicles. Last I heard, the problem had been fixed. This is only a rumor, however. If you are contemplating getting one of these cars, you might want to check with your dealer before you buy. If you already have one, it will pay to find out if you're courting disaster every time you check into the local repeater.

The Skyhook

Mobile antennas present extra challenges at HF, mostly because of their small size relative to frequency. The standard mid-position loading coil arrangement works fairly well above the 40 meter band, but I haven't had much luck with it on 40 and 75, the efficiency is just too low. But there are other designs which work reasonably well, although nothing is going to work as well as a dipole 50 feet up! The oddest automotive HF antenna I ever saw belonged to a guy I met at a New England hamfest. It's kind of hard to describe this thing: The best I can say is it was horizontal, took up the entire length of his large, American car, and made his vehicle look something from another planet. He designed it himself, and he claimed it worked like gangbusters on 75 meters.

Although there are several antenna tuners made for HF mobile, I think it pays to keep your own things working as you can. Efficiency is not that high to begin with, so you're better off if you don't have to use a tuner.

Sometimes, it seems like you have better bandwidth and lower SWR than you expect to get. Before you go rejoicing, take a look at your ground connection between the antenna mount and the car. Usually, a too-good SWR over too wide a bandwidth means you have exceptionally poor efficiency and are losing a lot of resistive loss. Remember, a dummy load a ways has the best SWR.

Louder?

Can you install a linear amp in your car? You sure can! There are several which have been made over the years and are still available. Next time, less serious I say, you're gonna need some serious amperage to run something like that. A big battery and a giant a tommar will need to be routed through humongous cables to the amp. And don't forget that all that RF power will be 2 or 3 feet from your head. Personally, I think I'll pass.

Pounding Brass

Can you pound brass in your car? Sure! I've tried it a few times, using a Microkeyer lamic keyer project I published some time ago. It works and it fun, but you need to be a decent CO op to avoid getting so distracted that you impair your driving. Obviously, you can't be writing down while you drive, so you need to copy in your head. RF feedback into the keyer hand key can be a problem which results in RF burns on your fingers. E sure to use shielded cable from the keyer to the rig.

The next thing to consider covers it for mobile operation. There's a special thrill you get from talking around the world, around town, while you cover the di stance between home and work, wherever. Happy and safe mobile now, let's look at it a letter.

Dear Kaboom,

I'm considering upgrading my station and I'm very interested in DC (digital signal processing). Several rigs offer inboard IF-lev el DSP units and there also are several third-party outboard IF-level DSP units available. Which is better?

Signe.

Dear Dr. Di.

In theory, IF-level signal processing should always be better than AF-level processing, because you deal with signal before the AGC stages. Then, if you remove an offending signal, it won't cause unwanted AGC action. With AF-level processing, you have control over that, and strong interferers near the one you want to see there can cause trouble, even though I filter has taken them out, because it can't help AGC to clamp down. As practiced today, though, it's a different story. The functions available the inboard units just don't compare the neat stuff you can buy in the card, board, AF-level boxes. So, for now, I think you're going to need the outside approach. Perhaps in a few years rig makers will put some serious effort into DSP and catch up with the sp hotly makers. By the way, I've been trying to check those out. Enjoy your new gear! 73 and see all next month, de KB1UM.

76 73 Amateur Radio Today • November, 1993
We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8 1/2" x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS / Special Events Message Area #11. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 924-9343). Please indicate if it is for publication. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters 1 or 1, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

I need operation and service manuals for COLLINS Model 32MS-1C tube-type transceiver, Serial #287. I will pay copying and mailing expenses; or furnish me the latest mailing address of Collins Radio, Canada or USA.

Thanks to all who respond. Benjamin Tan, United Marketing, Isabela, Baslian Province, 7300 Philippines.

I am looking for mods for the HTX-202 2m HT. If anyone has any, please send to Trevor Davis VE3OKV, 107 Government Road East, Kirkland Lake, Ontario, Canada P2N 1A9.

I am looking for the schematics, manual, or info on the Hammarlund FM50a or its power supply. I will gladly pay for copies and shipping. I am trying to use this unit for Civil Air Patrol communications. Any information will be helpful. Thank you. KB2QGO, (716) 526-5336.

Multiple Control Heads! HF SSB Transceiver

Most hams would never subject our SG-2000 all frequency HF transceiver to the kind of extreme conditions we designed it for. You'd likely be satisfied having 150 watt output, 644 ITU channels, 100 user defined (ham) frequencies in memory plus a direct entry VFO with 10 Hz stability, full frequency coverage, CW with sidetone and a super 2:1 IF shape factor. Features such as FCC Type Approval, made with pride in America, direct Weatherfax support, up to 8 control heads and full performance from -22F to +140F might seem a bit extreme and for under $2000. But if you’ve ever chewed the rag on 20 meters in a Force 9 Artic gale, you’ll appreciate that there’s a difference between extreme performance and the performance in the extremes.

EXTREME PERFORMANCE

Selling your product in 73 Amateur Radio Today!

Call Dan Harper at 800-274-7373.
NEVER SAY DIE

Continued from page 4

The main problem is that we're not interesting our newcomers enough to hold them. They go to a club meeting or two, find they are treated like lepers, and give up. Ten meters is nearly dead and will be for a few years. And CW at 5 wpm isn't nearly as much fun as you've told them it is. The result is that 94% of the Novices aren't seriously active. They spend less than an hour a week. That rattle you hear is amateur radio's death rattle unless you can figure some way to make hamming more fun. Fast. We're dying.

Oh well, Novices are kids anyway; right? Well, not exactly. Their average age is 39. Heck, when I got started in amateur radio the average age for all hams was about 32. Now the Techs average 45 and it's 50 for all hams, which puts the Advanced and Extras up in the 60s. No wonder almost everyone I work on 20m is retired.

Has your club made any effort to get newcomers to your meetings and get them involved with club activities? The answer, with very few exceptions, is no. Two-thirds of the Novices have never been to a club meeting. Most of the rest tried one or two and gave up in disgust. Very few said they were involved with any club activities.

What ever happened to the old ham radio fraternity concept? I read many of the club newsletters and see very little evidence of efforts to involve newcomers. We've let the hobby turn sour on our watch. We're putting up with bad language on our bands. Our personal ethics are a mess. We've cut off our newcomers. We used to be very proud of being hams. And rightly. We were the pioneers of all new radio modes. We were the major supplier of the best engineers and technicians to industry. And when WWII came along we helped save the country's bacon by volunteering for military duty. Eighty percent of us joined the armed forces. And don't you forget that it was electronics that was our big edge. It was a technology war and we hams were right there in the thick of it.

We've let ourselves become virtually useless. In 1964 we killed off thousands of radio clubs. These were the clubs that fed us our newcomers and we've never had any significant growth since. Not, lacking the enthusiasm and drive of youngsters, have we been able to keep up with commercial technology, much less be in the forefront.

If you were running a business and you found that you were getting fewer and fewer customers, would you consider making some changes? Worse, most of the new customers you get to come in the door go right back out and don't come back. Are you doing something wrong? Has your product or service kept up with the world as it is today?

In business you either grow or die. So what's holding back our growth? I've been talking about that in my editorials, so my ideas on the subject won't be any news flash for you. But let's not just accept my ideas. And let's not stick by the ARRL's either. Let's survey the kids and find out why they're not interested in amateur radio anymore. Yes, I know all the old excuses. TV, video games, on-line computer services and such keep kids too busy for them to take the time to learn the code and memorize the pathetical simple tests we've got set up as obstacles to keep out the "wrong" people.

Well, I've seen no sign that we've had any success in barring the wrong people. We've done a pretty fabulous job of keeping a lot of "right" people out.

The League hasn't a clue as to what to do to turn things around. They're asking, "What, if anything, can be done to reverse the trend?" Am I exaggerating? Check out page 9, July 1993, QST, last paragraph.

Wayne's Prescription

I'd like to see amateur radio fulfill its real potential... to help kids, our country and the world. I'd like to see millions of kids getting on the air and filling up our incredibly valuable, but presently vacant, microwave and satellite bands. I'd like to see 'em experimenting, building kits, and pioneering new technologies. We haven't had any shortage of new modes for them to develop.

One thing we do know from experience is that everything our government does messes it up, and the management of amateur radio is no exception. I wish the socialists and liberals left would go live awhile in the remaining socialist countries, China and Cuba, and get over their delusions. Maybe they'd stop trying to get the government to do everything for us.

My dream is to have amateur radio run by our radio clubs instead of the government. The clubs would be responsible for recruiting newcomers... kids in particular. They'd EMER radios in schools. The clubs would teach theory and operating practices and would license the member who earned the privileges. The club would be responsible for their licensees and for the de-licensing of any member abusing our privileges.

I envision a national conference every other year where delegates from each of the clubs would discuss amateur radio and vote on any rule changes proposed by the clubs. I'm sure you can come up with a long list of reasons why this wouldn't work. But I warn you, though, I haven't taken 10 pages here to try and refute your objections. I doubt the you'll be able to come up with one fact which I haven't a good answer. I've given you this a lot of thought.

Indeed, a few years ago I made th...
The clanking of the FCC Commissioners’ decisions around the table was heard by all. The FCC was ready to go into action. The call for the meeting was made. The FCC was ready to act. The FCC would not let the go to the press.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings. They also agreed that the FCC would be glad to find out what the Commissioners knew little of the FCC’s inner workings.

The C...
A Quote from Forbes

A recent Forbes column by Peter Huber discussed the effect technology is having on us. For instance, when I was young we spent a lot of time on pennmanship. Well, handwriting was how one communicated then. Typewriters were too expensive for the home and typing wasn’t taught in school. Once typewriters were cheaper, the need for good pennmanship disappeared.

Spelling was a big deal when I went to school. Now it’s handled by my word processor, which catches my errors. Peter suggested that before long making kids memorize all the irregular spelling rules would be like making radio engineers learn the Morse code. Heh.

We’ll soon have automatic language translation, and computers with voice input. Look where we are with bar-code and checkout counters which add up the items, calculate the change, debit the store inventory, and presumably even add in a few cents here and there to pad your bill. Fast-food cash registers have pictures instead of numbers, which is handy since fewer and fewer kids are being taught how to make change.

If you’re into video you can have a complete video production lab at home and do what used to take millions of dollars in equipment all by yourself. In audio, DAT recorders are under $1,000 and outperform a whole studio full of gear from a few years ago. Gas stations let you pump your own and pay with a credit card, with no attendant needed. Well, we’re a little behind on that one. I remember HB9RF doing that in Zurich over 20 years ago as we were driving to visit his moonbounce station.

---

"Are you keeping up with technology? As a ham you’re expected by the public to be knowledgeable about high-tech."

Are you still writing by hand? You’re two generations behind. I changed to typewriters as soon as I could, carrying portables with me on my trips. Then I changed to word processors, moving to a laptop system around 1980, as soon as the first one was available. I moved from CW to voice in 1989 . . . and from voice to RTTY in 1949. I put up my first repeater in 1966. Our pioneering HTs and repeaters of 1970 are now worldwide cellular telephone systems.

And look what’s happened to those microcomputer kits we were playing with in 1976? Now we’re using them to replace million-dollar typesetting systems. One of the first ads for the MITS Altair 8800 computer appeared in 73. Are you keeping up with technology? As a ham you’re expected by the public to be knowledgeable about high-tech.

Steve Jobs started out with nothing but a prototype built by Steve Wozniak. Bill dropped out of Harvard to work for MIT’s, in Albuquerque, where the action was. Communications, computers, information systems . . . all are changing.

We’re ready for a major change in education which will generate a few more billionaires. Ditto health care, which is a trillion dollar industry, and growing. How do you plan to meet the change? Close enough to see the opportunities and benefit?

Every major misery we have in America offers opportunities for the person willing to pioneer and work. The downside is that if you’re money-driven, your chances of making it big are not good. You’ll do best if you see something that needs to be done, figure out how to do it, and then work hard. Bill Gates made his billions accidently. He’s still wrapped up in what he’s doing, not in making money.

In my reports to the New Hampshire Economic Development Commission I’ve been coming up with endless ideas for new businesses and new areas that need to be researched and pioneered. My first reports have been fun. John Deacore Wate, who now has a book. Those since then are in my Declaray War Update reports. They’re available via Uncle Wayne’s Book shelf.

One of my joys is in getting letters from hams thanking me for keeping them through my editorials to get out there and be an entrepreneur. Some have been very successful, and a of those know a freedom they never experienced before.

---

DEALER DIRECTORY

DELAWARE

New Castle


DELWARE, CUMBERLAND, GUY LIVESTOCK, W 71 Meadow Road, New Castle DE 19720. (302) 329-7728.

NEW JERSEY

Lodi


NEW JERSEY

Park Ridge


NEW YORK

Manhattan

Manhattan’s largest and only ham Radio Dealer. The line of Business, Marine, Aviation, Shortwave Radios and Scanners, and Cellular Phones and beepers. Large selection of Books, Antennas, Test Equipment, coaxial cable and parts. Full Service Repair Lab on premises. O 44th Year . . . We carry all major line MOTOROLA, ICOM, KENWOOD, YAESU, BENDIX-KING, ASTRON, AEA, SONY, PANASONIC, MFJ, CTV CABLE, MANSFIELD, JR, MOTOROLA, BIRDMAN, BELL WATTMETERS, FREQUENCY COUNTERS, SCANNERS, HYGAIN, VIBRONIX, PLEX, GNR, CALLBOOK, OTI, OTHER PUBLICATIONS. Open 7 days M-9:5-p.m.; Sat.-10-5 p.m. Sun.-11-4 p.m. We ship Worldwide. Call, Fax, or write for information and prices. Your one Sour for Ham and Business Radios . . . BA RLEY ELECTRONICS, Lord Broadway New York 10011. (212) 925-7000 FAX (212) 925-7001.

OHIO

Columbus

Central Ohio’s full line authorized dealer for Kenwood, ICOM, Yaesu, Aline Japan Radio, Standard, AEA, Cushcraft, Diamond and MFJ. New use equipment on display and open 7 days, M-9:5-p.m.; Sat.-10-5 p.m; Sun.-1-4 p.m. We ship Worldwide. Call, Fax, or write for information and prices. Your one Sour for Ham and Business Radios . . . BARKLEY ELECTRONICS, Lord Broadway Columbus OH 43206 (614) 866-4267.

 PENNSYLVANIA

Trevose

Authorized factory dealer and servicing KENWOOD, ICOM, YAESU, featured AMERITRON, B&W, MFJ, HYGAI KLM, CUSHCRAFT, KEN patient KANTRONICS, VIBROPLEX, HE CALLBOOK, AEA, Publications, a much more. HAMTRONICS, INC., 39 Brownsville Road, Trevose PA 19020. (215) 357-1400, FAX (215) 357-8919. Sales Order 1-800-625-9232. Cln Reader Service 298 for more information.

---

Number 18 on your Feedback card.
TROPICAL HAMBOREE
AMATEUR RADIO & COMPUTER FAIR
ARRL FLORIDA STATE CONVENTION
FEBRUARY 5 - 6, 1994
DADE COUNTY YOUTH FAIR & EXPOSITION CENTER • MIAMI, FLORIDA
• Sponsoring by Dade Radio Club of Miami, Inc.

• PROGRAMS & ACTIVITIES FOR EVERYONE • 200 + EXHIBIT BOOTHS • 800 + INDOOR SWAP TABLES • FREE PARKING FOR 15,000 VEHICLES • 300 CAMPITES WITH HOOK-UPS & LAUNDRY FACILITIES • TWO ON-SITE LICENSE EXAM SESSIONS • DXCC FIELD CHECKING

FCC FORUM (Featuring Ralph Haller, Chief PRB)
INTERNATIONAL AMATEUR RADIO (Presented by Region II, IARU)
LIVE TUNERS DEMO (Presented by Gordon West, WB6NOA)
WORLD OF EXTRA TERRESTRIALS
LATEST DXPEDITION & DX FORUM (Presented by S. FL. DX Assoc.)
ARRL OPEN FORUM (Featuring Officers and Directors of ARRL)
AMATEUR RADIO PAST AND PRESENT (Harry Dannals W2HD, Pres. QCWA)
WHATEVER YOUR SPECIAL AMATEUR RADIO INTEREST... YOU WILL FIND IT AT HAMBOREE.

Registration: $5.00 Advance — $6.00 Door • Valid Both Days (Advance deadline Feb. 1) • Swap Tables: $20 ea., plus reg. ticket • Power: $10 per user. IF YOU HAVE NEVER HELD SWAP TABLES, CALL SWAP CHAIRMAN FRANK SULLIVAN 305-667-1047 TO CHECK TABLE AVAILABILITY BEFORE SENDING IN RESERVATION. • Campsites: 3 days (Fri., Sat., Sun.) $40.00
4 days (Thurs., Fri., Sat., Sun.) $55.00 (Prices quoted for tickets, tables & camping include tax)

Headquarters Hotel: Miami Airport Marriott — $69.00 Single, Double + Tax • Tel. (305) 649-5000 — Speak Only to Reservation Department and Must Mention "Tropical Hamboree" to Get Special Rate. Deadline Jan. 24, 1994

After deadline, special rates on room available basis only

TICKET, CAMP, TABLE PAYMENTS PAYABLE TO: Dade Radio Club of Miami, Inc.
Mail to: Evelyn Gaulens, W4WVR, 2780 N.W. 3 St., Miami, FL 33125
EXHIBIT SPACE INQUIRY: Call 305-649-4139 or Fax: 305-649-1648

CIRCLE 59 ON READER SERVICE CARD
Notes from FN42

As this month's column is being written, we in the U.S.A. are watching Hurricane Emily churn toward the central East Coast, hoping that the storm will not strengthen and do damage to life and property. So far, we have been very lucky that no loss of life has been suffered, even though the storm grazed the outer banks of North Carolina. Meanwhile, Typhoon Yancy was headed toward Okinawa and Japan, lasting out with high winds and heavy rain. I certainly hope that David Cowigh, Ambassador to Okinawa, and the rest of the people will be safe and secure.

I made it back to Colorado this summer, but wasn't able to have an eyeball with any of the Gunnison hams. I did find out that the triband beam received from Fran, the widow of Fred Palmblad WOCYM, was used during the Field Day operation, and that a plaque has been permanently placed on the beam by the Gunnison Valley ARC. Fran's generosity has certainly started me thinking about what amateur-related equipment I might leave to local hams or the local ham club to help further this fantastic hobby. I have already compiled a list and am planning to include it in the next update of my Last Will and Testament. I think that this is really a way that we can all get involved, but in a slightly different way. Think about it!

Lastly, I would like to introduce a new Ambassador to the Philippines, Lorenzo D. Gaston DU1CHD6. He sent along three submissions for our pleasure. Welcome, Lorenzo! That's all for this month. On to the great news from around the world! 73, Amie N1BAC.

Roundup

Dominican Republic Letter from Bill Meara NC2QR/H8: Greetings from Santo Domingo, capital of the Dominican Republic ("The DR" for short), land of sunshine, merengue music, and FB ham radio! The members Radio Club Dominican have authorized me to serve as "73 International" Dominican Republic Correspondent. I am on assignment with the U.S. Embassy here; my selection as correspondent was based largely on my more than 30 years of practice with the English language! We've seen the excellent reports from around the world and wanted to send in a contribution from the DR.

The Dominican Republic is located on the eastern two-thirds of the island of Hispaniola. We are on the large island between Cuba and Puerto Rico. The country has a population of over seven million and is Spanish-speaking.

The DR is big in the DR! A drive through Santo Domingo reveals numerous HF yagis. Radio Club Dominican (HB2RCD) is the IARU affiliate and has been in operation since 1926. The club sports a complete HF station, along with a meter, HF gear and packet equipment. A second club, Union Dominican de Radio Aficionados, is also very active in Santo Domingo. In the country's second city (Santo) there is much club activity, including the Hotel Indies DX Association.

Dominican hams are involved in a wide variety of radio operations. HSB DXing is the most popular. Geography has blessed the island with good DX conditions (we are surrounded by salt water and have abundant solar radiation). There are approximately one million Dominicans living in the U.S. (mostly in the New York area), and amateurs among this expatriate population maintain schedules with ham friends on the home island. There is a lot of 2 meter FM activity, and the packet revolution has also swept through the land. There is a small group of 6 meter radio enthusiasts providing a new country for VHF buffs. Hams here have worked the Mir space station, and there is interest in the satellite program.

The numbers after the HF prefix indicate geographic region (8 for the capital, 3 for Santo, etc.). The suffix letters are usually based on the ham's initials. Old-timers are authorized single-letter suffixes. Foreigners operating with Dominican licenses have suffixes that begin with X. The DR has a reciprocal license agreement with the U.S.; hams operating under this agreement work with their home call, followed by /HI. ARRL headquarters has up-to-date information on the fairly simple process for obtaining reciprocal operating permission.

While not really in the category of rare DX, an HI call can stir up some pile-ups on the HF bands—lots of fun for a visiting U.S. ham.

Tourism is one of the country's largest industries, and we are sure that there are hams among the million or so sun-seekers who visit the DR's beautiful beaches every year. While most of the resort areas are quite distant from Santo Domingo, tourists do frequent it to make it to the capital. If you're coming to Santo Domingo, drop us a line, and we'll see if a visit to the club can be arranged.

Dominican hams are very friendly to hams from across the sea. HIBRCD activity has members from Haiti, DR and Japan. Over the years, foreigners on assignment in the DR have been very active in the local club.

We will try to provide "73 International" with periodic updates. For now, best of 73 from HI8I.

[Bill Meara NC2QR/H8, Unit 5510, APO AA 34041 USA]

Russia: From Yuri V. Funkner, UN1LX (ex-UL7LS): The International Diploma Foundation is a nonprofit, volunteer effort devoted to the development of world amateur radio by means of establishment of awards. Membership is open to anyone who shares the objectives of the foundation and is ready to pay the entrance fee. Donors will receive handsome certificates. All gifts will be acknowledged. For further information, write to: Yuri V. Funkner, 2134 YDF Securities, PO Box 1 Frenz 45911, Ordzhonikidzev Rayon, Kustanyasaya Oblast, Republic of Kazakhstan. Yuri also hosts a DX Net on 7043 kHz on Friday at 1900 UTC.

Switzerland From the International Telecommunication Union (ITU) Press: The ITU has created a new strategic consultative body to step up telecommunications development worldwide. The Telecommunication Development Advisory Board (TDAB) held its first meeting on 7 and 8 July 1993 to advise ITU on priorities and strategies for telecommunications development, to advise ITU member countries on how best to step up telecommunications development and to reinforce the role of the development machinery of the Union in this area.

The board will neither exercise supervisory functions nor will it be involved in the management of ITU's development sector. It will, however, be required to:

- Review views and recommendations that will contribute towards the development, expansion and efficient operation of telecommunications;
- Help in raising the level of awareness of decision-makers of the importance of telecommunications in socio-economic development situations;
- Encourage the participation of industry, telecommunication operators and service providers, bilateral and multilateral organizations and financing institutions to promote telecommunication development in developing countries;
- Assist in the mobilization of actions and resources for pre-investment and investment activities in the field of telecommunications;
- Assist in the preparation of telecommunication development conferences.

U.S.A. from Patrick G. Lehrman N1QJV, The June issue of Radio Fun ran an article about the "School-to-School QSO Contest." Many schools, hams, and clubs in the U.S. and Canada have responded to that article. The contest started at 1200 UTC on October 5 and ran through 1200 UTC on October 6, 1993.

Please send photocopies of logs as well as any interesting stories to the establishment of amateur Radio Club by December 31, 1993, at 125 S. Grant St., Westmont IL 60559-1907 USA.

[This letter described the contest but also noted that it was too late to include in the October issue before the contest. — Amie]

CANCAN ISLAND SPAIN

Woodson Garinaway EAB/NSKVI Apartado 11 35490 Sta Maria Guia (G.C.) Islas Canarias Espaňa.

Well, the Amateur Radio Club held last fall came as great. We had hoped for more participation, but about the only foreign operators who showed up were the vice president of the French amateur radio, my wife, a Portuguese couple, and some Russians who sailed here in a Viking-type ship (it would be worth a story in itself) several months earlier. There was a wide range of activities, excursions, and such, which put the annual fling to shame.

So this was another event in which a go was had by all. More recently, it hosted a CW contest weekend. I'll get up to that hill again to see what they're planning next.

In a previous report, I mentioned learning to make ordinarily s CW work. At the same time, I was talking about it with someone, and when I wrote about them, I suppose that is a worthy motive, but it certainly doesn't guarantee that if someone has experienced that they can then write clearly and correctly about a particular subject.

In a different report, I mentioned something about heroes in the mold. What I had in mind was how of moral courage instead of, a physical courage. People who can spur us by the moral nobly they try to do, even when they are not professional heroes.

What I think of is people like Matthew H. Peary, who accompanied Peary in his achievements in the Arctic. We may have to accompany Peary referred to as "indispensable, more of an Eskimo than some others," and he is still greatly admired by the descendants of the Eskimos who worked under him. "K. "K." Matthew" he was known among those who had my favorite photograph is of holding a muskox calf in his arms (I ran a photo of this very interesting and informative picture in American Geographic Vol. 174 No. 9 September 1988, p. 429).

He became one of the great frontiersmen and drivers of all. He lived out his life in the same old cabin that his brother's cabin was. There is no doubt that he lived a physically courageous, but he also had much more. Loyalty, humility—why you might enjoy reading his story.

ISRAEL

Ron Gang 4X1MK Kibbutz Urim D. Negev 85530 Israel Packet: 4X1MK @ 4Z4LYJSR MDLE

About 40 amateurs were present at the NATO's Goldfinch DXpedition to the And Israeli Packet Group's meeting.

82 73 Amateur Radio Today • November, 1993
**Heterodyne Headache #14.226.5**

Get fast relief with a Magic Notch automatic notch audio filter

**Why listen to carriers?**
The Magic Notch filter:
- is fully automatic. Nothing to set or do.
- is easy to install between the rig and an external speaker or headphones.
- can be left on all the time while operating SSB.
- shows filter operation with its 2 color LED.
- allows you to work any SSB signal under a 30 kHz carrier.
- requires 12 VDC—usually available from the accessory jack on your rig.

30 day money back guarantee

**$109.95**

Shipping & handling Free
Foreign orders $10.00

---

**Sell your product in 73 Amateur Radio Today**

Call Dan Harper today... 1-800-274-7373

---

**Official 1934 SHORT WAVE RADIO MANUAL**

simple, high-performance old-time shortwave radio!

All of the secrets are here: the circuit diagrams, parts layout, coil specifications, construction details, operation hints, and much more.

This is a compilation of Short Wave Constructions articles from "Short Wave Craft" magazines published in the 20's & 30's. It's wall-to-wall "how-to" information included are circuit diagrams, photographs, and design secrets of all shortwave receivers being manufactured in 1934 including some of the most famous: SW-5, the SW-5 "Thrill Box", the deforest KR-1, the Hammarlund "Comet Pro", and many more.

Also included is a new chapter showing how you can use transistors to replace hard-to-find vacuum tubes. You'll even see the circuit that was fitted together on a table top one night using junk box parts, a hair curler and alligator clips. Attached to an antenna string across the basement ceiling and a 9 volt battery, signals started "POPPING" in like crazy. In a couple of minutes an urgent message from a ship's captain off Seattle over 1300 miles away was heard asking for a navigator to help him through shallow water!

These small regenerative receivers are extremely simple, but do they ever perform! This is a must book for the experimenter, the survivalist who is concerned about basic communication, shortwave listeners, ham radio operators who collect old receivers, and just about any radio enthusiast.

Great book! Fun to read! ONE OF THE BEST old-time radio books to turn up in years.

Heavily illustrated! Order today! 1/2 x 11 paperback 260 pages... only $16.70 postpaid! Guaranteed! Free catalog included!

---

**BIG CATALOG!**

Discover exciting old shortwave books from decades ago! Big Catalog packed with how-to books on old time radio, shortwave, television, Tesla coils, lightning bolt generators, motors, magnets, unusual science projects and equipment! & much more! Quality! Write for your personal copy of this great catalog!

**Lindsay's Technical Books**

Box 538-WB6, Bradley IL 60915


---

**Learn to Build and Program Computers with this Kit**

- Includes: All Parts, Assembly and Manual

- Model: MM-1037

- $129.00

by Elenco

---

**Official 1934 SHORT WAVE RADIO MANUAL**

simple, high-performance old-time shortwave radio!

All of the secrets are here: the circuit diagrams, parts layout, coil specifications, construction details, operation hints, and much more.

This is a compilation of Short Wave Constructions articles from "Short Wave Craft" magazines published in the 20's & 30's. It's wall-to-wall "how-to" information included are circuit diagrams, photographs, and design secrets of all shortwave receivers being manufactured in 1934 including some of the most famous: SW-5, the SW-5 "Thrill Box", the deforest KR-1, the Hammarlund "Comet Pro", and many more.

Also included is a new chapter showing how you can use transistors to replace hard-to-find vacuum tubes. You'll even see the circuit that was fitted together on a table top one night using junk box parts, a hair curler and alligator clips. Attached to an antenna string across the basement ceiling and a 9 volt battery, signals started "POPPING" in like crazy. In a couple of minutes an urgent message from a ship's captain off Seattle over 1300 miles away was heard asking for a navigator to help him through shallow water!

These small regenerative receivers are extremely simple, but do they ever perform! This is a must book for the experimenter, the survivalist who is concerned about basic communication, shortwave listeners, ham radio operators who collect old receivers, and just about any radio enthusiast.

Great book! Fun to read! ONE OF THE BEST old-time radio books to turn up in years.

Heavily illustrated! Order today! 1/2 x 11 paperback 260 pages... only $16.70 postpaid! Guaranteed! Free catalog included!

---

**BIG CATALOG!**

Discover exciting old shortwave books from decades ago! Big Catalog packed with how-to books on old time radio, shortwave, television, Tesla coils, lightning bolt generators, motors, magnets, unusual science projects and equipment! & much more! Quality! Write for your personal copy of this great catalog!
opening address was given by pioneer packeteer Bentzi 4X1IL, while the Hannukah candles were lit by Yankele 4X1AH, IARC President. Further talk on subjects related to packet radio was given by Yossi 4X6KK, IARC Chairman, Naffaty 4Z4RM, and "Dimaona Danny" ZD9DDA.

The Packet Cluster, which shall soon start operation on 144.675, the 4X1Fnet frequency, was discussed by 4X1HFK and 4X1DHA. The first Cluster's call sign will be 4X4BX, in memorial to the late DXer Siona Manzari 4X4BX, who was the first IARC chairman. Hot DX information will be transmitted to all Cluster members who have left their packet gear on the frequency in the same manner as in a telephone conference call.

Jim 4X1RU outlined the newest version, 5.14, of the FEPBB BBS program, which is installed in his BBS and requires one megabyte of computer memory. Mail from abroad comes through 4X1AS's satellite gateway and six European HF BBSs. Features of the new software are: a BBS data base which completes incomplete addresses automatically, a REJEC feature to eliminate undesirable, and Send (Send Reply) feature that automatically addresses according to the number of the message being answered. Jim also reviewed the amateur communications software being integrated into the Technion's satellite project, the Techsat.

Peleg 4X1GIP clarified points on proper packet operation stressing the inclusion of one's own packet forwarding address in the body of the message, so that the addresse will know how to reply. Recommended operating parameters for the TNC dealing with switching time and delays for proper integration into the Net were discussed.

He also explained the TCP/IP protocol, the latest improvements made in it. He recalled the problem of the 'hidden station' that reduces the throughput in the system to 18% of the capacity. He presented a solution where a commanding station will work as a digital regenerator transmitting what it's receiving simultaneously. This will raise the efficiency to 56% at the cost of allocating two frequencies to communication.

Shlomo 4XlAS described the communications programs (PG and PB) for which the satellites OSCAR 16 (1200 baud) and OSCAR 22 (9600 baud). Messages are sent in the BROADCAST mode, and the satellite can be utilized by up to 20 users simultaneously. If 20 are already connected, you are given a number and must wait in line until your turn comes up. The satellite transmits 10 seconds to each connectee. Make sure your packets are sent to the correct satellite and the local directory should be constantly updated. If the requested information is not received during this pass, the program will automatically request it again when the bird comes overhead the next time. Files arrive in compressed form and as such are transferred to 4X1RU, where they are unraveled. There are 25 satellite gateways in the world. Each one receives material only from other gateways and checks the satellite's directory if there are any messages for it.

All-in-all, this year's Packeteers' meeting was a fruitful one, giving a good forum for the exchange of ideas and furthering the advancement of the fast-growing field of digital communications in Israel. Looking back to the inception of packet in Israel a mere six years or so ago, the growth has been amazing. [Also amazing in the rest of the world too!—Arnie]

OKINAWA JAPAN

David Cowigiah 7J6BCBWA1LP
AmCom Naha
FBU P1O 558, Box 840
FPO AP 96572-0840
Now it is late June. The plum rain season has ended and we are moving into Okinawa's hot season. Soon will come the Eisa festivals throughout Okinawa (July and August) where the Okinawa, who follow the animist-ratification religion of the Chinese, welcome back the spirits of their ancestors for a three-day visit. Large groups of men and women dance in fine costumes, carrying drums like those shown in JS64NO Okama-e's QSL card. The instruments and distinctive rhythms of Okinawan music, very different from those of the rest of Japan, owe much to China, Thailand, China and probably India as well.

When Emperor Akihito and Empress Michiko visited Okinawa in April, they passed just 200 meters from our house in the central Okinawan village of Kitanaakagusu on their way to visit some handicapped children. Our neighbors waved Japanese flags as the couple drove by in their black limousine and hundreds of children waved a white handkerchief. Not to be left out, my children, Patrick and Frances KD4BMJ, grabbed Japanese flags and waved them enthusiastically as the Emperor and Empress passed by. I couldn't help but think what a wonderful difference 50 years makes!

One theme of the Emperor's visit for the National Arbor Day Celebration was reconciliation with the Okinawan people who had suffered terribly at the hands of the Japanese Imperial Army. Today, as they do every 23-25, Okinawans remember the 200,000 Japanese, Americans, and Koreans who died here in 1945. The Okinawans plan to dedicate a memorial on the 50th anniversary of the Battle of Okinawa which will have the names of all the soldiers—Japanese and American—who died in the battle. In the words of Jana, the 17th century Ryukyu Kingdom statesman, "inochi da takara"—life is treasure."

During a mid-May trip to Yanaguni, the westernmost of the Japanese islands and home of the world's largest moth (wingspan up to 24 cm), my efforts to reach Taiwan, just 80 miles, on 2 meters failed but I met island physi

masaki Akamine JS6GNN, his wife Mimako JS6KHO and their two children. The Okinawa Prefectural government assigns Akamine-san to a new outlying island every year. He likes islands so he started his assignment on Yanaguni, population 80,000, in 1953. I met JS6GNN on the 80-miles-distant 439.88 MHz JG6YI shigaki island repeater but soon switched to 2 meters simplex and then the eyeball mode since Akamine-san's home (and clinic) was just 50 meters from my minshuku (Japanese traditional-style hotel). The Akamines took me on a tour of the island while I worked in Honshu using the 3 watts Mizuno 21 MHz SSB handle talkie.

We finished the evening in a restaurant run by Yanaguni Mayor Tatsujiro's family—named the White House, naraudo (that's, of course, in Japanese).

Yanaguni lives by raising beef cattle, growing sugar cane and vegetables, fishing, selling the local awamori, rice liquor (at 60% alcohol), the strongest brew in all Japan), and tourism. Yanaguni enjoyed a brief boomtown era (the island population hit 12,000 in 1947) as Japan's Wild West just after World War II. Enterprises smugglers liberated goods from the US military PX for cheap Taiwan rice which they could sell for a 700% profit on the Japanese black market.

[More next month!—Arnie]

PHILIPPINES

Lorenzo D. Gaston DUICH#80
PO Box 27
6116 Sila City, Neg. Occ. Philippines

Amateur Radio licenses in the Philippines are issued by the National Telecommunications Commission (NTC). NTC is under the Department of Transportation and Communications (DOTC). NTC is headed by one commissioner and assisted by three deputy commissioners. The NTC issues Amateur Radio Licenses and Radio Amateur Operator's Certificates with a maximum effectivity period of three years.

There are four classes of amateur radio licenses in the Philippines: Class A, B, C, and D.

Class A licensees have full privileges and who have issued and restricted power in limited to 2 kW PSB or 1 kW CW. Class A licensees who have operated for at least the preceding five years as Class A are qualified to be their appointed as club station. New stations are required to have abbreviated (qualified) licensees. Licensees to operate repeaters are only granted to duly recognized amateur organizations, clubs, or societies. All club station and their repeater(s) have the same callsign and are assigned DX prefixes.

Class B licensees are not authorized to transmit on the 160 meter band. Operation on 20 meters is limited to 14.000 to 14.257 MHz. Operation on all other bands and modes is allowed and restricted power output is limited to 1 kW PE PSB or 500 watts CW. All Class B licensees are assigned DX prefixes.

Class C licensees are authorized to transmit on all modes on 40, 15, 10, and 2 meters only. Authorized station power output is limited to 200 watt PSB, 100 watts CW, and 10 watts on 2 meters. All Class C licensees are assigned DX prefixes.

Class D licensees are limited to the 160 meters only (all modes) and 100 watt power output. All Class D licensees are assigned DX prefixes (FY-_irq) QSL cards are not valid for the UN-D Award or any other award so please do not contact or send a QSL card to a DX-prefix station on any band except 2 meters, just in case you hear one.

A "Radio Amateur Operator Certificate" is a certificate of authority issued by the NTC to a qualified person who has passed an appropriate amateur radio examination. This certificate authorizes the holder to operate any licensed amateur radio station of an appropriate class as indicated in the certificate.

Next month I will cover the reciprocal licensing in the Philippines.
NOV 7
KAUKAUNA, WI The Fox Cities ARA will hold a Ham and Computer Fest at the Starlite Club, VE Exams. Talk-in on 146.76 (CTCSS 107.2 Hz). For details, contact Dan Vanevenhoven N8LVS, 2410 E. New- 
berry, Appleton WI 54915. Tel. (414) 799- 
3101. VE Exams, contact Larry Siedent K6NA, (414) 799-3823.

NOV 13
MONTGOMERY, AL The Montgomery ARC will host the 16th annual Montgomery Hamfest/Computer Show in Garrett Colle-
seum at the South Alabama State Fair 
grounds on Federal Dr., from 8 AM-3 PM CST. VE Exams start at 8 AM. Talk-in on 146.24/84 (W4AF). Rag chew on 146.32/52 (with phone patch, up/down), 147.7/18, 449.50/444.50. Special Rates: 
Days Inn, (205) 269-9611; Colliseum Motel, 
(205) 265-2098 or (800) 834-5095; or Best Wes-
tern Regency Inn, (205) 269-
4444(000) 528-1224. Contact Hamfest Commit-
tee, c/o 111 Diane Cir., Proprietary, Montgomery, AL 36066, or phone Jiggs, (205) 365-0380, 
FAX (205) 365-1190.

PLUYMOUTH, MA The Plymouth ARC will host a Flea Market at the Plymouth Mem-
orial Hall Bldg. in Plymouth Center (RT3A), 
from 9-3 PM. Walk-in VE Exams. Talk-in 
on 146.25/162 and 146.25 simplex. For 
Flea Market info, call Jon WS1K, (508) 
746-0162 or Jim NM1F, (508) 747-2224 
even. For exam info, call Bob, (508) 747-
4025.

NOV 14
BRANFORD, CT The Southwestern Conn. 
ARA will hold its 14th annual Flea Market at the Branford Intermediate School, 195 
Princetown Rd., starting at 9 AM. VE Ex-
ams—reservations must be mailed to be 
received before Nov. 1st. Talk-in on 146.0/11.61. For details, call Bill, (203) 265-
3983, 24 hrs. Mail reservations with 
SASE to SCARA, P.O. Box 705, Branford 
CT 06405-0705.

CHICAGO, IL The Chicago ARC will hold 
the Fall Ham Auction at the Dev'Tyi Inst. 
Tech., 3300 N. Campbell, starting at 12 
noon, until all is sold. Door opens at 10 AM 
for inspection of items.

NOV 20
BILLERICA, MA An Amateur Radio and 
Electronics Auction will be held from 11 AM-4 PM at Bull HN, 300 Concord Rd. 
Talk-in on 147.12. Seller Check-at 9:30 
AM. Item Inspection at 10 AM. Sponsored 
by BULL HN 1200 RC and Whalarn ARA.

Contact Elliot Mayer W1JMJ, (508) 851-
0183.

HOLLAND, MI The 3rd annual Westshore 
Hamfest will be held by the Holland ARC, 
at Holland Christian H.S., 956 Ottawa 
Ave., from 8 AM-2PM. VE Exams. Make 
reservations early. Contact Joe Campbell, 
(616) 722-4928 after 6 PM or mail reser-
vations to Westshore Hamfest, c/o Joe 
Campbell, 10413 Northfield Dr., Holland MI 
49424. Talk-ins on 147.30.

NOV 21
BENSON, NC The Johnston ARS, Inc., will 
hold its annual "Jamboree at the 
American Legion Complex from 8 AM-4 PM. 
Contact Bill Lambert AK4H, 8117 NC 50 
H, Benson NC 27504. Tel. (919) 330-3002 
even. 7 PM-10 PM.

WASHINGTON, PA Washington Amateur 
Communications (W.A.C.) will hold its 
6th annual Tri-State Hamfest/Computer Fair from 8 AM at Charters-Hou-
ston H.S. VE Exams. Talk-in on 145.49-
9/WCXY. Contact Ted Lombok WBBZK, (412) 222-6473; Russ Burhenn N3NHEL, (412) 222-4037; or FAX (412) 
258-6342. Or write W.A.C. P.O. Box 1385, Washington PA 15301.

NOV 27
EVANSTVILLE, IN The All NEW 
Evansville Winter Hamfest, sponsored by 
EARS, will be held at the Vanderburgh 
County 4-H Center, Highway 41 (just 

of Evansville). Doors open at 8 AM. Con-
tact Beverly Hunter K9PDPG, (812) 471-
5741. Talk-in on 145.150 in Evansville on 
146.925 in Vincennes. Send reservation 
to EARS, 1506 S. Parker Dr., Evansville I. 
47714.

NOV 28
WHEATON, IL IL-GMRS of Illinois, Inc. 
will hold their annual "Winterfest" from 
AM-1 PM at the DuPage County Fair 
grounds in Wheaton. Call (708) 690-149-
1, or write GMRS, 2077 W. Roosevelt Rd. 
Wheaton IL 60187.

DEC 4
NORTH OLMSTEAD, OH The Nort 
Coast ARC will hold their Fall Hamfair 
from 8 AM-2 PM at St. Charles Church 
30106 Lorain Rd. Electronics. Computer 
Talk-in on 145.29 and 230.76 Toms. 
Contact John Hoffman N2NUI, 146.01/ 
0.61. For details, call 216-677-5033, or 
Rick McC (R~ 400-5201 T~ 
11 PM. 

NEWSPAPER ADVERTISING

NOV 4
CLINTON, NC The Sampson County ARS 
will operate KD4AR from the Sampson 
County Expo., from 17002-2400Z, low 
portion of the bands. For a certifi-
cate, send QSL and SASE to SCARS, P.O. 
Box 64, Clinton NC 28328.

EVERY ISSUE of 73 on microfiche!

The entire run of 73 from October, 1969 
through last year is available.

You can access to the treasures of 73 
without several hundred pounds of 
bulky back issues. Your 24X fiche has 98 
pages each and will fit in a card file on 
your desk.

We offer a battery operated hand held 
viewer for $75, and a desk model 
for $220. Libraries have these readers.

The collection of over 800 microfiche, 
is available as an entire set, (no partial 
sets) for $285 plus $5 for shipping (USA). 
Annual updates available for $10.

Your satisfaction is guaranteed or 
your money back. Visa/MAI accepted.

BUCKMASTER PUBLISHING

"Whitehall" 
Route 4, Box 1630 
Mineral, VA 23117 
703-894-5777 
800-262-5628

CIRCLE 168 ON READER SERVICE CA
OLTON, VT The Central Vermont ARC will operate the Vermont Girl Scout Council E Station W1BD from the Bolton Valley resort, 1700Z Nov. 7-9. Nov. 7th, req.: 14.233, 7.233, 3.685 MHz. For a special Event QSL card, send QSL and ASE to CIARC/VGSC Special Event, O, Box 674, Montpelier VT 05602-9754.

EW HAVEN, CT The South Central CT RA will operate W1GB 14002-2300Z to commemorate the operation of the first iephone switchboard in the U.S. Operation will be in the General 40 and 20 meter subbands. For a certificate, send QSL and a 9" x 12" SASE to Bruce Tolerto A1EX, 94 Dogwood Rd., Orange CT 06477.

UELPH, ONT., CANADA SE Station G3W will operate on 10, 15, 20, 40 and 60 meters as an "in memorium" for the fall of both World Wars. Operation will be 1 AM-S 5 PM EST each, with a minute silence at the 11th hour of the 11th day the 11th month. For a QSL card, send the IRC or Canadian Postal on SASE to G3W, c/o VE32M, P.O. Box 1305, Leith, Ontario, Canada N1H 9N9.

LBUQUERQUE, NM The Albuquerque 10c will operate W5MMI from 1700Z Nov. 7-1700Z Nov. 12th. To commemorate the Stalion Days. The Station is located at the Stalion Administration Medical Bldg. For certificates, please send a QSL and a 9" x 12" SASE to AARC, P.O. Box 11853, Albuquerque NM 87192.

ARLOTTE, NC Mecklenburg ARS will operate W4BBF from 1400Z-2400Z Nov. 13th, and 1800Z-2400Z Nov. 14th, to celebrate the 2nd Anniversary of the amateur radio education center at Discovery Place, the hands-on science museum in uptown Charlotte. Operation will be in the upper 25 kHz of the General 80, 40, and 20 meter phone subbands; as well as in the Novice 10 meter phone subband. For a certificate, send a 9" x 12" SASE to Mecklenburg ARS, 2425 Park Rd. -Room 023, Charlotte NC 28203-5974.

COLLEGE PARK, MD The Laurel, MD ARC will operate W3DQI FROM 1700Z Nov. 13th-2100Z Nov. 14th, from College Park Airport. Operation will be in the lower portions of the General bands, near 28.5 in the Novice subband, and on 147.54 FM. For a certificate, send QSL, 9" x 12" SASE, and your QSO to nr to LARC, P.O. Box 3039, Laurel MD 20709-0039.

STUART, FL Martin Co. Aces/Races will operate W2ATRI 14002-2300Z both days, from the 6th annual Jensen Beach Pineapple Festival. Operation will be on the lower portion of the General 10, 15, and 20 meter bands. For a certificate, send QSL and a 9" x 12" SASE to Larry Cohen WASTRI, 5595 SE Lamay Dr., Stuart FL 34997.

FORT LANGLEY, B.C., CANADA The Fraser Valley ARC will operate V7FL from Fort Langley, to commemorate the 135th Anniversary of the Proclamation read by Sir James Douglas at Fort Langley, Nov. 19, 1858, creating the Colony of British Columbia. Operation will be on the 20, 15, and 10 meter bands in the General portions, from 1700Z to 2300Z over the 3 days. For a certificate, send QSL and a 9" x 12" SASE (1 to cover postage), to Fraser Valley ARC, Box 50, Fort Langley, BC, V0X 1JO Canada.

RF ENTERPRISES TO ORDER: 1-800-233-2482 Service & Info: 218-765-3524 Fax: 218-765-3308 Complete Inventory

- ANENNAS
- TOWERS
- ROHN
- HY-GAIN
- DIAMOND
- ACCESSORIES

YAESU ICOM MFJ AEA


IOTOR Cable: standard (0-23, 2-18) heavy duty (25-10, 1-5) 'a stock Amphenol Connectors, connectors installed' Jumpers & custom cable assemblies.

ISA Mastercard can return to change without notice, being extended except as noted. Items subject to 20%, excluding tax unless lower returns.

CIRCLE 171 ON READER SERVICE CARD

CIRCLE 291 ON READER SERVICE CARD

Come to the 1993 AMSAT Space Symposium
La Quinta Inn & Conference Center
Arlington, Texas
October 8, 9 & 10
Your Best chance to learn how to work
Amateur Satellites:
The high orbit DX satellites:
OSCARS 10 & 12
The "Easy birds":
RS 10 & 12
Store & forward PACKET spacecraft
AG 16, LU 19, RU 22, KO 23
and more coming SOON!
Now building:
Phase 3D (The satellite for all amateurs)
SIdEsat (Easy to use 2 to 10 meter transponder + digital)
ASEAT (An experiment in amateur spread spectrum)
RS 15 (A new Russian 2 to 10 meter satellite)
More PACKET satellites

Marjorie Swain with Grand Prize won at 1992 Symposium - a Kenwood TR-751A all-mode 2 meter transceiver. GM Carroll W7DU seems pleased with her good fortune.

For more information write or call
AMSAT
PO Box 27
Washington, DC 20044
301-589-6062

CIRCLE 110 ON READER SERVICE CARD

73 Amateur Radio Today • November, 1993 87
NEW PRODUCTS
Compiled by Charles Warrington WA1RZW

MULTIFAX
The new MultifAX external WEFAX demodulator is now available, and it can be used anywhere with an IBM or compatible PC, Laptop, or Notebook. The unit interfaces directly through the parallel printer port; it does not require its own internal slot.

This external unit uses the same software and supports the same features as the popular MultifAX Version 2.2 plug-in card. The unit runs on any 12 VDC supply, including cars and boats. Now you can downlink NOAA satellite weather imagery wherever you go.

The price is $389 plus $8 S & H in the US. (The unit is shown with its cover removed.) For further information, contact: MultifAX 143 Rollin Irish Road, Milton VT 05468; (802) 893-7006, FAX (802) 893-6859. Or circle Reader Service No. 202.

PAKTEK
PAKTEK has introduced the “Tool Tote” as their unique solution for the two biggest complaints about hard utility boxes: 1) They are clumsy; and 2) They damage surfaces. The new-fashioned Tool Tote is strong but gentle.

This handy soft-sided utility organizer features an oversized center compartment opening for easy access, 14 external pockets, an extra-large zipper with two pulls, bold red and black styling, and an affordable price of $24.97.

For more information or to place an order, contact: PAKTEK, Inc., 7307 82nd St. Ct. SW, Tacoma WA 98448; (800) 258-8458. Or circle Reader Service No. 201.

JADE PRODUCTS, INC.
Here’s the latest addition to Jade Products FUN-KIT line: the 160 Meter Twin-Lead Marconi Antenna. This antenna (Model AN-00001-01) is a complete, ready-to-install kit consisting of all the necessary hardware, wire, twin-lead, connectors, and support rope.

This antenna provides unique support for the twin-lead, thus preventing the failure due to fatigue and flexing which often occurs when hanging twin-lead by rope. This elbow support forms a gradual bend, and is adjustable. The antenna is approximately 126 feet long. With the elbow elevated to 35 feet, the horizontal section would require only 90 feet of installation and connection is simple; an antenna tuner is not required.

The price is $39.95. To order or for more information, contact Jade Products Inc., P.O. Box 368, East Hampstead NH 03826; (603) 329-6935. Or circle Reader Service No. 206.

S-COM INDUSTRIES
S-COM Industries is now shipping a powerful 100-setpoint scheduler as a standard feature on all 5K Repeat Controller. The scheduler executes user-defined macro commands at programmable setpoints (times and dates). The macro commands determine the action the controller will take, such as changing repeater access modes for day and night, and reprogramming the identifier for holidays and special events, etc. These can be set for a specific time and date, or for events recurring on a regular basis.

The controller automatically compensates for power outages and leap years. The 5K Repeat Controller is priced at $175. Options and upgrades for older models are available. For more information, contact: S-COM Industries, P.O. Box 1718, Loveland OH 44319-3696; voice (216) 840-1128, Fax (216) 349-8407. Or circle Reader Service No. 203.

ANTENNA SPECIALISTS
The Antenna Specialists Co. has developed a new set of software programs to aid communication system designers and operators in producing critical antenna calculations and patterns tailored to their own system requirements. Called the RF Tools Series, the programs are said to be both highly accurate and easy to use.

Disk 1, called DXPLOT, permits precise calculation of beam tilt coverage, and is available for $29.95. Disk 2, called PATPLOT, displays and plots digitized antenna patterns. Disk 3, called ANT PLOT, develops patterns for side-mounted base antennas. These programs are available on 5 1/4” IBM compatibles disks, but the programs can be so downloaded, free charge, from the manufacturer's remote bulletin board system (RBBS). The AS RBBS is line 24 hours a day and offers an enormous bank of technical product information, files capability, and help utilities, and listings technical and engineering support staff. The modern communications matrix is 360/1200/2400/9600/8N1. The number is (216) 349-8698.

For further information contact: Antenna Specialists Company, 3300 Canfield Drive, Cleveland OH 44139-3596; voice (216) 349-8400, Fax (216) 349-8407. Or circle Reader Service No. 203.

P.C. ELECTRONICS
Here’s a low-cost progressive way of getting into ATV: the P.C. Electronics Model TX70-1b 1.5 watt 70 cm (240-450 MHz) Transmitter. Many start by purchasing the $89 TVC-4G Tunable Down Converter just to check out the local ATV repeater or simplex action. After the ATV bug bites, they are ready to transmit back. But now, instead of trading for an all-in-one transceiver, they can just add the companion TX70-1b Transmitter for $279.

The transmitter’s rugged die-cast aluminum cabinet weighs less than two pounds and is enough easily fit a knapsack.

The unit comes with one crystal and has provisions for switching between two frequencies. The external power requirements are 12 to 14 VDC at 5 mA. The antenna connector is a ty N; a BNC outputs to the receive down converter from the built-in and power T/R relay.

No code Technician Class or higher amateurs are welcome to write or call for a 10-page catalog. Please contact: P.C. Electronics, 5252 Paxson La, Arcadia CA 91007; (818) 447-4865. Or circle Reader Service No. 205.

NCG COMET
New from Comet, this compact Cross Needle SWR/Power Meter has its metering separate from its RF sensor. Three models are available for high power HF, low power HF/VHF, and low power VHF/UHF. The Cross Needle design provides forward and reflected power and VSWR simultaneously.

Three-switch selectable power ranges are provided on each model, with a fourth switch to measure DC voltage from the power supply or vehicle. The meter is lighted in color for easy reading.

The CMX Meter Series is specifically designed and ideally suited to mobile operation. Each meter comes with a standard six-foot cable allowing placement of the meter head near the rig’s remote head, while the sensor is near the rig itself. An optional 10-ft extension is also available.

The CMX Series is available for your amateur radio dealer. For more information contact: NCG Company, 1275 North Grove St., Anaheim CA 92806; (800) 962-2611, FAX (714) 830-7024. Or circle Reader Service No. 204.

Circle Reader Service No. 206.

Number 22 on your Feedback card

The unit runs on any 12 VDC supply, including cars and boats. Now you can downlink NOAA satellite weather imagery wherever you go.

The price is $389 plus $8 S & H in the US. (The unit is shown with its cover removed.) For further information, contact: MultifAX 143 Rollin Irish Road, Milton VT 05468; (802) 893-7006, FAX (802) 893-6859. Or circle Reader Service No. 202.

S-COM Industries is now shipping a powerful 100-setpoint scheduler as a standard feature on all 5K Repeat Controllers. The scheduler executes user-defined macro commands at programmable setpoints (times and dates). The macro commands determine the action the controller will take, such as changing repeater access modes for day and night, and reprogramming the identifier for holidays and special events, etc. These can be set for a specific time and date, or for events recurring on a regular basis.

The controller automatically compensates for power outages and leap years. The 5K Repeat Controller is priced at $175. Options and upgrades for older models are available. For more information, contact: S-COM Industries, P.O. Box 1718, Loveland OH 44319-3696; voice (216) 840-1128, Fax (216) 349-8407. Or circle Reader Service No. 203.

The Antenna Specialists Co. has developed a new set of software programs to aid communication system designers and operators in producing critical base antenna calculations and patterns tailored to their own system requirements. Called the RF Tools Series, the programs are said to be both highly accurate and easy to use.

Disk 1, called DXPLOT, permits precise calculation of beam tilt coverage, and is available for $29.95. Disk 2, called PATPLOT, displays and plots digitized antenna patterns. Disk 3, called ANT PLOT, develops patterns for side-mounted base antennas. These programs are available on 5 1/4” IBM compatibles disks, but the programs can be so downloaded, free charge, from the manufacturer's remote bulletin board system (RBBS). The AS RBBS is line 24 hours a day and offers an enormous bank of technical product information, files capability, and help utilities, and listings technical and engineering support staff. The modern communications matrix is 360/1200/2400/9600/8N1. The number is (216) 349-8698.

For further information contact: Antenna Specialists Company, 3300 Canfield Drive, Cleveland OH 44139-3596; voice (216) 349-8400, Fax (216) 349-8407. Or circle Reader Service No. 203.

P.C. ELECTRONICS
Here’s a low-cost progressive way of getting into ATV: the P.C. Electronics Model TX70-1b 1.5 watt 70 cm (240-450 MHz) Transmitter. Many start by purchasing the $89 TVC-4G Tunable Down Converter just to check out the local ATV repeater or simplex action. After the ATV bug bites, they are ready to transmit back. But now, instead of trading for an all-in-one transceiver, they can just add the companion TX70-1b Transmitter for $279.

The transmitter’s rugged die-cast aluminum cabinet weighs less than two pounds and is enough easily fit a knapsack.

The unit comes with one crystal and has provisions for switching between two frequencies. The external power requirements are 12 to 14 VDC at 5 mA. The antenna connector is a ty N; a BNC outputs to the receive down converter from the built-in and power T/R relay.

No code Technician Class or higher amateurs are welcome to write or call for a 10-page catalog. Please contact: P.C. Electronics, 5252 Paxson La, Arcadia CA 91007; (818) 447-4865. Or circle Reader Service No. 205.
Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try to sell it, but you know you'll get a far more realistic price if you have it out where 100,000 active hams can see it than the few hundred local hams who come by a flea market. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your kids to throw out? That stuff isn't getting any younger!

The 73 Flea Market, Barter 'N' Buy, costs you peanuts (almost) — comes to 35 cents a word for individual (non-commercial) ads and $1.00 a word for commercial ads. Don't plan on selling a long, long item. Use abbreviations, cram it in. Be honest. There are plenty of hams who love to fix things, if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include a commercial phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you list many calls, you will price it low. If you don't get many ads, you're getting by on your computer and put together a list of small parts to send to the interested parties.

Send your ads and payment to the Barter 'N' Buy Judy Walker, 70 Pr. 202N, Peterborough NH 3458 and get set for the phone calls.

de deadline for the December classified ad section is October 14, 93.

.. ABOUT CRYSTAL SETS. Theo and construction of crystal set ra.

$.75 each, ppd USA. Send to: ..LABWORK BOOKS., Dept. P.O. 

x 2236, San Diego, CA 92102.

BNB200

PERFAST MORSE CODE SU.

REASY. Subliminal cassette. $12.

RN MORSE CODE IN 1 HOUR.

learning supereasy technique. $12.

90 Moneyback guarantee. Free 

alog: SASE. BAHR-77, 150 Greend.

ing, Bloom indulge IL 6108. BBNB21

IL CARDBOXES & INDEX DIJ.

ERS. Send SASE. 7-Mike HAM-M.

UFF, P.O. Box 14455, Scottsdale 

85267-2455. BBNB224

DSP AUDIO PROCESSING.

MPARES TO JPS. Eliminate varie.

ated noises. NF-10 special, $19.95.

NF-60 Notch Filter, $139.50. In

satisfaction guaranteed. Authorized de-

lts. RALF CO. 24-HOUR OR.

RS: (800)484-4002, CODE 1356.

(800)369-1738. BBNB254

IMMODORE 64 REPAIR. Fast tun.

und. SOUTHERN TECHNOLO.

'S AMATEUR RADIO, 10715 SW 

11th Street #9, Miami FL 31357.

3238-3327. BBNB285

DIO RUBBER STAMPS free 

shure. REID ASSOCIATES, 6680 

low Wood, West Bloomfield MI 

22. BBNB297

NTEC ELECTRONIC TUBES, ICS.

MICONDUCTORS. APOST. P.

O. 707ST, Linden NJ 07036. Call 

666-8467. BBNB307

JWOOD AUTHORIZED REPAIR. 

, ICOM, Yaesu. GROTON ELEC.

e tos. Box 379, Groton MA 

(908)859-1616. BBNB310

RADIO CRAFTSMAN, newsletter 

or those who want to build their own 

ally. Send large SASE for ple 

issue information. AAOIS, 

3682, Lawrence KS 66046. 

BNB325

2950 OWNERS: New modifica-

nal manual including Power increase 

ier modification. Modulation in-

crease. Operating hints, and more. 

Parts included. Only $200.00 ppd 

in U.S. (Missouri residents add $1.15 

税). SCOTT, P.O. Box 510403, 

Louis MO 63151-0408. (314)846-

0252. Money Orders or C.O.D. 

BNB340

CONNECTICUT'S FAVORITE HAM 

STORE. ROGUE ELECTRONICS, 

250 Meriden-Waterbury Turnpike, 

Southington CT 06489. (203)212-

2252. BNB355

KIT BUILDERS! Complete list of 136-

kit vendors. SASE + $3.00 USD to: 

RUDY RITERNBERG, 38045 10th St. E. 

#75, Palmdale CA 92560. BNB365

QSL CARDS - Standard and cus-

tom. Your ideas or ours. Excellent 

quality. Stamping available. Many 

designs and style catalog. Catalog 

and samples $1.00 refundable. 

WILKINS, Dept. A, Box 787, Atascadero CA 

93423. BNB370

20 METER SUPERHET C.W. 

TRANSCIEVERS KIT, $49.95 plus 

$3.75 shipping. Check/M.O. 1994 Cat-

alog for 2 Stamps. DANS SMALL 

PARTS & KITS, 1935 South 3rd West 

#1, Missoula MT 59801. BNB385

6 CD-ROMS, 5 GIGS! A CD-ROM 

packs clocked full of this world's 

highest quality-MS/DS, OS/2, Wind-

dows, Games, Gifs, and literature 

galore. No CD-ROM older than 6 

months. $99 Money back guarantee. 

Linux on CD-ROM, $39. (408)241-

7376. BNB390

AMATEUR MARKET PLACE. New 

monthly newsletter listing for sale 

wanted Amateur & Computer equip-

ment. $19.95 or US$16.50. US 

pars re卖 price of $6 exchange by 

buying CANADIAN ENTER-

PRISES, P.O. Box 8180, Ottawa, 

Canada K1G 3H7. BNB405

BROWNIES QSL CARDS SINCE 

1939. Catalog & samples $1 (refund-

able with order), 3635 Lehigh Street, 

Allentown PA 18103. BNB430

QSL CARDS- Look good with top 

quality printing. Choose standard 

designs or fully custom cards. Re-

quest free brochure, samples (stamp 

appreciated) from: CHESTER QSLs, 

310 Commercial, Dept. A, Emporia KS 

66801. FAX (316)342-4705. BNB434

Link Communications RLC-II 

Repeater and Linking Controller

RLC-II Features:

(1) Full Featured Repeater port

(2) Linking Full Duplex Port

(3) Linking Port capable of operating as Linking Port or as Repeater Port

(4) Analog Lines Programmable for Temperature and Voltage Readings

(5) Output Lines for control of external peripherals

- Clean and Understandable Voice Synthesizer with 400 + words
- All Ports have both COR and PL inputs allowing off site access changes
- DTMF Access from ALL Ports
- 2400 baud Serial Port allows remote programming of the RLC-II
- Optional Full Duplex Autopatch with 200 Number Dialer Only $199.95 plus s&h
- Optional 19 Ink Stain Mountable Enclosure Only $100.00 plus s&h
- 20 Time Scheduler Slots with Hourly, Daily and Weekly Events
- Voice Time of Day Clock
- Complete Remote Programming using DTMF Tones
- Multiple Password Priority Assignable to each command
- All Commands can be renamed from 1 to 6 digits in length
- Independent DTMF mute function can be assigned to all ports
- Doug Hall Rabbit Remote Base control Kenwood Radio support

CIRCLE 47 ON READER SERVICE CARD

KRP-5000 REPEATER

2 METERS-220-440

Enjoy high performance operation in tough repeater environments, so the KRP-5000 receiver gives you 7 helical resonators, 12-poles of IF filtering, and a precise Schmitt trigger squelch with automatic threshold switching. The transmitter gives you clean TMOS FET power

KRP-5000 Repeater shown with PA-100 Amplifier

Call or write for the full 

performance story... and the 

super value price!

Micro Control Specialties 

23 Elm Park, Greenvale, MA 01834 

(508)372-3442 

FAX: (508)373-7304

CIRCLE 144 ON READER SERVICE CARD
Fast & Fun 5GRV. QuicKits™

PUTTING THE AMATEUR BACK IN RADIO

**NEW!**

BC01 Battery Charger Kit (Lead-Acid/Gel Cell) Uses the UC3000C. Cont. duty, keeps battery charged for immediate use. Only high quality components used. PCB mounted on other: 12V DC, battery, enclosure assembly. $15.00. $275.00

BC02 Battery Charger Module Same as BC01 except enclosure. 12V DC, battery, and enclosure $15.00. $275.00

**REPACKED!**

BC03 Battery Charger Module Same as BC02, minus transformer. Needs 12 - 21 Vac $25.00

E01, Experimenters’s Kit $69.95

A prototyping kit for radio 4 test equip. circuits. Inc. PCB, NE5550, MC1454, LM308. 75 s & 5.5 x 2. Faceted enclosure. $25.00.

160 METER TWIN-LEAD MARCONI ANTENNA $36.00

Complete, Trim to length and attach connector. Takes less space than 50’. Spliced. Needs no tuner. Max. por 300 (50 VR) 2000.CC.

**CALL FOR QUOTES!**

**THE ANSWER IS GAP TECHNOLOGY**

If you’re looking for an antenna that can out perform the others and get you more for your money, then you’re looking for a GAP. The Challenge DX-VIII is the revolutionary design that answers your demands for multi-band operation and unequalled quiet efficiency with low noise. This is the technology that eliminates Earth Loss. GAP delivers from an elevated feed, your power doesn’t disappear into the ground, it is up. Turn it on and turn off. No frustration. GAP delivers everything but the hassles. And — GAP delivers at a fraction of the cost of the so-called competition.

The Challenger DX-VIII

Get the best for less! To order 1-800-777-1984

$249.95 plus shipping

**THE ANSWER IS GAP TECHNOLOGY**

DODGE COMMUNICATIONS,

1113 Central Ave. Billings, MT 59102

406-252-9220

OUR 20TH YEAR IS ALMOST OVER

So call today to check out our anniversary specials.

Buy or write for current flyer

Buy - Sell - Trade

WOLF COMMUNICATIONS

1113 Central Ave. Billings, MT 59102

406-252-9220

OUR 20TH YEAR IS ALMOST OVER

So call today to check out our anniversary specials.

Buy or write for current flyer

Buy - Sell - Trade

WOLF COMMUNICATIONS

1113 Central Ave. Billings, MT 59102

406-252-9220

OUR 20TH YEAR IS ALMOST OVER

So call today to check out our anniversary specials.

Buy or write for current flyer

Buy - Sell - Trade

WOLF COMMUNICATIONS

1113 Central Ave. Billings, MT 59102

406-252-9220

OUR 20TH YEAR IS ALMOST OVER

So call today to check out our anniversary specials.

Buy or write for current flyer

Buy - Sell - Trade

WOLF COMMUNICATIONS

1113 Central Ave. Billings, MT 59102

406-252-9220

OUR 20TH YEAR IS ALMOST OVER

So call today to check out our anniversary specials.

Buy or write for current flyer

Buy - Sell - Trade

WOLF COMMUNICATIONS

1113 Central Ave. Billings, MT 59102

406-252-9220

OUR 20TH YEAR IS ALMOST OVER

So call today to check out our anniversary specials.

Buy or write for current flyer

Buy - Sell - Trade

WOLF COMMUNICATIONS

1113 Central Ave. Billings, MT 59102

406-252-9220

OUR 20TH YEAR IS ALMOST OVER

So call today to check out our anniversary specials.

Buy or write for current flyer

Buy - Sell - Trade

WOLF COMMUNICATIONS

1113 Central Ave. Billings, MT 59102

406-252-9220

OUR 20TH YEAR IS ALMOST OVER

So call today to check out our anniversary specials.

Buy or write for current flyer

Buy - Sell - Trade

WOLF COMMUNICATIONS

1113 Central Ave. Billings, MT 59102

406-252-9220

OUR 20TH YEAR IS ALMOST OVER

So call today to check out our anniversary specials.

Buy or write for current flyer

Buy - Sell - Trade

WOLF COMMUNICATIONS

1113 Central Ave. Billings, MT 59102

406-252-9220

OUR 20TH YEAR IS ALMOST OVER

So call today to check out our anniversary specials.

Buy or write for current flyer

Buy - Sell - Trade

WOLF COMMUNICATIONS

1113 Central Ave. Billings, MT 59102

406-252-9220

OUR 20TH YEAR IS ALMOST OVER

So call today to check out our anniversary specials.

Buy or write for current flyer

Buy - Sell - Trade

WOLF COMMUNICATIONS

1113 Central Ave. Billings, MT 59102

406-252-9220

OUR 20TH YEAR IS ALMOST OVER

So call today to check out our anniversary specials.

Buy or write for current flyer

Buy - Sell - Trade

WOLF COMMUNICATIONS

1113 Central Ave. Billings, MT 59102

406-252-9220

OUR 20TH YEAR IS ALMOST OVER

So call today to check out our anniversary specials.

Buy or write for current flyer

Buy - Sell - Trade

WOLF COMMUNICATIONS

1113 Central Ave. Billings, MT 59102

406-252-9220

OUR 20TH YEAR IS ALMOST OVER

So call today to check out our anniversary specials.

Buy or write for current flyer

Buy - Sell - Trade

WOLF COMMUNICATIONS

1113 Central Ave. Billings, MT 59102

406-252-9220

OUR 20TH YEAR IS ALMOST OVER

So call today to check out our anniversary specials.

Buy or write for current flyer

Buy - Sell - Trade

WOLF COMMUNICATIONS

1113 Central Ave. Billings, MT 59102

406-252-9220

OUR 20TH YEAR IS ALMOST OVER

So call today to check out our anniversary specials.

Buy or write for current flyer

Buy - Sell - Trade

WOLF COMMUNICATIONS

1113 Central Ave. Billings, MT 59102

406-252-9220

OUR 20TH YEAR IS ALMOST OVER

So call today to check out our anniversary specials.

Buy or write for current flyer

Buy - Sell - Trade

WOLF COMMUNICATIONS

1113 Central Ave. Billings, MT 59102

406-252-9220

OUR 20TH YEAR IS ALMOST OVER

So call today to check out our anniversary specials.

Buy or write for current flyer

Buy - Sell - Trade

WOLF COMMUNICATIONS

1113 Central Ave. Billings, MT 59102

406-252-9220

OUR 20TH YEAR IS ALMOST OVER

So call today to check out our anniversary specials.

Buy or write for current flyer

Buy - Sell - Trade
DTMF/Encoders

STEEL KEYS
SEALED GOLD CONTACTS

An ultra high quality DTMF Encoder for absolute reliability and function.
- Contacts are Water Proof / Dust Resistant
- Completely Self Contained - No RFI
- Simple 3-Wire Connection - Output Level Adj.
- Wide Operating Range 8 to 16V
- Wide Temperature Range -22°C to +160°F
- Supplied with Instructions, Schematic, Template & Hardware

Call or Write for Catalog

VISA/AMEX

MAIL ORDER TO:
Pipo Communications
P.O. Box 2020
Pollock Pines, California 95726
(916) 644-5444
Fax: (916) 644-5440

HIGH SPEED SIGNALLING > DTMF > ANI * MEMORY DIAL * STORE & SEND

STEEL KEYS
SEALED GOLD CONTACTS

An ultra-high quality DTMF Encoder for absolute reliability and function.
- Software-Driven and Keyboard Programmable
- 25 Memories - High Capacity, 30 Digits per Location
- Non-Volatile Memory - Auto Test & PTT Disable
- 5-10-30 DPS, Pure Signalling - "No Pops"
- Speed Adj - Pause Adj - Digit Expand - Wait & Send
- Wide Operating Range - 10-16V / 8-26 VDC
- Full Level Programming - Self-Contained Side Tone

Call or Write for Catalog

MAIL ORDER TO:
Pipo Communications
P.O. Box 2020
Pollock Pines, California 95726
(916) 644-5444
Fax: (916) 644-5440

Electromagnetic Field Meter Meters

Reduce exposure to potentially harmful electromagnetic fields. Alphalab's handheld TriField™ Meter measures AC electric fields, AC magnetic fields and radio/microwave power density. Find ground faults, AC current wires or measure high-field generators with its Magnetic setting (2 - 100 MHz, 60 Hz); identify poorly grounded or shielded equipment, high VDT or fluorescent light fields, distinguish hot vs. ground wires with Electric setting (.5 - 100 kV/m, 60 Hz); measure antenna radiation patterns or leaky microwave ovens, etc. on RF/microwave setting (50 MHz to 3 GHz, .01 to 1 mW/cm²).

Electric and magnetic settings are omnidirectional, measuring full magnitude of fields without the need to reorient the meter. Price of $145 includes delivery and one-year warranty.

AlphaLab, 1272 Alameda Ave, Salt Lake City, UT 84102
Call (801) 532-6504 for speedier service or free literature on electromagnetic radiation health risks.

JOIN TAPR - TUCSON AMATEUR PACKET RADIO (non-profit developers of the TNC). Membership benefits include: supporting the development of new communications technology, quarterly newsletter, low-priced software/sharesware, kit catalog $15/year US and possessions, $18/year Canada, and $25 elsewhere. US funds. Visa/MC accepted. Bonus: mention TAPR, receive TAPR Packet Radio General Info booklet ($7 value) [Voice (502)742-9479, Fax: (502)742-5636, Mail: PO Box 12825, Tucson AZ 85722. BNB785]

SOLAR POWERED HAMS! The Sunswitch is a charger controller to protect your batteries from overcharge. Power MOSFETs are used, no relay! As designed, tested and tuned. Now with Wall Mount Case, $55.00 plus $3.00 shipping. SUNLIGHT ENERGY SYSTEMS, 2225 Mayflower NW, Massillon OH 44647. BNB774

WANTED: clean, unused, COAXIAL CONNECTORS, ADAPTERS, RF AND MICROWAVE COMPONENTS. IGU, PO Box 27849, Santa Ana CA 92799. Fax (714) 553-0260. BNB810

R-390-A SALES & SERVICE, PO BOX 3541-S
TOLEDO OH 43608. BNB813

FREE SHAREWARE AND HAM CATALOG from IBM or Com. Morse code Computer Interface $49.95. DYNAMIC ELECTRONICS, Box 896, Hartville OH 44635. Call (216)773-2758, FAX-773-7295. BNB815

SENSATIONAL NEW WAY TO LEARN CODE-O-Aerobics, Sing, Jog, or Drive while learning code! The secret is yours! Order THE RHYTHM O THE CODE! Morse code music cassette today $9.95 ppd KAWA RECORDS P.O. Box 319-L Weymouth, MA 02188. The hit of the 1993 Dayton Hamvention! BNB824

SEIZED GOODS, radios, stereos, computers, an more by the FBI, IRS, DEA. Available in your area now. Call (800)436-4836 ext C-6223. BNB825

DIGITAL SWR and POWER METER, Assembled Kit, or Plans, with Alarm and Set Points. FREE information. RUPP ELECTRONICS, 8403 Wes breeze, Fort Wayne IN 46704. (219)432-3049. BNB831

FCC COMMERCIAL LICENSE PREPARATION RADIO TELEPHONE-RADIO TELEGRAPH. Late home study fast easy audio video. Q & A problems. FREE details WPT PUBLICATION (800)800-7588. BNB846

VIDEO SYNC GENERATOR Restores horizontal vertical sync lines from distorted analog video formats. For information on completed units & prices write: RC DISTRIBUTING, Box 552, South Bend IN 46624, phone (219)236-5776. BNB895

ELECTRONICS GRAB BAG! 500 pieces of new components: inductors, capacitors, diodes, resistors. $5.00 postpaid. ALLTRONICS, 2300 Zank Rd., San Jose CA 95131. BNB889

WANTED: COLLINS ANTENNA'S, anytime up from antennas, speakers, receivers, transmitters, and all a cesories, any condition. Top $55 paid. Ric (800)462-2972 anytime. BNB886

RFI SHIELDED PC'S: great for HF/VHF Pack $800. Loc. (703)660-5171. BNB877

AMATEUR RADIO REPAIR! All makes & modes average labor per unit, $96.00. W7HBF, DA RUPE, 1302 S. Uplands Dr., Camano WA 98282, (206)397-3554. BNB880

PRINTED CIRCUIT BOARDS for 73 Magazines EASTERN ELECTRONICS, Box 2004, 856 Upland James E Hamilton, Ontario, Canada L9G 7M5. BNB911
Say you saw it in Barter 'n' Buy!
Random Output

David Cassidy N1GPH

Giving Thanks

It is approaching that time of the year when we are supposed to reflect upon our lives, and ponder the things for which we should give thanks. When I sit down to that Thanksgiving meal, here are some of the things that I'll be giving thanks for.

First and foremost, thanks to Wayne Green for his continued trust, guidance and example. I have learned so much, and do a side-by-side company in the last three years than I did in the previous 10. We don't just talk about things here at WGI, we do them. It is the leadership that fosters this type of entrepreneurial spirit, and makes it a pleasure to come to work in the morning.

I also need to thank the staff of 73. Less than a dozen people put out this magazine (as well as Radio Fun), and I can honestly tell you that I have never worked with a more talented group of people (and I've been lucky to have worked with some very talented folks). We are truly a team, and I think it shows in the quality of our magazine. I hope you agree.

"Lots of people won't admit it, but the no-code license has single-handedly kept the amateur radio industry from feeling the worst of the economic difficulties of the last few years."

Thank you to the columnists and writers who give us each month with their talents. I am continuously amazed at how good our writers are! I truly believe that 73 has the finest group of columnists and regular contributors of any magazine in the electronics field. If you doubt me, go ahead and do a side-by-side comparison with any other magazine. It ain't bragging when it's true.

Thank you to the ARRL, Yup... I said the ARRL. Regular readers of this column might be asking themselves, "Why is Dave thanking the organization that he spends so much time criticizing?" First of all, I am not anti-ARRL. I believe that the League is the only organization that is capable of representing the interests and ensuring the future of amateur radio. I just wish they would do it! I'd like to thank the gang in Newington for providing me with so much material over the last few years. We can only hope the day will come when this will no longer be the case.

We should all thank the FCC for the new Technician Class license. While we're at it, let's send a hearty "thanks" to all of the Techs (and all the other newcomers) who have received their licenses this year. Lots of people won't admit it, but the no-code license has single-handedly kept the amateur radio industry from feeling the worst of the economic difficulties of the last few years.

Thank you to you, the readers. You tell us that you appreciate our efforts, and you let us know when we've fallen short of our own high standards. More thanks to the over 20,000 (and growing) of you who plunk down your $2.95 every month to buy 73 on the newsstand.

Thanks to those of you who take the time to stop by the 73 booth at hamfests. You have no idea how helpful it is to have face-to-face discussions with our readers... and our non-readers. You remind us that, more than most magazines, the relationship we have with our readers is a phenomenon in the publishing industry. That goes double for Radio Fun readers. It is a relationship that we here at the home office truly cherish and strive to live up to.

Finally, thanks to all of you who read Random Output," especially those who choose to write and comment on my monthly musings (even those who think I should shut up and stop bothering people). Your opinions are of vital importance, and it helps immeasurably to know what you are thinking. A magazine column is often a monologue. You folks make it more of a dialogue, and that makes all the difference.

Propagation

Jim Gray W1X

210 East Chateau Circle
Payson AZ 85541
You can expect November conditions to be generally Fair (F) to Good (G) this month, except for the week between the 16th and 22nd when conditions are expected to be Poor (P) to Very Poor (VP), particularly on the 18th and 22nd. During this week there may be geophysical disturbances in the atmosphere as well as the ionosphere, so be aware of possible heavy storms of rain or snow and other effects such as volcanism, earthquakes, and the like somewhere on earth. Pay particular attention to your local radio and TV stations during this week with announcements of local weather conditions.

November is a month when propagation is trending from the good DX outlook of September and October to the generally poorer DX conditions of November, December, and January. The higher frequency bands above 20 meters are likely to close early (at sunset or shortly thereafter), and the lower frequency bands below 20 meters will be open after dark and until the early morning hours. Except for the days on the chart marked Poor or Very Poor, you will find the ionosphere for DX work a lot better after the first half of November.

As you know, the sunspot numbers are declining each month, with only an occasional burst of solar flux above the 100 level in the sunspot minimum is now predicted for sometime in late 1996 or early 1997. There is a good possibility that an even earlier minimum may occur. During these times of sunspot inactivity there will be fewer openings for DX on the HF bands. Keep an ear open for DX to Europe in the morning hours local time, and to the Pacific in afternoon hours on the 10, 12, 15, and 17 meter bands.

Midday openings to South and Central America and Africa may be possible on some days this month. Short skip within the U.S. will prevail on Good (G) days. The 160 meter band will be the mainstay this month, with occasional sidehumps in the higher bands. Twenty vhf show openings to all parts of the world on Good (G) days until well after dark on the 40 and 80 meter bands (and higher), so will be very good for DX to Europe in the evening hours, and the Pacific during the early morn hours around sunrise. Eighty might even be the choice of DXers for the next couple of months, so make sure your antennas for these bands are up and running at optimum performance on 160 meters, there will be little activity until around sunset and after throughout the evening hours a peak toward Europe around midnight. DX openings to the Pacific and south west will be best around sunrise. You will enjoy very low atmosphere noise and strong signals. See you next month!

EASTERN UNITED STATES TO:

CENTRAL UNITED STATES TO:

WESTERN UNITED STATES TO:

NOVEMBER 1993

SUN  MON  TUE  WED  THU  FRI  SAT
1 G    2 G-F  3 F    4 F    5 F    6 F
7 F-G  8 G    9 G    10 G-F  11 G-F  12 G    13 G
14 G  15 G-F  16 F-P  17 P    18 V-P  19 P-F  20 F-
21 P    22 VP  23 P    24 P-F  25 F    26 F-G  27 G
28 G-F  29 F    30 G-F
**YAESU**

**HOLIDAY SPECIALS**

- **$100.00 off**
  - FT-1000D/FT-1000
- **$50.00 off**
  - FT-990/FT-990DC
- **$35.00 off**
  - FT-890AT/FT-890
  - FT-840
  - FT-767GX, FT-736R
  - FT-411E
  - FT-2200
- **$25.00 off**
  - T-5100
  - FT-5200/6200
  - FT-530
  - FT-470
  - G-2700SDX, G-1000SDX, G-800SDX
- **$15.00 off**
  - FT-2400H
  - FT-411E

GOOD OCT. 15 1993 THROUGH JAN. 10 1994

**JSTOMER:** Surrender this coupon at time of purchase to your authorized Yaesu dealer for discount. Limit one coupon per purchase. Coupon is non-transferable and can only be used for products as advertised in this ad and for discounts as stated. Offers only good at authorized U.S. and Canadian Yaesu dealers. DEALER: Send this coupon along with a copy of sales receipt to Yaesu U.S.A., Sales Dept., 17210 Edwards Rd., Cerritos, CA 90701.

**S 100 OFF**
- FT-1000D/FT-1000
  - FREE also with purchase of FT-1000D or FT-1000, Limited Edition Embroidered Yaesu Jacket. Dealer will provide redemption coupon for jacket.
  - FT-990DC/FT-990
  - FT-5100

**S 50 OFF**
- FT-5200/6200
- G-2700SDX, G-1000SDX, G-800SDX

**S 35 OFF**
- FT-411E

**S 25 OFF**
- FT-416/816

**S 15 OFF**
- FT-2400H, FT-2200, FT-416/816, FT-411E

**MODEL PURCHASED**
- **DATE OF PURCHASE:**
- **YOUR NAME:**
- **ADDRESS:**
- **CITY, STATE, ZIP:**
- **PHONE:**
- **CALL SIGN:**

**DEALER NAME/STATE:**

Coupon offer valid in USA and Canada only. Offer void where prohibited by law. Coupon has no cash value. Limit one coupon per purchase. Not valid with any other Yaesu offers or discounts. Offers not applicable to purchases made prior to October 15, 1993 or after January 10, 1994.

Offering superb TX/RX performance plus exceptional signal purity, Kenwood's TS-950SDX establishes a new benchmark for HF communications.

- Built-in DSP (digital signal processor)
- Dedicated Power MOS FET final section
- User-friendly menu system
- Automatic antenna tuner built-in
- AIP (Advanced Intercept Point) system
- Ultra-fine (1Hz) tuning

- Super stability with reliability
  The Power MOS FET final section is conservatively rated at 150W (40W in AM mode). This increases reliability and lowers distortion.
- Wideband general coverage receiver
  The TS-950SDX covers all Amateur bands from 160 to 10 meters. The receiver covers 100Hz to 30MHz.
- 100 memory channels with multi-scan functions
  Enabling independent storage of TX and RX parameters, 100 memory channels may be scanned with such conveniences as programmable memory channel lock-out and continuous control of scan speed.
- Built-in DSP
  The digital signal processor replaces conventional analog circuitry for processing the TX signal in the SSB, CW, AM and FSK modes. Reception is also enhanced: digital PSK detection and digital audio filtering help to eliminate interference and improve audio quality.
- Power MOS FET final section
  The TS-950SDX ranks as the first Amateur Radio transceiver to feature an FET final section. Superior linearity results in greatly improved TX performance.
- Dual-frequency receive
  The TS-950SDX can simultaneously receive two frequencies within 1kHz of each other. To facilitate split-frequency operations, front panel controls include N/S (main/sub select) and an RX + SUB key for instantly swapping the frequencies. A 500Hz CW filter is included in the sub receiver.

KENWOOD COMMUNICATIONS CORPORATION
AMATEUR RADIO PRODUCTS GROUP
P.O. BOX 27745, 2001 E. Dominguez Street
Long Beach, CA 90801-5745

KENWOOD ELECTRONICS CANADA INC.
6070 Kernell Road, Mississauga, Ontario, Canada L5T 1S8
93AR0-0758