73 Amateur Radio Today

JANUARY 1994
ISSUE #400
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CAN $3.95
A WGI Publication
International Edition

GADGETS & GIZMOS
Build These Great Projects

Versatile NiCd Charger
Automatic Morse IDer
Ultra-Accurate Frequency Standard
Hula Loop Bi-Directional Antenna

73 Reviews
Easy PC Layout Software
Radio Doctor Videos

Two Antennas Twice the Fun!

"...bringing you another nonstop 60 minutes of your kind of music from..."

"...fire has jumped to adjacent apartment building; requesting additional units..."

"...unidentified object does not respond to radio; attempting to make contact..."

"...appears to be gang-related, large number of youths on foot moving toward..."

"...blackout apparently caused by car striking utility pole at corner of..."

"...search from the northwest quadrant and proceed south, maintain visual..."

"...campers are advised to leave upper elevations before sundown due to..."

"...do not, repeat, do not approach intake by boat since dock is damaged in..."

"...bright yellow, red trim Piper last reported lost and disoriented in fog near..."

"...conditions for trout in the deeper pools best before 6 am, they're taking..."

"...sending a chopper over to have a look before the news people find out about..."

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—QST Oct. 1992

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B	***TA-90***	Telescope BNC antenna	12.
C	***TA-90-L***	Telescope elbow antenna	16.
D	***RD-150***	150 MHZ rubber duck	16.
E	***RD-2750***	27-50 MHZ rubber duck	28.
F	***RD-800***	800 MHZ rubber duck	29.
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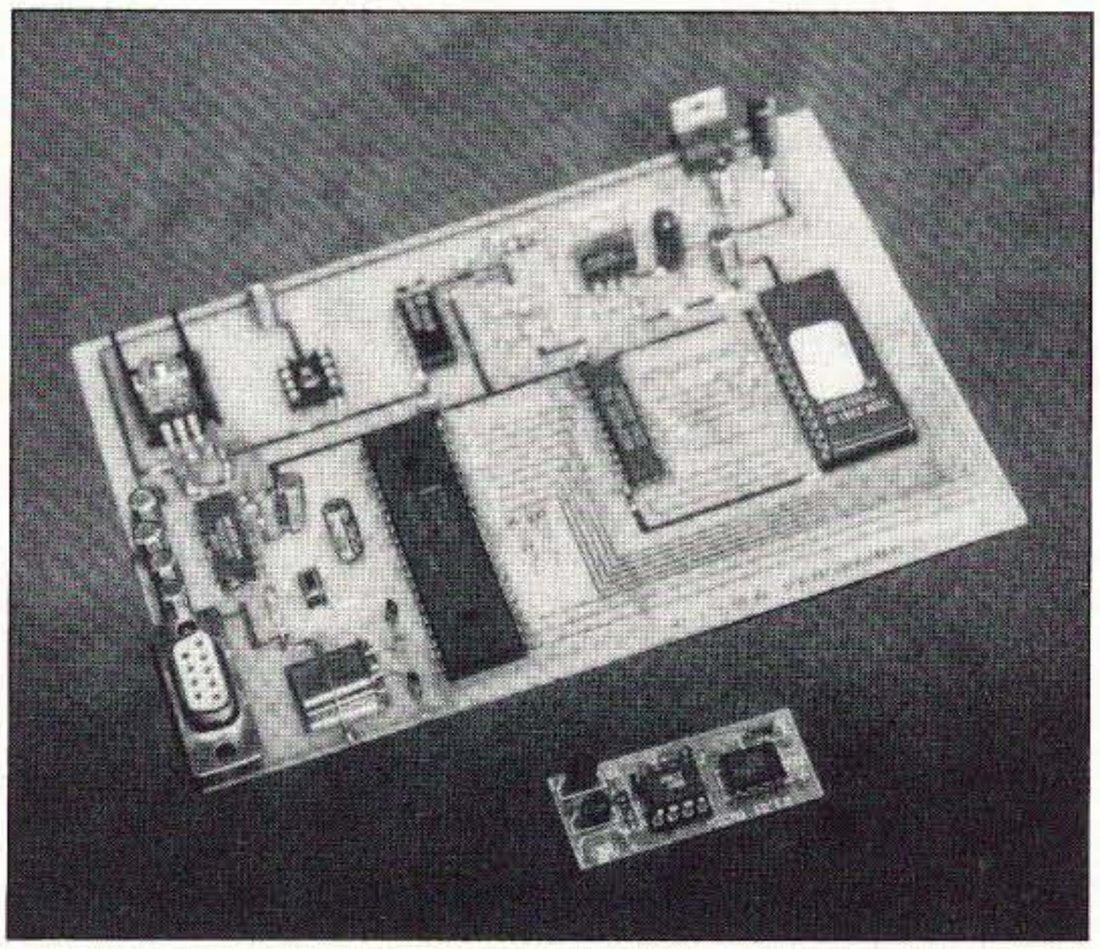

Build this automatic Morse identifier . . . see page 18.

DEPARTMENTS

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On the cover: Recharge all of your NiCd cells with this versatile, easy-to-build project. See page 34.

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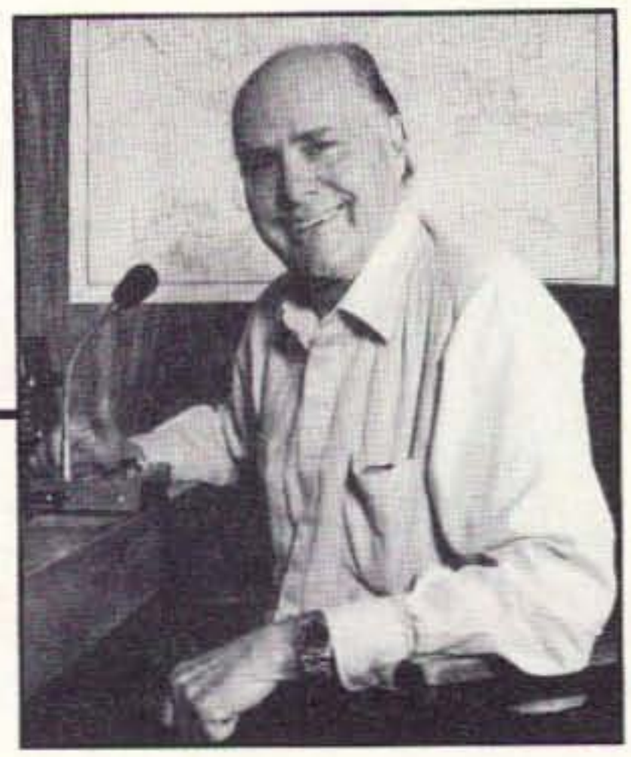

Stop That Damned Noise!

Is that your normal response when you hear opportunity knocking? This came to mind when I got several letters recently from readers thanking me for getting them off their fat lazy butts and thinking about making money. There are endless opportunities, it's just that most of us are not tuned to that wavelength, so we don't see 'em. Yet, I'll bet there are dozens of readers who are bitching because they don't have enough money for this or for that. Whine . . . I can't afford those new expensive rigs . . . whine. Oh, baloney!

You can have anything you want . . . if you really want it and are willing to spend some time and effort. Opportunities lie everywhere. I see 'em every day and I think, Lordy, if I just find a couple more people with an interest in working, what fun we'd have with that idea! And I wonder why no one else has thought of anything so obvious. Well, maybe that's why I have a Ph.D. in Entrepreneurial Science and you don't.

Let me give you a "for instance." I subscribe to a bunch of magazines and buy a lot of stuff by mail, so I'm on endless sucker lists. The other day this resulted in a stack of catalogs from Home Automation Laboratories (HAL). I looked through them and thought, what a great opportunity for hams to go into business selling and installing home automation and security products in their neighborhoods. The catalog is packed with hundreds of great gadgets. The outfit is in Smyrna GA 30082-5141, if they missed sending you a catalog.

Then There's the Music Business

The music industry is in chaos these days. Wherever there's chaos, there's opportunity, and the opportunities in the music field are endless today. I know I'm having a ball. There are so many things that can be done I hardly know which way to turn next.

Let me be specific. Let's say you'd like to make some change in your spare time. Sure, you're afraid to quit your 9-5 and step off the cliff as an entrepreneur. You don't have to. If you invest maybe $2,000 tops in a digital audio tape recorder and a good stereo microphone set, you'll be in business. With a little shopping you might even find used stuff for half that.

Who should you record? Well, how about tackling any large city and recording the street musicians? There are some fabulous musicians working the streets of every big city in the world. All you have to do is record 'em . . . preferably playing their own music . . . and I'll take it from there. I'm set up to make the CDs and cassettes, complete with the liner notes, bar codes, and so on. Further, I can get you started with promotion in music publications read by consumers and the record store buyers. I'm already distributing music for over 500 record companies, so I know the ropes. There are a zillion people who'd love to start collecting a set of street musician performances from cities around the world.

I've heard marvelous performers in London, Munich, Berlin, Vienna, Cannes, Paris, Amsterdam, New York, Chicago, New Orleans, Philadelphia, Boston, San Francisco, etc. I just wish I had the time to record 'em all. There was even one guy wheeling a grand piano around the New York streets and playing classical music. There are some wonderful steel bands, violinists, great guitar players, and endless Peruvian and Ecuadorian groups.

Think about it. Street performers get eight to 12 hours a day of practice, seven days a week, so unless they've some mental problems, they tend to get awfully good. I discovered Scott Kirby playing his piano on the streets of New Orleans. Today, as a result of my recordings, Scott is recognized as the finest ragtime pianist in the world. He's the only ragtime pianist who's making a living at it just playing his music. Around 99% of our musicians have to have daytime jobs to pay the bills so they can play gigs at night.

You'll be helping yourself as well as the performers. They'd all love to have CDs and cassettes to sell and we can supply 'em, with endless commissions to you. They normally sell the CDs for $15, making $5 on every sale. You make a buck. They sell cassettes for $10 and make $3. You make 66¢. That adds up fast and I really enjoy sending out nice fat commission checks.

Well, obviously only a few people can record street music, so what else is there? Within a few miles of you there are endless musicians. They're everywhere. All performers need CDs and cassettes to sell at their performances. They usually make more selling these than they get for their gigs.

Then there are endless places to find performers. I'm way up in the mountains of New Hampshire, yet in the tiny town of Antrim we've got a blues club in the Rynborn restaurant. Every performer there should be recorded. By the time you have 15 of 'em you've got enough for a CD . . . for both the performers and the club to sell. In Peterborough we've got the Folkway, which attracts many well-known performers, plus there's Latacarta, and Del Rossi's (mostly bluegrass). All three of these restaurants should be recording their artists and helping them sell their CDs and cassettes. There's enough going on just in Peterborough to keep someone busy in their spare time . . . and making very nice money. That's one great thing about recordings, once you have 'em, you can sell 'em for years.

So what's it cost to do all this? I've explained about the equipment. That's simple, though you'll want to get good at placing your stereo mike. It costs about $2,300 to make a thousand CDs. They normally wholesale to distributors for around $7.50, sell to record stores for $10, and retail for $15. The spread between the $2.30 it costs to manufacture the CD, complete with liner notes, tray card, jewel box, shrink wrap, plus three months of promotion in the *Secret Guide to Music*, *CD Review*, and *Music Retailing*, and the distributor price has to cover the costs of making the DAT recording, further promotion, advertising, and payments on your yacht. If the CD sells at all well you'll see some pretty good money rolling in.

Any club or restaurant that has music should be a good potential customer. Every musical group. How about school (great graduation gift) or town bands? Many companies have bands. In England there are many superb company bands and I've got their CDs to prove it. In Germany there are endless folk music groups that are marvelous. I'll bet I have close to a hundred CDs of German oompah and yodeling groups, and I enjoy every one of them. I've even got a collection of Polish folk singing groups.

In America there are polka bands, square dance bands, country fiddling contests, bluegrass festivals, cajun, zydeco, rap, Dixieland, ragtime festivals, maybe a couple hundred jazz festivals, and so on. These all are ripe for recording

So Who Pays for the CDs?

I'll underwrite the street musician series if you're short of money to get started. But I'll bet I can get it back from Chambers of Commerce. And even if not, I can sell enough of a series like that via mail order and record stores to make it profitable.

But even if you have to finance the CDs yourself, you can be making a profit after the first 250 are sold.

I recommend you record music written by the performers so you'll avoid having to pay copyright royalties. These can come to $1.20 per CD, so they're tough. That's a federal law, so you don't mess with it. Performer royalties are usually 12%. That's about 90¢ per CD. All that brings your investment to about $4.40 per CD. You sell 'em to distributors for $7.50, or to your local record stores or restaurants for $10. $9 to your performer(s).

The Music Industry Chaos

Up until the last two or three years six record companies had a stranglehold on the whole industry. It was a solid cartel. They controlled the major artists, distribution, many of the record stores, virtually all major radio station air play, MTV, and so on. Since five of the six megacorporations are foreign-owned, most of the money from all this is probably being sent abroad. Just in the last couple years, with the formation of the Independent Music Producer's Syndicate (IMPS), this has begun to change. The majors have been fighting back, cutting off advertising to retailers not toeing the line. They've also stopped selling to troublesome retailers, forcing them to buy from the more expensive "one-stops." The majors are trying to stop retailers from selling used CDs. They're trying to stop them from letting customers return any CDs they don't like . . . or even be able to listen to them in the stores before buying.

The result of all this has been a bonanza for the small independent record companies (indies). Record stores are getting angrier and angrier at the majors and are starting to seriously push indie music as an alternative. But we need tons more indie music to fill this need. Good music. The performers are out there, we just have to get 'em on digital tape (DAT) and then make the CDs.

Those are some of the opportunities I see in the music field, but I'll bet that whatever business you're in, if you start thinking, you'll see plenty of exciting ways to make money. You just

Continued on page 84

BASE/REPEATER
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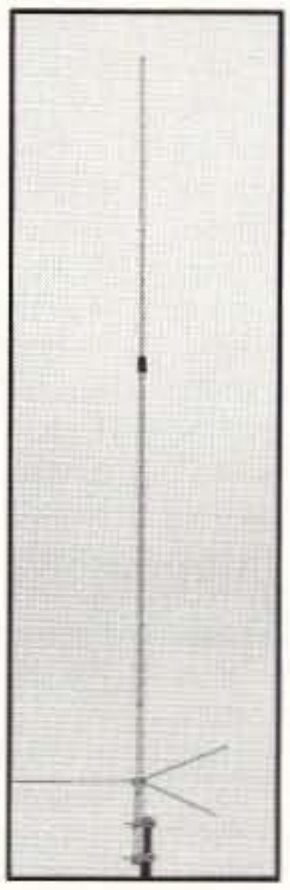
COMET

MODERN, MULTI-BAND ANTENNA SYSTEMS

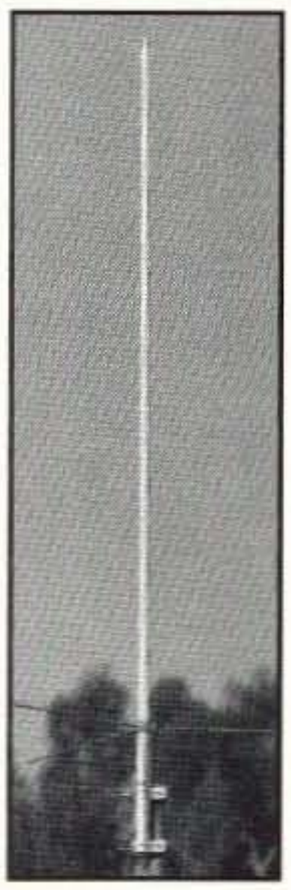
Featuring the COMET exclusive SLC System. The SLC actually increases the gain of the Dual/TriBand Antennas. A completely pre-formed phasing coil and phosphorous copper element produces a low-loss, highly effective, high gain antenna. All COMET antennas are pre-tuned and come complete will all mounting hardware. Simply mount to your mast and experience incredible COMET performance!

COMET DUAL-BAND

CA-2x4MAX
Dual-Band 146/446 MHz
SLC System
Gain & Wave:
146MHz 8.5dB 5/8 wave x 3
446MHz 11.9dB 5/8 wave x 8
VSWR: 1.5:1 or less
Max Power: 200 watts
Length: 17' 8" **Weight:** 5 lbs. 11 ozs.
Mounts to Mast Size: 1 1/4 - 2 1/2"
Connector: SO-239
Construction: Heavy duty fiberglass, 3 sections



CA-2x4WX
Dual-Band 146/446 MHz
SLC System
Gain & Wave:
146MHz 6.5dB 5/8 wave x 2
446MHz 9.0dB 5/8 wave x 5
VSWR: Less than 1.5:1, 144-148MHz
440-450MHz
Max Power: 200 watts
Length: 10' 2"
Connector: SO-239
Construction: Heavy duty fiberglass, 2 sections

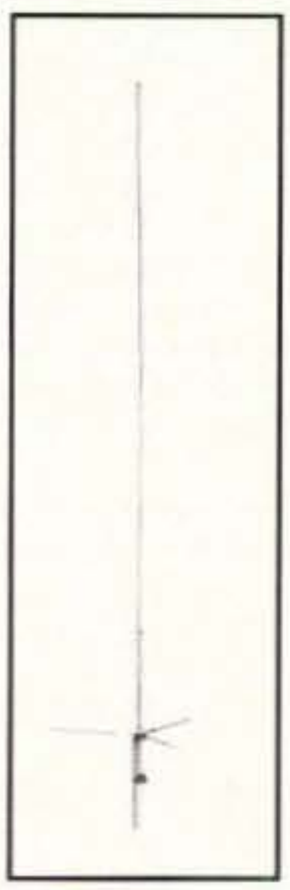


CA-2x4FX
Dual-Band 146/446 MHz
Base-Repeater Antenna
Gain: 146MHz 4.5dB 446 7.2dB
Impedance: 50 ohms
VSWR: Less than 1.5:1, 144-148MHz
440-450MHz
Max Power: 200 watts
Length: 5' 11" **Weight:** 2 lbs. 12 ozs.
Mounting Mast Dia: 1 1/2 - 2 1/4"
Connector: SO-239
Construction: Heavy duty fiberglass

COMET MONO-BAND

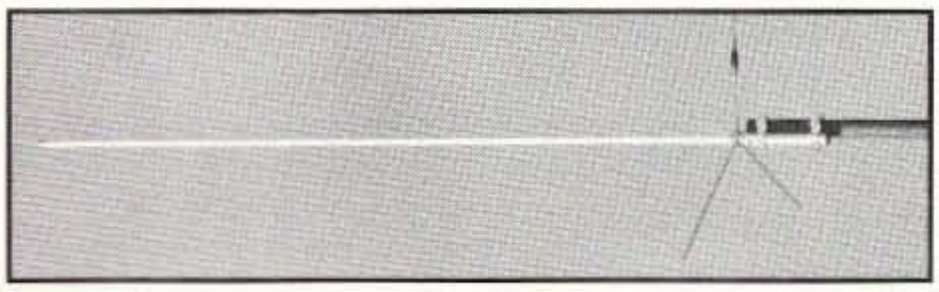
CA-ABC 23
Mono Band 146 MHz
Base-Repeater Antenna
Gain & Wave:
146MHz 7.8dB 5/8 wave x 3
VSWR: 1.5:1 or less
Max Power: 200 watts
Length: 13' 4" **Weight:** 3 lbs. 8 ozs.
Mounting Mast Dia: 1 - 2 1/2"
Connector: SO-239
Construction: All Aluminum

CA-712EF
Mono Band 440-450MHz
Repeater Antenna
Gain & Wave:
446MHz 9dB 1/2 wave x 12
VSWR: 1.5:1 or less
Max Power: 200 watts
Length: 10' 5" **Weight:** 3 lbs.
Mounting Mast Dia: 1 1/2 - 2 1/2"
Connector: N-Type
Construction: Heavy Duty Fiberglass

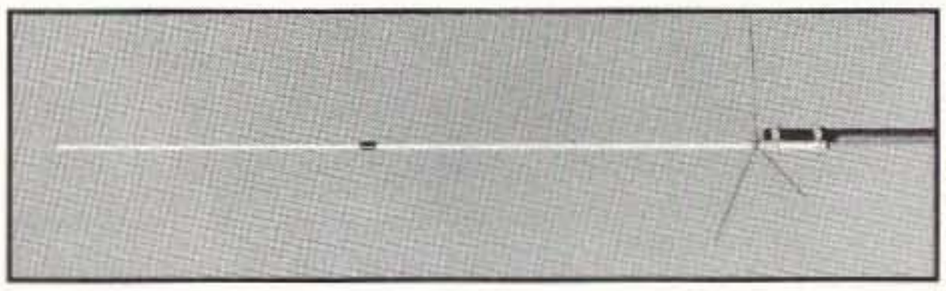


CA-62DB
6 Meter Vertical
Gain & Wave:
52 MHz 6.5dB 5/8 wave x 2
VSWR: 1.5:1 or less
Max Power: 500 watts SSB
Length: 21' **Weight:** 5 lbs. 11 ozs.
Mounting Mast Dia: 1 1/4 - 2"
Max Wind Speed: 100MPH
Connector: SO-239
Construction: Heavy Duty Aluminum

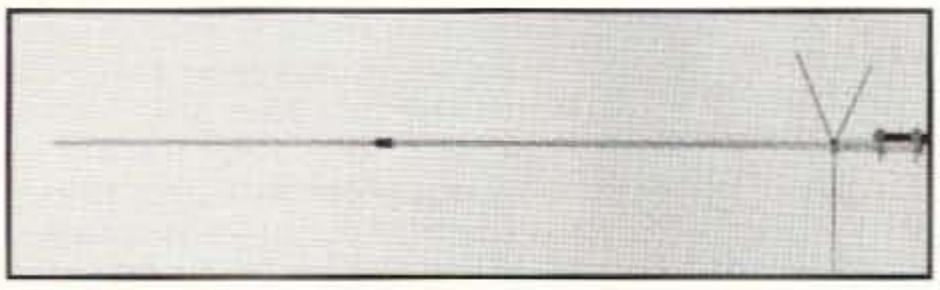
COMET TRI-BAND



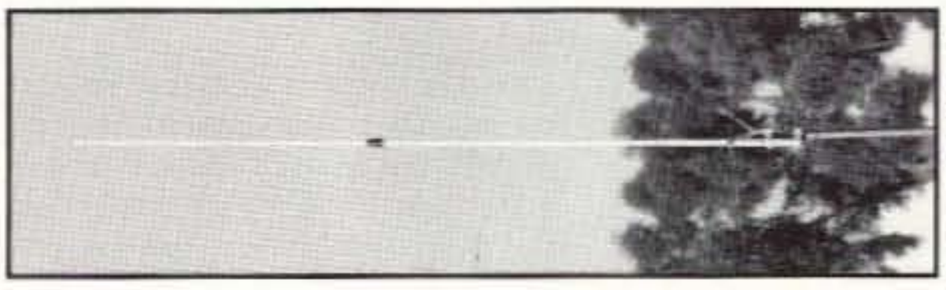
CX-725
Tri-Band 50/146/446MHz
Gain & Wave:
50MHz 2.15dB 1/2 wave
146MHz 6.2dB 5/8 wave x 2
446MHz 8.4dB 5/8 wave x 4
VSWR: 1.2:1 or less
Max Power: 200 watts
Length: 7' 6"
Weight: 3 lbs.
Connector: SO-239
Construction: Fiberglass



CX-902
Tri-Band 146/446/1200 MHz
Gain & Wave:
146MHz 6.5dB 5/8 wave x 2
446MHz 9.0dB 5/8 wave x 3
1200MHz 9.0dB 5/8 wave x 5
VSWR: 1.5:1 or less
Max Power: 200 watts
Length: 10'
Weight: 3 lbs. 3 ozs.
Connector: N-Type
Construction: Fiberglass, 2 sections



CX-333
Tri-Band 2M/220/440MHz
SLC System
Gain & Wave:
146MHz 6.5dB 5/8 wave x 2
223MHz 7.8dB 5/8 wave x 3
446MHz 9.0dB 5/8 wave x 5
VSWR: Less than 1.5:1,
145-147.5MHz, 220-225MHz,
440-450MHz
Max Power: 120 watts
Length: 10' 2"
Connector: SO-239
Construction: Heavy-Duty Fiberglass, 2 Sections



CX-903
Tri-Band 146/446/1200 MHz
Gain & Wave:
146MHz 6.5dB 5/8 wave x 2
446MHz 9.0dB 5/8 wave x 5
1200MHz 13.5dB 5/8 wave x 12
VSWR: 1.5:1 or less,
144.5-147MHz, 440-450MHz,
1260-1300MHz
Max Power: 100 watts
Length: 9' 4"
Weight: 3 lbs. 8 ozs.
Connector: N-Type
Construction: Heavy-Duty Fiberglass, 2 sections

NEW

CROSS NEEDLE METERS

- Separate Meter and RF Sensor allows for convenient placement of the meter.
- Cross Needle Meter provides FWD, REF, and VSWR simultaneously.
- The RF-Sensor is a compact design, and has an extremely low-loss circuit.
- Beautifully illuminated when connected to power supply.
- 6 foot cable standard.
- Optional EKS-3 10 foot extension cable for a total of 16 feet between the sensor and meter.

CMX-1	CMX-2	CMX-3
1.8-60MHz	1.8-200MHz	140-525MHZ
0-2KW	0-200W	0-200W
30/300/2KW	20/50/200W	20/50/200W

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LETTERS

Number 2 on your Feedback card

From the Hamshack

Sid Wolin K2LJH, Manager, Azden Communications Division, Franklin Square NY We at Azden are very appreciative of your having published a review of our AZ-61 6 meter handheld radio (November '93). While reading it, I noticed a statement that could be misunderstood and would place the radio in a poor light.

Gordon West says, "Unlike the 2 meter version, the Azden 6 meter handheld offers no oddball duplex split." What it should have said was, "Just like the 2 meter version, the Azden 6 meter handheld offers any combination of oddball splits in each of its 40 memories." It is a most versatile radio.

I would appreciate your including a correction in the next available issue.

Sid—Thanks for setting us straight. That AZ-61 sure is a nice little radio . . . David N1GPH

Carl Moore W4MJK, Sparta TN Wayne—Thanks for your editorials, comments, etc., especially the one following Rickey's letter in the September issue. Wayne, you should realize that you could increase your circulation much quicker by telling people what they want to hear, rather than the truth.

Now that we get everything for nothing these days, we no longer have to work for what we get out of life. Hell, today when you graduate, with a degree in Bull-S, you are qualified for CEO of a multinational corporation. If the world fails to recognize your talents, just continue to sponge off of Mom and Dad. Shoot, these are the '90s, do your thing.

I heard my first radio in 1926, the Dempsey-Tunney fight. I've been involved in communications since age 11, when we built our first portable radio. We put a crystal inside a big earphone and wired it up. You could hook onto a barbed-wire fence near Atlanta and hear WSB loud and clear. Of course, the fence wasn't portable.

I have enclosed a photo of the TU-1000 RTTY unit, described in the June 1985 issue of *73*. I built it last year, even though I already had a RTTY unit. I just enjoy the feeling of satisfaction and accomplishment that comes from creating something. I know you have experienced that feeling many, many times during your life. I bet you a buck that if you could get a lot more Americans to experience that feeling, just once, what a wonderful change we would see!

D. E. George WP4XD, Isla Verde, Puerto Rico Dear Charles Warrington: I am addressing this letter to you because I am not sure who or what should get it. Is it "Kaboom," "Carr's Corner," "Ham Help," or "Letters," or all of them?

My problem, and I'm sure other hams who have Heathkits have or will have this problem, is replacement of certain proprietary devices used in some kits. The immediate problem is with two ICs used in the Heath Handheld Frequency Counter Model IM2400. They are identified as Heath p/n 442-698 and p/n 443-937. I've searched my sources for these devices to no avail. HELP!

This poor meter (sad, not bad) went through Hurricane Hugo a few years ago, from which I lost the NiCds and now the High Frequency Channel. The Low Frequency Channel works fine, as did the High Frequency, until last week. In the absence of the NiCds, I've been running off of a regulated power supply. Apparently, this power supply developed a spike(?) which popped these devices. I've temporarily replaced the p/n 442-698 with a MAR-1, but can't find a replacement for the divide-by-10 p/n 443-937 that can operate at 500 MHz! I would appreciate any help you could provide. Thanks in advance.

P.S. I enjoy *73* as it is; please don't change it (including Wayne's ramblings—or should I say rumblings?)

I have a Heath HW5400 that has some output devices: 417-971, 972-8973, that also fall into this category. Fortunately, the HW5400 survived Hugo totally unscathed!

P.P.S. I live about 100 feet from the ocean on the North Shore of Puerto Rico, so we got Hugo full force!

Dan—As it turns out, the Heath Company is still in business. They are no longer producing the catalog of products which made the name Heathkit legendary in ham radio circles. Yet, Heath's downsized descendant continues to provide some support for hams and others who need help.

As fate would have it, the two ICs you seek (Heath p/n 442-698 and p/n 443-937) are in stock and can be ordered direct from Heath Company, P.O. Box 1288, Benton Harbor MI 49023-1288; (616) 925-5899. While Heath Company may not be able to provide all of the technical support they used to back in the old days, they can sometimes refer you to other companies who can. Heath's general information number is (616) 925-6000 . . . Charlie WA1RZW

Dave Swanson N1MJC, Dennisport MA Wayne, you have interesting editorials, sometimes a little repetitious, but I guess you are trying to drive home your point of view. I read an excerpt on "What's wrong with Peterborough" from your *Declare War* book, sent to me by a friend who knows of you and also knows that I subscribe to *73*. I thought it read very well and made a lot of sense.

My last comment has to do with the CW mode of operation: I also think that with the present state of the art in the communication field, the CW requirement needs an overhaul since it is but one of the many modes of amateur communication. I think CW is a fun mode and a historically significant mode and certain portions of the spectrum should still be allocated for it, but as a requirement for the advanced operating licenses it should be eliminated. My personal choices of communication are limited because, for all practical purposes, I am deaf (flu-related nerve deafness at age 28); I cannot communicate by voice and group club meetings are out, unfortunately. I have no problems with CW, and the tone-deafness mentioned by N8YBK in the September '93 "Letters" column, regarding an individual who couldn't learn the code, is not a correct analysis of that individual's problem. As you would probably agree, the code tone can be at almost any audible frequency and still be copied; it's the duration and spacing, etc., of tones, not the tones themselves, that make the code comprehensible.

Ron Gillies, Lloydminster, Alberta, Canada Wayne, I am a Canadian (mid-30s) who is approaching my exam/license within the next few months. I have been reading the various magazines on the hobby and have consistently found *73* to be the most interesting, provocative and useful of the bunch.

I especially enjoy your editorials, but I have to admit that the September '93 one left me a little at a loss. I have noted that you do not have a lot of time for the ARRL, and that in the mid-1960s (when I was just starting grade school) the ARRL did something that you view as the real death of modern amateur radio.

Without dragging you over ground that you are probably very tired of, can you give me a brief rundown? As a Canadian under 40, I'm afraid that some of the implicit references just shoot over my head.

I am also an avid computer hobbyist (assembled my own Heath from a kit a number of years ago) and I wondered, have you ever thought of starting an echo on one of the major nets, such as Fido? Your editorial material would be great stuff to spread, and the faster timeline for comments could make for very readable fun!

I look forward to more of your writings—they're great fun and make me think about things from different points of view!

Yes, I'm tired of writing the details of the Great Catastrophe of 1964. Someone please write and tell Ron about it . . . Wayne

Daniel Plett 3A2LZ, Monaco Wayne, I have been reading your magazine for about a year now and have enjoyed it thoroughly. The articles seem to be more rooted in reality than most other U.S. amateur radio magazines. Usually I agree with your column, and when I disagree it is a matter of perspective.

For instance, although I'm pretty active on SSB and RTTY, I still operate a lot of CW. This is because I have a lousy antenna and CW can get through where voice won't. Also, on the international scene some hams can only afford a small, low-power, CW-only rig and don't know enough English to communicate with others but *can* get by on CW.

I'm also an Extra Class U.S. license holder and find the current system of exams and licenses lacking. Six levels of licenses and exams is ridiculous. It would make more sense to me to have three levels of licenses. The first would be like the current No-Code Tech, which has proven itself to be an excellent entry-level license. The next would be like the current General license, with at least a 12 wpm code requirement (to fit within CEPT and other reciprocal programs) and a power limit of 100 watts. This would raise a lot of opposition, but isn't uncommon in other parts of the world. You can still do almost anything with 100 watts as you can with more power, with the exception of good moonbounce. It might encourage learning good operating skills, antenna construction, and understanding of propagation instead of just buying and amplifier to cut through it all. Then have the current Extra license, perhaps still at 12 wpm code, but with the higher power and additional frequency allotments. A number of other countries also require that you be licensed three to five years before you are allowed more than 100 watts.

While VE testing is a marvelous step forward, I strongly dislike having the test questions available ahead of time. I don't know how to prevent them from being made public, though.

Recently I spent about eight months in the U.S. and attended a number of hamfests and radio clubs and it seemed that most people's activities were limited to the occasional chat with a friend or on a net on HF, 2 meter FM, and packet radio. I share your sentiments about the lack of building, experimentation, and interest in anything out of the ordinary. I looked in vain everywhere for someone to explain or talk to me about APLINK, for instance, and found hardly anyone who could knowledgeably talk to me about AMSAT. Amateur radio has a proud heritage of experimentation and innovation, but for the most part it seems that U.S. hams almost always look inward, not considering the rest of the world, and use ham radio as an expensive telephone. Let's see some articles on home-brew DSP, possibly putting this and other digital processes into practice. These are some ideas brought about by your column and by my personal experiences in the U.S. and overseas. 73

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- **Stable:** low-feedback dual-gate FET

**Specify tuning range: 26-30, 46-56, 137-152, 152-172, 210-230, 400-470, 800-960 MHz.*

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ONLY $29 kit, $44 wired&tested

- GaAs FET Preamp similar to LNG, except designed for **low cost & small size.** Only 5/8"W x 1-5/8"L x 3/4"H. Easily mounts in many radios.

**Specify tuning range: 25-35, 35-55, 55-90, 90-120, 120-150, 150-200, 200-270, 400-500 MHz.*

LNS-(*) IN-LINE PREAMP

ONLY $89 kit, $119 wired&tested

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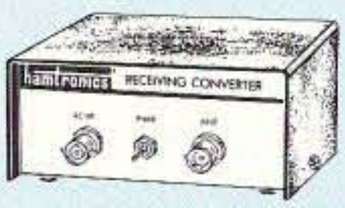
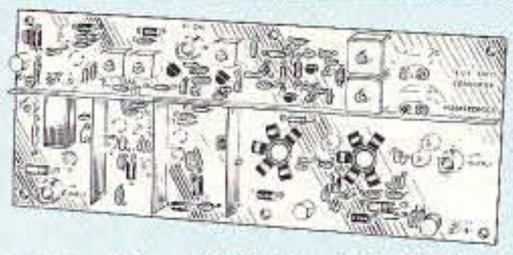
RECEIVING CONVERTERS



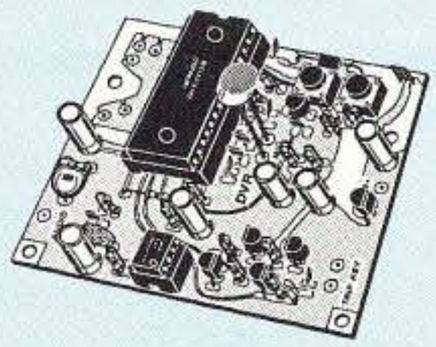
Low noise converters to receive vhf and uhf bands on a 10M receiver.
- **Kit less case *$49*, kit w/case & BNC jacks *$74*, w&t in case *$99*.**
- Input ranges avail: 50-52, 136-138, 144-146, 145-147, 146-148, 220-222, 222-224 MHz, 432-434, 435-437, 435.5-437.5, and 439.25 (to chan 3).

TRANSMITTING CONVERTERS



XV2 for vhf and XV4 for uhf. Models to convert 10M ssb, cw, fm, etc. to 2M, 220, 222, 432, 435, and atv. 1W output. ***Kit only $89.*** PA's up to 45W available.

ACCESSORIES



NEW **DVR-1 DIGITAL VOICE RECORDER** Module. Primarily a **voice ID'er for repeaters**. May also be used as a **contest CQ caller** or as a **"radio notepad"** to record up to 20 seconds of received transmissions for instant recall. As a **repeater ID'er,** it will record your voice, using either the built-in microphone or an external mic. It can be used with almost any repeater COR module. As a **contest caller,** you can record a message or even several messages and play them through your transmitter at the press of a switch. As a **radio notepad,** you can keep it wired to the audio output of a receiver ready to record up to 20 seconds of anything you might want to recall later. Play it back as many times as you like through a small external speaker. (Call for more information.) .....kit $89, w&t $139

TD-3 SUBAUDIBLE TONE DECODER/ENCODER. Adjustable for any tone. Designed **especially for repeaters,** with remote control activate/deactivate provisions ....kit $29, wired & tested $69

COR-3 REPEATER CONTROLLER. Features adjustable tail and time-out timers, solid-state relay, courtesy beep, and local speaker amplifier ..... kit $49

CWID. Diode programmed any time in the field, adjustable tone, speed, and timer, to go with COR-3 ..... kit $59

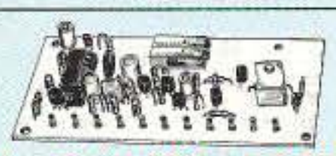
COR-4. Complete COR and CWID all on one board for easy construction. CMOS logic for low power consumption. Many new features. EPROM programmed; specify call ..... kit $99, w&t $159

TD-2 TOUCH-TONE DECODER/CONTROLLER. Full 16 digits, with toll-call restrictor, programmable. Can turn 5 functions on/off. Great for selective calling, too! .....kit $89, wired & tested $149

NEW **TD-4 SELECTIVE CALLING** Module. Economy touch-tone decoder with 1 latching output. Primarily designed to mute speaker until someone calls you by sending 4-digit tt signal but may also be used to turn on autopatch or other device..... kit $49, w&t $89

AP-3 AUTOPATCH. Use with above for repeater autopatch. Reverse patch and phone line remote control are std. .....kit $89, wired & tested $149

AP-2 SIMPLEX AUTOPATCH Timing Board. Use with above for simplex operation using a transceiver ..... kit $39



MO-202 FSK DATA MODULATOR. Run up to 1200 baud digital signals through any fm transmitter with full handshakes. Radio link computers, telemetry gear, etc. ..... kit $49, w&t $79

DE-202 FSK DEMODULATOR. For receive end of link. ..... kit $49, w&t $79

9600 BAUD DIGITAL RF LINKS. Low-cost packet networking system, consisting of MO-96 Modem and special versions of our 144, 220 or 450 MHz FM Transmitters and Receivers. Interface directly with most TNC's. Fast, diode-switched PA's output 15 or 50W.

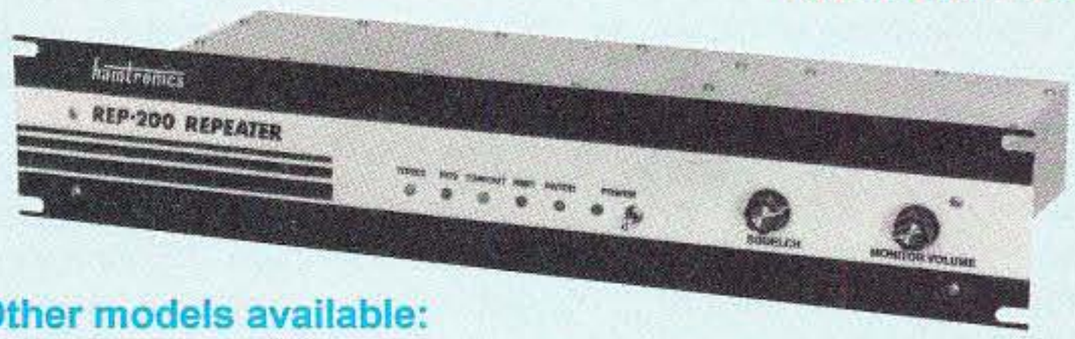
NEW **Real-Speech Voice ID Option Available With DVR-1 Digital Voice Recorder Shown At Left!**

REP-200 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.

Kit $1095; w&t only $1295!
Voice ID Option $189.



Other models available:

REP-200V Economy Repeater. As above, except uses COR-4 Controller without DTMF control or autopatch. **Kit only $795.**

REP-200N Repeater with no controller. For use with external controller, such as those made by ACC. **Kit only $695, w&t $995.**

- Available for the 50-54, 143-174, 213-233, 420-475, 902-928 MHz bands.
- *FCC type accepted for commercial service (hi-band and uhf).*
- **Rugged exciter and PA**, designed for continuous duty.
- Power out 20W 50-54MHz; 15W (25W option avail.) 143-174MHz; 15W 213-233 MHz; 10W uhf; 10W 902-928MHz.
- Available add-on PA's **up to 100W.**
- **Six courtesy beep types**, including two pleasant multi-tone bursts.
- **Open or closed access autopatch, toll-call restrict**, auto-disconnect.
- **Reverse Autopatch,** two types: auto-answer or ring tone on the air.
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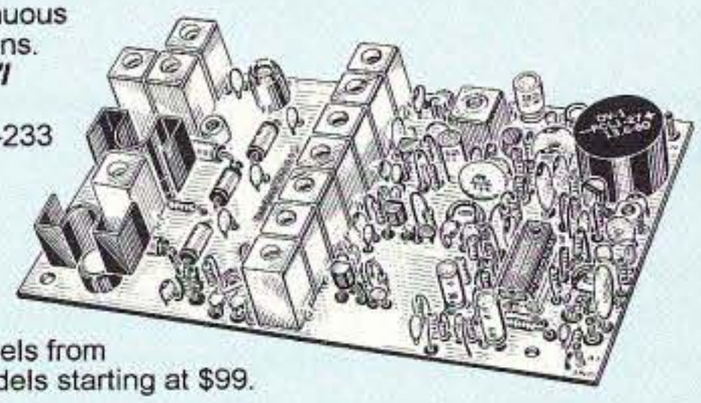
- **DTMF CONTROL:** over 45 functions can be controlled by dtmf command. 4-digit control code for each function.
- **Owner can inhibit** autopatch or repeater, enable either open or closed access for repeater or autopatch, and enable toll calls, reverse patch, kerchunk filter, site alarm, aux rcvr, and other options.
- Cw speed and tone, beep delay, tail timer, and courtesy beep type **can be changed at any time** by owner password protected dtmf commands.
- **Auxiliary receiver input** for control or **cross linking repeaters.**
- Many **built-in diagnostic** and testing functions using microprocessor.
- Color coded **LED's indicate status** of all major functions.
- **Welded rf-tight partitions** for exciter, pa, receiver, and controller.
- 3½ inch aluminum rack panel, finished in eggshell white and black.

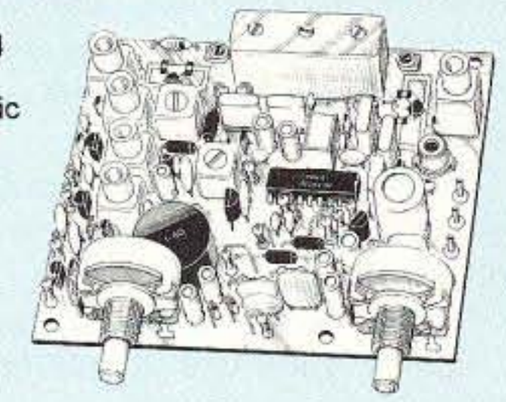
XMTRS & RCVRS FOR REPEATERS, AUDIO & DIGITAL LINKS, TELEMETRY, ETC.

Also available in rf-tight enclosures, and with data modems.

FM EXCITERS: 2W continuous duty. TCXO & xtal oven options. ***FCC type accepted for com'l high band & uhf.***
- **TA51**: 50-54, 143-174, 213-233 MHz ...kit $109, w&t $189.
- **TA451**: 420-475 MHz ...kit $109, w&t $189.
- **TA901**: 902-928 MHz, (0.5W out); w&t $219.
- **VHF & UHF AMPLIFIERS.**
- For fm, ssb, atv. Output levels from 10W to 100W. Several models starting at $99.



FM RECEIVERS:
- **R144/R220 FM RECEIVERS** for 143-174 or 213-233 MHz. **GaAs FET** front end, 0.15uV sensitivity! Both crystal & ceramic if filters plus **helical resonator** front end for exceptional selectivity: >100dB at ±12kHz (best available anywhere!) Flutter-proof hysteresis squelch; afc tracks drift. ...kit $149, w&t $219.
- **R451 FM RCVR,** for 420-475 MHz. Similar to above. ...kit $149, w&t $219.
- **R901 FM RCVR,** for 902-928MHz. Triple-conversion, GaAs FET front end. ...$169, w&t $249.
- **R76 ECONOMY FM RCVR** for 28-30, 50-54, 73-76, 143-174, 213-233 MHz, w/o helical res or afc. ...Kits $129, w&t $219.
- **R137 WEATHER SATELLITE RCVR** for 137 MHz. Kit $129, w&t $219.



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Ham Nobel Prize Winner

The winner of the 1993 Nobel Prize for physics, Princeton University's Dr. Joseph H. Taylor K1JT, attributes his success in science to his early involvement in amateur radio. Taylor shared the prestigious award with his former student and now Princeton colleague, Dr. Russell A. Hulse.

Upon learning of his winning the prize, Dr. Taylor told reporters that he developed his scientific skills as a ham during his years at Moorestown Friends Academy in New Jersey. He later earned a Bachelors degree from Haverford College and a Doctorate in Astronomy from Harvard University. The Nobel Committee honored Taylor and Hulse for their study of the gigantic gravitational forces exerted by pulsars. *TNX ARRL.*

The Car of the Future

Technology offers new hope for those among us who hate to stop and ask for directions. Commerce Secretary Ron Brown joined automotive industry leaders recently to announce an international agreement which will accelerate the development of practical GPS receivers for motor vehicles.

Many hams are already familiar with the GPS (Global Positioning System) technology. Originally developed by the Department of Defense as a worldwide navigation system for the armed forces, GPS uses satellites to pinpoint the exact locations of special receivers.

Magellan Systems, a California based manufacturer of GPS receivers, will develop, build, and export the units. Experts predict the receivers will be so small and inexpensive they will become a standard feature in new automobiles.

Quick Ticket

The FCC has proposed a measure which would grant temporary operating authority to unlicensed persons who have passed their examinations for new amateur radio licenses. The temporary operating authority would begin when the exam is passed and the application filed. The maximum limit would be 120 days.

The temporary authority would not benefit anyone whose license has been suspended, revoked, or subjected to other FCC enforcement proceedings. The commission reserves the right to yank this operating authority at any time without a hearing.

The Commission says the system ". . . would be useful to the amateur community, yet practical to implement." The proposal, designated P.R.Docket 93-267, was based on a Petition for Rulemaking from the Western Carolina Amateur Society. *TNX Westlink Report, No. 661, November 12, 1993.*

Fork It Over

If you think your last traffic ticket was painful, wait until you see what your friends at the FCC have cooked up for you. The commission's new fine schedule includes a $625 penalty for any "assorted minor violations," and a $1,250 fine for failure to identify your station. Unauthorized use of equipment will cost you $5,000.

Running excessive power, failing to respond to an FCC communication, or operating on an unauthorized frequency will set you back $10,000 under the new fine schedule. Transmitting indecent material or words will cost you $12,500, causing malicious interference to another ham is set at $17,500, and failing to permit an FCC station inspection carries an $18,500 price tag.

If you really want to help reduce the national debt, just get caught sending out a false SOS. Illegal misuse of distress communications like that will cost you $20,000 for each transmission! The FCC has the authority to adjust these fines, but these base amounts are recommended for first-time offenders. *TNX Newsline & Westlink Report, No. 661, November 12, 1993.*

Radio Sleuth Lauded

The FCC recently presented a bronze plaque of appreciation to Melvin I. Woods KN4ZT, of Annandale, Virginia, for his "outstanding assistance" in solving a false distress signal case. The 1992 case involved a false SOS on 14.313 MHz. The commission says Woods not only provided important information at the time, he also cooperated with the subsequent FCC investigation.

The 58-year-old Amateur Extra Class operator served in the US Navy from 1952 to 1976 as a senior chief radioman and chief electronics technician. Woods started in ham radio in 1953 as a Novice. He was also awarded the US Coast Guard Public Service Award from Rear Admiral William J. Ecker during the October ceremony. *TNX Westlink Report, No. 661, November 12, 1993.*

Malfunction Grounds Earthwinds

A November launch attempt for the Earthwinds around-the-world balloon flight was aborted after a system malfunction damaged the crew capsule. Crewmembers Larry Newman KB7JGM, Richard Abruzzo, and Vladimir Dzhanibekov RV3DD were not on board at the time and no one was injured during the mishap.

Project leaders suspect a cable support anchoring the capsule to the ground gave way, causing the capsule to rise prematurely and then fall. The damage is being assessed. The ham-radio-equipped historic balloon flight has been set back a minimum of six to eight weeks. *TNX W5YI Report, Issue #22, November 15, 1993.*

Let's Talk Ham Radio

A Phoenix-based radio talk show called "Ham Radio & More" has gone national after 2-1/2 years of success on station KFNN. The show began broadcasting nationally over more than 80 Talk America Network affiliate stations in late November. The weekly program is hosted by Len Winkler KB7LPW, and features special guests, give-aways, listener call-ins, and DX news.

"Ham Radio & More" can be picked up in any market by a local talk station. You can suggest your favorite station carry the program by having them contact the Talk America Network at (508) 460-0588. The show can also be picked up on Satcom C-5, Transponder 19, 6.0 audio and Galaxy 2, Transponder 3, Channel 55.4. The show is designed to increase the public's awareness of ham radio and thus help the hobby to grow. It includes discussions of all aspects of hamming, and is not limited to technical topics. Listen for it on Sundays at 6 p.m. EST.

Be Prepared

Members of the Amateur Radio Emergency Services group of Mercer County in rural Kentucky had a very authentic training exercise one recent Saturday. Ham operators and other volunteers were staging their response to a mock plane crash when a very real crash occured on nearby Highway 127—an automobile and a large truck had collided.

Using 2 meter gear and a repeater phone patch, Robert James KC4ZOX summoned local authorities and the accident was handled without delay. Despite bad weather and that highway collision, the simulated hunt for the "downed aircraft" was a success. Organizers called the day's work excellent training for the unexpected. *TNX Dan Cordray KD4PWP.*

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 70310,775; MCI Mail "WGEPUB"; 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.

Why Wait For The Weather?

Hate to wait for the weather? AEA FAX II is the answer. This IBM-compatible software receives HF SSB transmissions and displays satellite maps and WEFAX images in 16 levels of gray, giving you highly detailed pictures like the one you see here.

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Features, like the ability to export your fax pictures to PCX and GIF files and a logging function to keep track of your favorite stations, make AEA FAX II easy to use right out of the box! Simply plug in the demodulator (shown here), install the software, and you're ready to receive highly detailed images.

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Requires PC-compatible XT, AT, or better and a general coverage HF SSB receiver. VGA monitor required for gray-scale fax display.

Using the World's Most Accurate Frequency Standard, Part 1

Building a receiver for WWVB.

by Bob Roehrig K9EUI

How accurate is your frequency counter? Chances are it is not as good as you think it is. Even if your counter has a high stability time base of 0.1 or 0.2 ppm, it must still be checked against a known standard from time to time. I have seen many counters that are off by as much as 10 ppm, which means the measurement of a 2 meter rig would be off by more than 1 kHz. If you experiment with microwaves, it is essential that you have an accurate frequency counter.

The standard rule of thumb is that your measuring instrument should be at least 10 times more accurate than the device you are trying to measure. See the sidebar: "Comments on Frequency Counters" on page 17.

The most accurate frequency source in this country is obtained from the National Institute of Standards and Technology (NIST), formerly called the National Bureau of Standards (NBS), in Colorado. This is the organization that operates WWV. All the WWV frequencies are obtained from a cesium standard, which is the most accurate frequency source in the world. WWV is OK for setting clocks and zeroing a receiver's crystal calibrator, but it is not the ideal source for checking a frequency counter.

The best standard frequency you can get is from the LF transmissions of WWVB on 60 kHz. Because of the low frequency used, the fading and multipath problems are minimized and an almost constant signal is available. With the equipment described in this article you can easily check your local standard or countertime base to within 0.0001 parts per million, which is not possible using the HF WWV signals.

The WWVB Signal

The WWVB transmission on 60 kHz has no audio modulation. The carrier power is reduced 10 dB at the beginning of each second and held low for 0.2 to 0.8 seconds before returning to full power. This pulse width modulation is a serial binary time-of-day code used to synchronize clocks. The second form of modulation is a 45-degree advance in phase shift at 10 minutes past the hour, which is returned to normal five minutes later. This phase shift will have little effect on our use of the signal but you will see it when doing phase comparisons. The WWVB signal strength is sufficient to be received throughout most of the continental U.S.

System Block Diagram

Figure 1 shows a block diagram of the WWVB receiver/comparator. The receiver is basically a sensitive RF amplifier that amplifies the 60 kHz carrier up to a 5 volt level signal. The carrier frequency is then com-

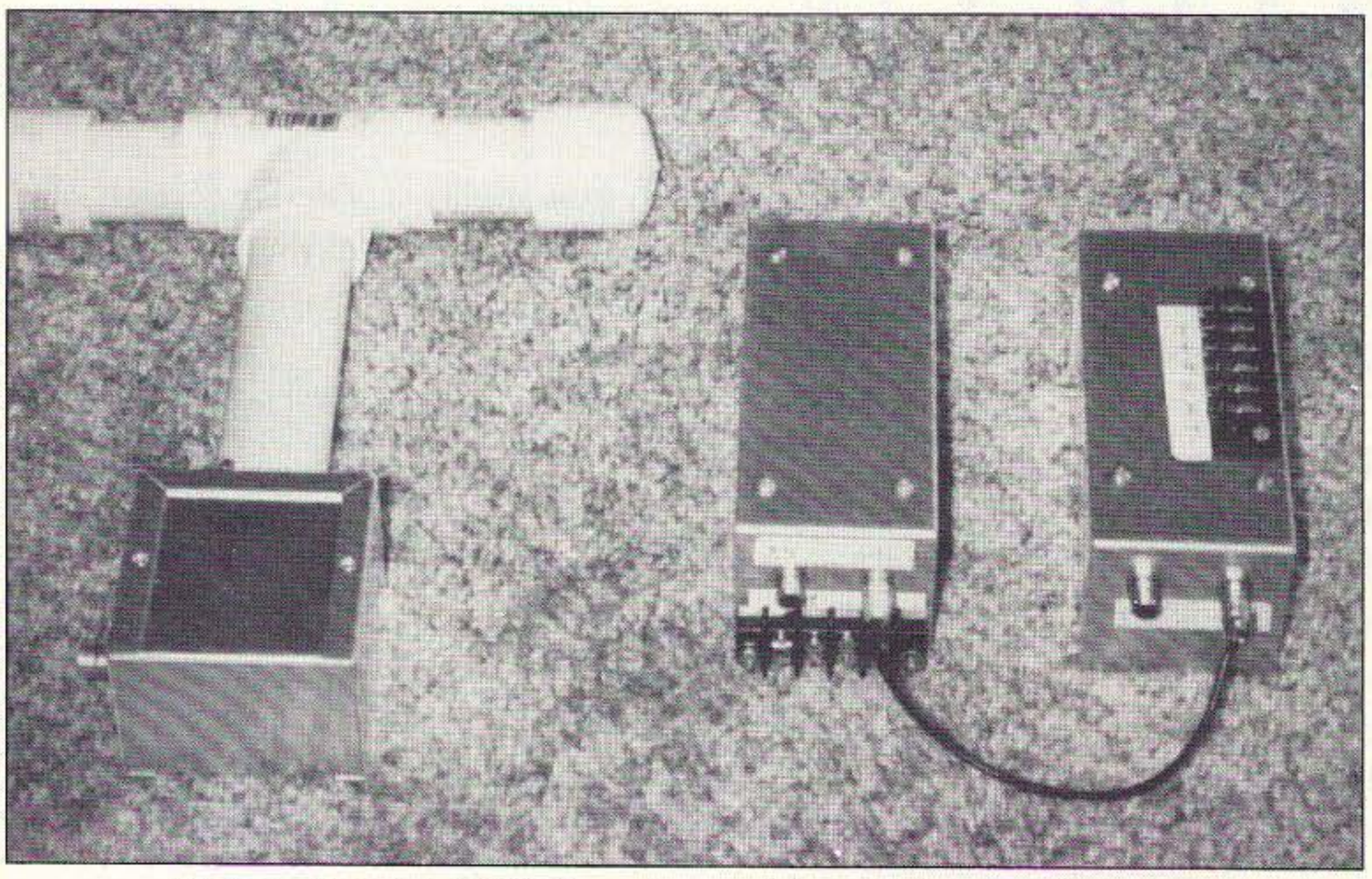

Photo A. Completed WWVB receiver modules with indoor rod antenna.

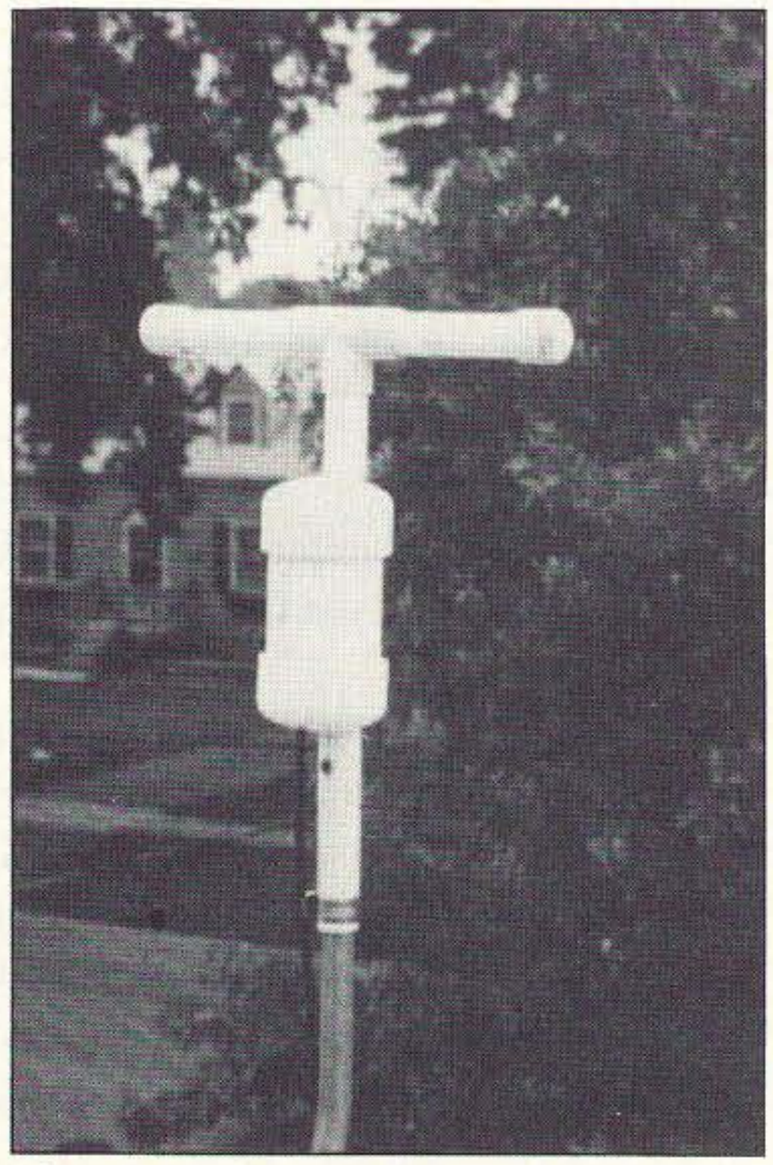

Photo B. Outdoor version of rod antenna and preamp in waterproof housing.

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Greatly improves your signal if you're using a random wire or longwire antenna with an ineffective ground.

Electrically places a far away RF ground directly at your rig by tuning out reactance of connecting wire.

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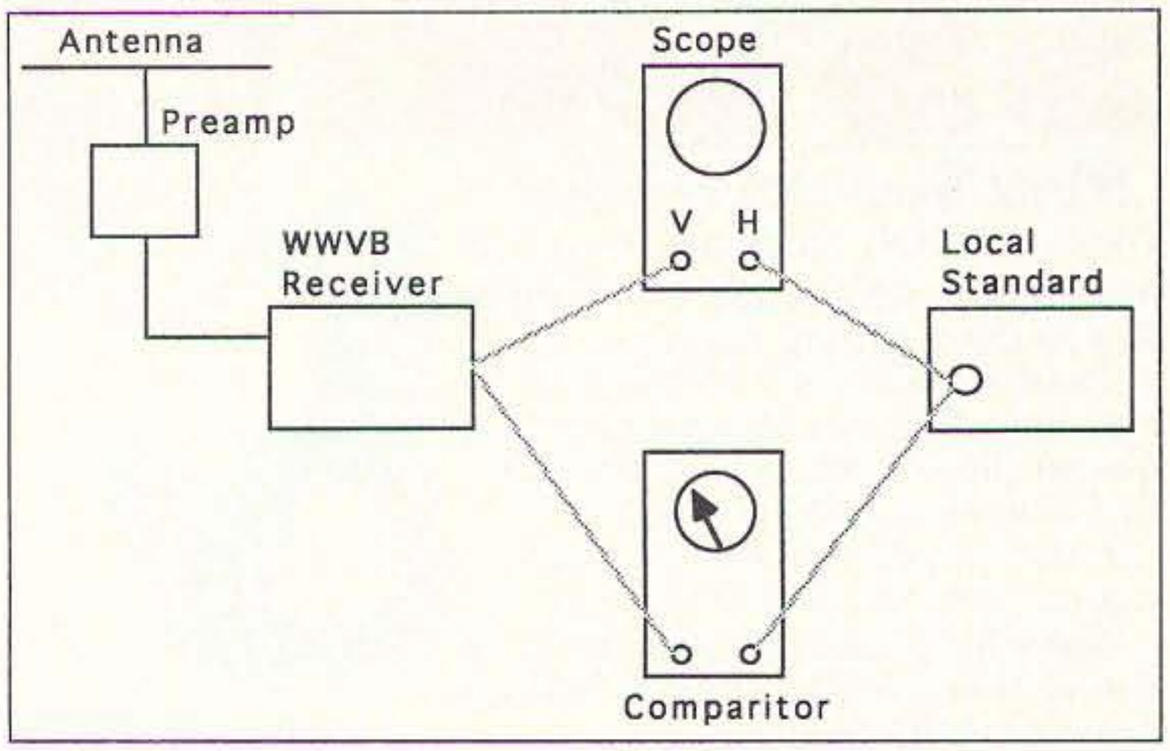

Figure 1. Block diagram of the WWVB receiver/comparator.

pared to your local standard, which may be a separate highly accurate oscillator or a stable oscillator that exists within a piece of equipment such as a frequency counter. The comparator can be either a scope, which is used to observe the Lissajous patterns showing the drift of the local standard, or a digital comparator, which shows the drift rate on a meter or chart recorder. The second part of this article will show the details of a digital comparator.

The Antenna System

This is an active antenna using cascaded followers for a high input impedance and a low output impedance. The unit should be at least 25 feet away from the receiver and is connected to the main unit with coaxial cable. Any common coax can be used since impedance matching is not a critical issue here. Power is supplied from 12 volts via a series 330 ohm resistor in the receiver and the signal is superimposed on this same conductor. The board should be mounted in a waterproof housing if it is to be mounted outdoors. (See Photos A and B.)

Two types of antenna can be used, a wire or a ferrite rod. The same preamp is used for either type antenna with just a few component changes. The antenna/preamp circuit is shown in Figure 2.

For the wire version, a 3- to 50-foot antenna is connected to J2; the length depends on the signal strength at your location. R3 is a fixed 1k resistor and C1, C4, L1, and L2 are not used. To adjust, connect the circuit as shown in Figure 3A and adjust L3 for maximum signal at 60) kHz.

A wire antenna can gather a lot of signal but may also pick up a lot of noise. Also, a longwire antenna may pick up enough HF energy from a nearby ham transmitter to damage the preamp. Therefore, I recommend putting in the extra effort to build the rod antenna.

For the preamp circuit with the rod antenna. install C1, C4 and a 1k pot for R3. C2 should be an 820 pF capacitor. C5, L3, and J2 are not used. L1 consists of a 1/2-inch by 7-1/2-inch-long ferrite rod from Amidon Associates (2216 East Gladwick St., Dominguez Hills CA 90220; 310/763-5770), Part No. R33-050-750. You will also need about 50 feet of #28 gauge enameled wire, also available from Amidon.

Starting about two inches from one end, close-wind about 4-1/2 inches of wire around the rod. Secure the ends of the windings with tape. After L1 is wound, wind a layer of electrical tape around the center portion and wind 20 turns of wire over this area for L2. Be sure to leave about two feet of wire off the ends of the windings to make connections to the preamp.

The rod antenna is adjusted by first powering up the board as shown in Figure 3A and checking for regeneration. Rotate R3 throughout its range. If it does not oscillate, swap the two tickler lead connections on the board. Once oscillation is obtained, reduce the setting of R3 by about 1/16 of a turn, below the point of oscillation. Then connect the generator to points A and B and tune to resonance by adjusting the number of turns of L1 and choosing the correct value of C2, making it resonate at 60 kHz with C1 at mid-capacity.

After tuning, cover the entire winding with electrical tape. Final tuning should be done with C1 after the rod is installed in its PVC housing and its attachment to the preamp enclosure. In my case, the antenna is mounted outdoors (see Photo B) so I mounted the preamp in a 2-inch PVC tube and the antenna housing uses 3/4-inch pipe, end caps and a "T."

If you have some ferrite rods around, try them. I successfully used an 8-inch rod that was used as an AM antenna on an old stereo receiver. On this rod I wound 6 inches of wire (0.33" in diameter), which tuned to 60 kHz with two of the 820 pF caps in parallel.

The WWVB Receiver

To maintain the accuracy of the transmitted frequency, the receiver cannot modify

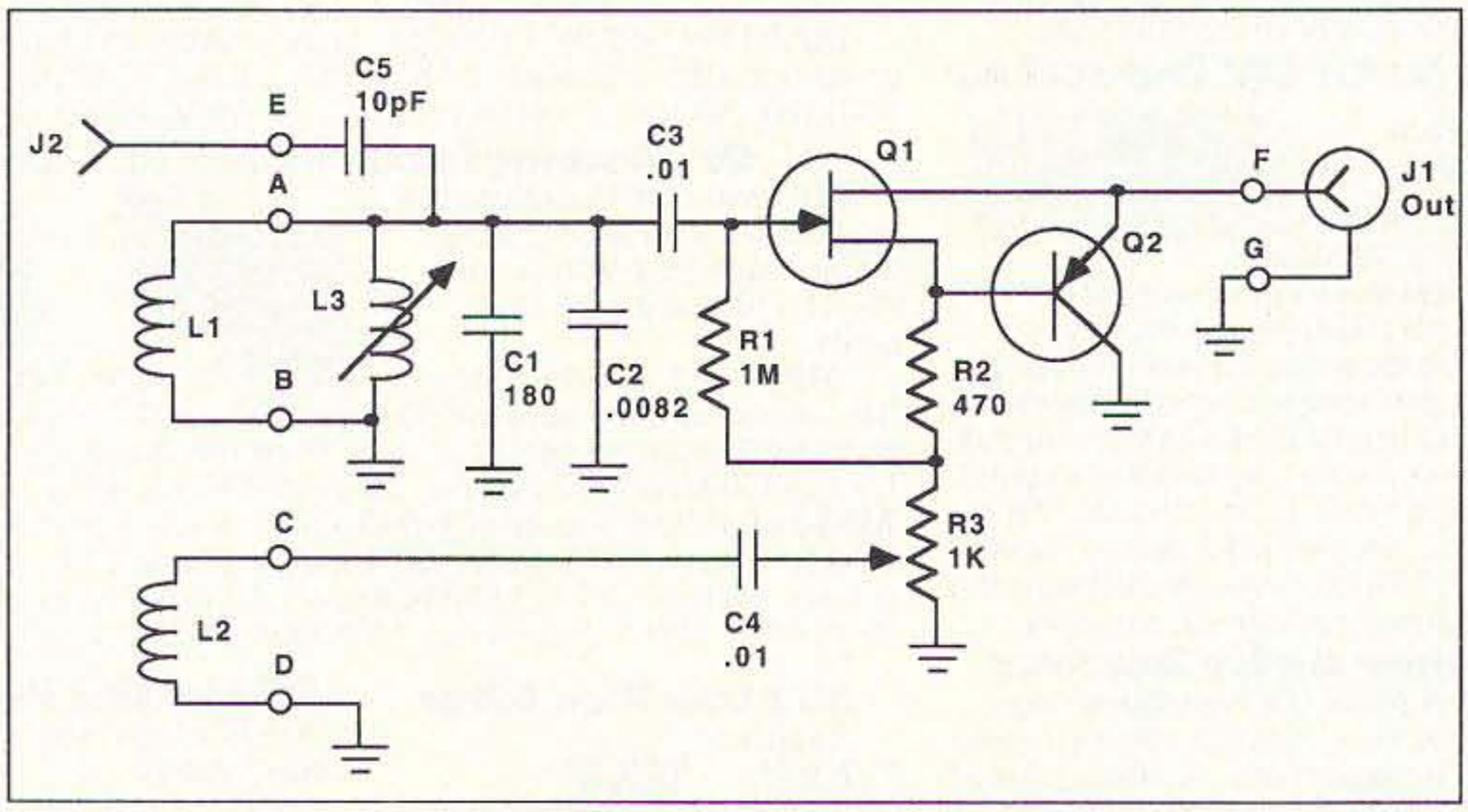

Figure 2. The antenna/preamp circuit.

Parts List, Figure 2

(All fixed resistors 1/4 watt)

R1	1 Meg	
R2	470 ohms	
R3 *	1k	
R3 **	1k pot	Digi-Key #36C13
L1,2 **	See text	
L3 *	800 µH	Digi-Key #TK1725
C1 **	10-180 pF trimmer	Digi-Key #SG3014
C2 *	0.0082 µF	Digi-Key #P3822
C2 **	820 pF (see text)	Digi-Key #P3821
C3	0.01 µF	Digi-Key #P4513
C4 **	0.01 µF	Digi-Key #p4513
C5 *	10 pF	Digi-Key #4837
Q1	MPF102	Digi-Key #MPF102
Q2	2N2907	Digi-Key #2N2907
J1	Output connector: BNC, Phono, or coaxial UHF	
J2 *	Antenna connector: Pin or bananna jack	

The enclosure for indoor use is 4" x 2-1/8" x 1-5/8" minibox: Radio Shack #270-239 or Digikey #L114ND.

* Use these parts for the wire antenna version only.

** Use these parts for the ferrite rod antenna version only.

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April 29, 30 & May 1, 1994

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Asst. General Chairman, Ken Allen, KB8KE

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Advance Registration and Banquet
USA - April 8 Canada - April 1
Flea Market Space: February 1

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Flea Market Tickets (valid all 3 days) will be sold IN ADVANCE ONLY. No spaces sold at gate. A maximum of 3 spaces per person (non-transferable). Electricity is available in a portion of the last Flea Market row for $40 additional per space. Rental tables and chairs are not available in the Flea Market. Vendors ***MUST*** order an admission ticket when ordering Flea Market spaces. Please send a separate check for Flea Market space(s) and admission ticket(s). Spaces will be allocated by the Hamvention committee from all orders received by February 1. Please use 1st class mail *only*.

Notification of Flea Market space assignment will be mailed by March 15, 1994. Checks will not be deposited until after the selection process is complete.

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Novice thru Extra exams scheduled Saturday and Sunday only. Send FCC form 610 (Aug 1985 or later) - with requested elements shown at top of form, copy of present license and check for prevailing rates (payable to ARRL/VEC) to Exam Registration, 708 Mapleside Dr. Trotwood, OH 45426

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	_____	$150/3 adjacent	$_____
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Covered tent	_____	$215.00 ea.	$_____
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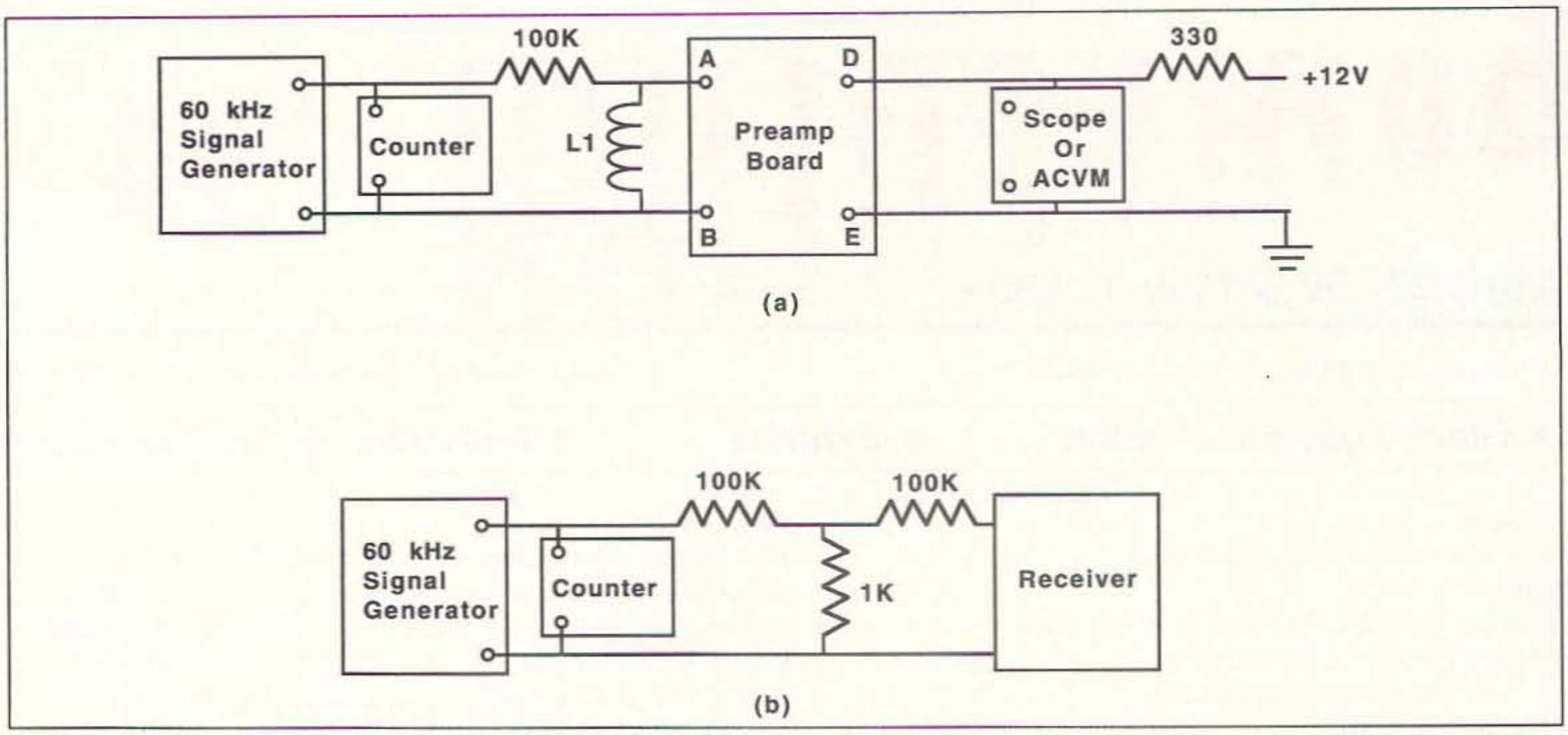

Figure 3. A) Preamp tuning setup; B) Receiver tuning setup.

the frequency in any way, so we must use a TRF system rather than a superhet. Because the entire receiver operates on a single frequency, it must be well-shielded and is therefore built in two separate minibox modules to prevent self-oscillation. RF connections between modules are via coaxial connectors and cables and other connections are provided by barrier-strip screw connections. The receiver design is the result of many months of trying many different circuits and the discreet component version shown here proved to be the most stable and reliable of many that were tried.

The two receiver boards are mounted in the miniboxes using 3/4-inch spacers and 4-40 hardware. The jacks and barrier strips are mounted on the ends and tops of the boxes. The covers may then be mounted to a rack panel or to a cabinet base, as desired. In my final unit, I also included a multi-position switch so I can monitor other functions with the 50 µA meter.

Figure 4 shows the RF amplifier portion

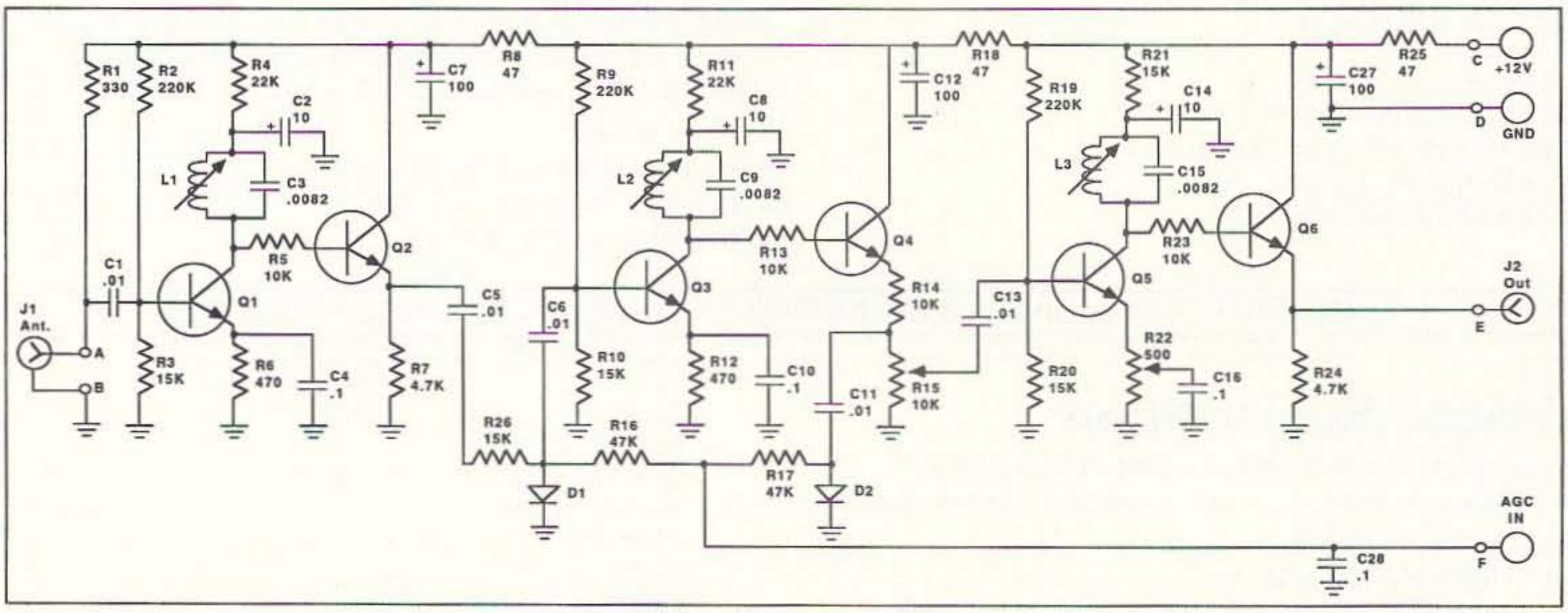

Figure 4. RF amplifier portion of the receiver.

Parts List, Figure 4

(All fixed resistors 1/4 watt)		
R1	330 ohms	
R2,9,19	220k	
R3,10,20,21,26	15k	
R4,11	22k	
R5,13,14,23	10k	
R6,12	470 ohms	
R7,24	4.7k	
R8,18,25	47 ohms	
R16,17	47k	
R15	10k pot	Digi-Key #36C14
R22	500 ohm pot	Digi-Key #36C52
C1,5,6,11,13	0.01 µF	Digi-Key #P4513
C4,10,16,28	0.1 µF	Digi-Key #P4525
C3,9,15	0.0082 µF	Digi-Key #P3822
C2,8,10	1O µF	Digi-Key #P807
C7,12,27	100 µF	Digi-Key #P833
L1,2,3	800 µH	Digi-Key #TK1725
Q1-6	2N2222 or equiv.	
D1,2	1N34A	Radio Shack #276-1123
J1,2	BNC, phono or UHF coaxial connectors	
Enclosure: Digi-Key #L116ND or Radio Shack #270-238		

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* IBM XT is a registered trademark of the IBM Corporation.

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14.03510-T    0930
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- Standard Display shows RX/TX VFO freq's, time and current memory

- Send & Receive in: CW / RTTY(BAUDOT) / ASCII

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TNX FER QSO. 73
■
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← Incoming data

← Outgoing data appears here

- Store up to nine 256 character messages.

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14.03510-T    0930
3>CANNED      MSG■
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← Format & Edit stored MSG's here

- Messages can be: edited, sent & appended to outgoing message

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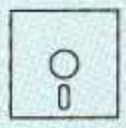

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of the receiver. It consists of three stages of tuned amplifiers with emitter followers. The followers and low collector current in the tuned stages help preserve the high Q of the coils to maintain selectivity. AGC is applied to two stages. As the signal strength increases, the AGC detector provides a higher DC voltage. This voltage is applied to diodes D1 and D2. The higher the current that passes through these diodes, the more the signal voltage is shunted to ground. During normal operation the output of this section of the receiver is about a 1 volt P-P sine wave.

Figure 5 shows the remaining amplifier stages and the AGC detector. The normal signal level at TP1 is about 5 volts P-P. The carrier is rectified by D2 and D3. Q6 is a follower to isolate the slow AGC time constant circuit from the detector. C7 is charged to several volts through R23. The discharge time constant is via D5, R24, and R25. The AGC voltage developed across C7 is dropped to less than a volt by D5. The higher AGC voltage is reduced in this way, rather than with a voltage divider, to maintain a greater dynamic range. The slow-responding circuit sets the AGC level relative to the average signal level, rather than allowing it to follow the 10 dB carrier reduction that occurs each second. The slow AGC voltage is available at board point J while the fast AGC voltage is at point H. These two voltages can be used to drive a detector to decode the time-of-day pulse information. This decoded information can be used to operate a self-setting digital clock. If you are interested in such a clock project, drop me a card and let me know.

Stages Q3 through Q5 amplify the main received signal and provide a 5 volt TTL compatible output. This signal is used to drive the 60 kHz input of the comparator unit or to connect to the scope.

Receiver Adjustments

On the RF amplifier board, set R15 and R22 to mid-range. Connect the test equipment to the RF amplifier module alone using the scheme shown in Figure 3B. Using the scope or an AC voltmeter, set the generator to 60 kHz at a level of 150 mV RMS. This is equivalent to a 30 microvolt signal at the actual receiver input. Observe the output signal at J2 with the scope. Carefully adjust the three coils for maximum signal using a nonmetallic tool. The level should end up being about 1 volt P-P.

After alignment is complete, place the cover on the box of the module, then connect the cables between the two receiver units: RF amplifier J2 connects to amplifier unit J1, and "F" of both units are connected together. Temporarily ground the AGC line "F." With the 150 mV signal applied as before, there should be a 6 volt P-P sine wave at TP1. The signal may be slightly clipped at the top and bottom of the waveform. J2 should have a 5 volt square wave. TP2 should read about 6 VDC and TP3 should be about 3.3 VDC.

Remove the short from "F." The signal at TP1 should drop to around 4 volts P-P and TP3 should read around 1.8 volts. If all is well, changing the generator output from 150 mV up to 1.5 volts (a change of 20 dB) should show no more than about a 6 dB change at TP1. With the 50 uA S-meter connected, it should read around mid-scale with the 150 mV input and around 45 uA with the 1.5 volt input.

The receiver will operate with an actual input level of only 3 microvolts with R15 and R22 at maximum level (counterclockwise rotation). With nothing connected to the receiver input, there will be a 5 volt square wave at output J2. This will be close to 60 kHz and is not an oscillation but just the amplification of internal noise. Any useful signal will override this so it is not of concern.

Finally, disconnect the generator and turn it off or change its frequency so the receiver won't pick it up. Connect the cable from the antenna unit and observe the TP1 signal. You should see the 60 kHz signal, around 6 volts P-P or so, dropping in level every second. The signal should be a fairly clean sine wave.

The final gain adjustment is made while

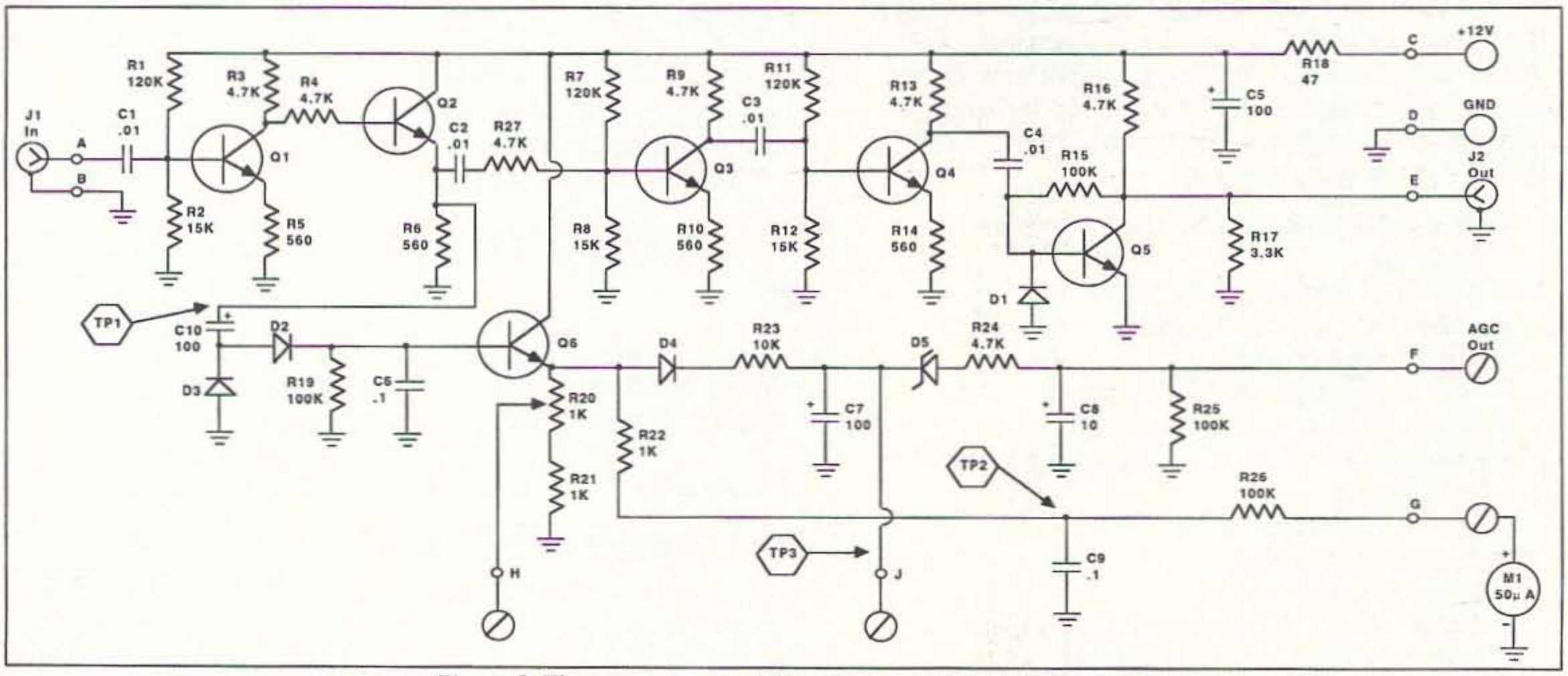

Figure 5. The remaining amplifier stages and the AGC detector.

Parts List, Figure 5

	(All fixed resistors 1/4 watt)	
R1,7,11	120k	
R2,8,12	15k	
R3,4,9,13,16,24,27	4.7k	
R5,6,10,14	560 ohms	
R15,19,25,26	100k	
R17	3.3k	
R18	47 ohms	
R21,22	1k	
R23	10k	
R20	1k pot	Digi-Key #36C13
C1-4	0.01 μF	Digi-Key #P4513
C5,7,10	100 μF	Digi-Key #P833
C6,9	0.1 μF	Digi-Key #P4525
C8	10 μF	Digi-Key #P807
D1-4	1N914 or 1N4148	
D5	3.9V zener, 1N4730A or 1N5228B	
Q1-6	2N2222 or equiv.	
J1-3	BNC, phono, or UHF coaxial connectors	
M1*	50 μA meter	

*Various models available from Fair Radio Co., 1016 E. Eureka, Box 1105, Lima OH 45802; (419) 227-6573

Enclosure: Digi-Key #L116ND or Radio Shack 270-238

observing the signal at its strongest period, usually around noon local time, or four or five hours after sunset. Adjust R15 and R22 on the RF amplifier board for maximum signal at TP1, without clipping. The AGC will then compensate for lower signal levels at other times of day. Maximum signal should peak no higher than 45 µA on the S-meter.

During use, if the meter shows erratic fluctuations other than the normal 1 pps time code drops, it indicates atmospheric disturbances that may affect the signals usefulness. If the meter does not show the 10 dB drops each second, it may be that the noise level is high or you are getting interference. If the meter is steady, the unit may be oscillating because the antenna is too close to the receiver.

Phase Comparisons

The simple form of phase comparison between WWVB and your local standard is done with the setup shown in Figure 1, using a scope. The receiver output is fed to the vertical scope input and the local standard is fed to the horizontal input. The 60 kHz signal and your local standard are compared by observing the rotation of the Lissajous pattern. Alternatively, connect the local signal to the external sync input to synchronize the scope's horizontal oscillator. The comparison will then be a slow drift of the waveform across the screen. In any case, your local standard must be an integer value of 60 kHz.

If your frequency counter time base is your local standard, you can probably find a point in the countertime base divider chain that provides 10 kHz. This would be a good choice of signal to compare to the 60 kHz. At 10 kHz, to achieve an accuracy of 1 part in 10^8, it will take over two hours of comparison time.

Whatever the accuracy you are trying to achieve, it takes 100 times as long to observe a 10 kHz signal drift as it does 1 MHz. For that reason, the serious user of this equipment should consider building a simple digital phase comparator. This will be discussed in the second part of this three-part series.

Using the Receiver for Other Frequencies

WWVB is usable in most of North America. In other parts of the world there are other LF standard frequency transmissions that may be of use. I cannot vouch for the accuracy of the following list but I have seen these stations mentioned in various publications from time to time. There may also be others that I have not heard of. The station must emit a CW carrier and not have FSK keying as many military stations do.

Location	Call	Freq., kHz
U.K.	MSF	60
Germany	DCF77	77.5
Switzerland	HBG	75
Japan	JJF	40
Czechoslovakia	OMA	50
Irkutsk, Russia	RTZ	50

The receiver can be tuned for these other frequencies by selecting different values for C3, C9, and C15 as follows:

40 kHz	0.018 µF
50 kHz	0.012 µF
75 kHz	5300 pF
77.5 kHz	5000 pF

C2 on the antenna preamp board must also be changed as necessary.

I encourage any correspondence regarding this project (314 S. Harrison St., Batavia IL 60510); however, if you expect a response, please include an SASE. A full set of boards for this project can be obtained for $11 plus $1.50 S & H from FAR Circuits, 18N640 Field Court, Dundee IL 60118. 73

Comments on Frequency Counters

If you are planning to purchase a frequency counter, consider the following:

1. The counter specs should state the accuracy and frequency of the time base. Accuracy should be expressed in terms of drift with temperature change. The time base should be one using a "standard" frequency, such as 1, 3, 5, or 10 MHz. Avoid counters which have a nonstandard time base, such as 3.579545 MHz. Nonstandard frequencies generally mean cheap crystals. Also, they cannot easily be compared to a known standard.

2. A good counter should have an output connector which allows you to easily check the internal oscillator.

3. The better counters have an external time base input that allows you to use a more accurate oscillator than the internal one.

4. Unless you can use an external time base, you should consider buying the counter with the high stability time base option, if available, but again, make sure it has an output connector so you can check it.

I have counters made by Hewlett-Packard, Fluke, Anadex, and others. All of these either met the above requirements or were easily modified to do so. Even my synthesized signal generator has an external time base input, so all my units are run from my "house" standard.

5. There are other counters available than those advertised in the amateur publications, such as those I mentioned above. If you frequent hamfests, keep an eye out for older commercial-grade counters. Sometimes excellent units can be purchased inexpensively. The owner may just want to get rid of it because it is not as small as more modern counters.

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10 Hamsats
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Micro IDer

An easy-to-build automatic Morse code station identifier.

by Steve Look KA9SZW and David Pointer

More and more hams these days are attaching miniature radio transmitters to weather balloons, kites, and rockets. This underscores the need for a very small Morse code identifier necessary for legal operation. A very small identifier would also be useful for compact and portable foxhunt transmitters and beacons.

The typical Morse code identifier uses an EPROM and several other logic chips. This confuguration is fine for applications where size, weight, and power consumption are not considerations. The Micro IDer presented here consists of a maximum of 12 components mounted on a single-sided printed circuit board measuring only 1-5/8" x 5/8". The complete unit weighs less than 1/2 gram. Power requirements are 1-2 mA at 3 to 6 volts. One Duracell DL2032 3V lithium cell will power the IDer for hours. Total cost should not exceed $20.

Theory of Operation

The Micro IDer is based on the Xilinx 1736A serial PROM (U2). This eight-pin IC will store 36,288 bits of data. When a clock signal from the 555 timer (U1) is applied to pin 2, each bit in the memory appears at pin 1 in sequence. This pin is connected to the base of transistor Q2 to drive the keying circuit of a transmitter. Q3 and R3 may be needed on the keying circuit to invert the output if you find the code being sent is inverted. Adding the transistor is cheaper than programming a new PROM.

Q1, R4, and R5 form an inverter between pin 6 and pin 3.

When the last bit of the memory has been clocked out, the PROM generates a logic high at pin 6. The inverter applies a momentary logic low to pin 3. This resets the PROM and the entire memory is read out again.

The timing is provided by a CMOS 555 timer in an astable multivibrator configuration. The value of resistor RA sets the clock speed and is determined by the software that generates the actual ID bit pattern. A standard 555 timer may be used instead of the more expensive CMOS part, but the power consumption goes up by a factor of at least 10, greatly affecting the battery life.

Construction

Mount the two ICs first. We recommend only a high quality machine socket for U2 to allow PROM changes. A spring contact socket may cause reliability problems. Mount RA, R1, R2, and R4 on the bottom of the board next. This is done to save space. All the other components can now be mounted to the top of the board.

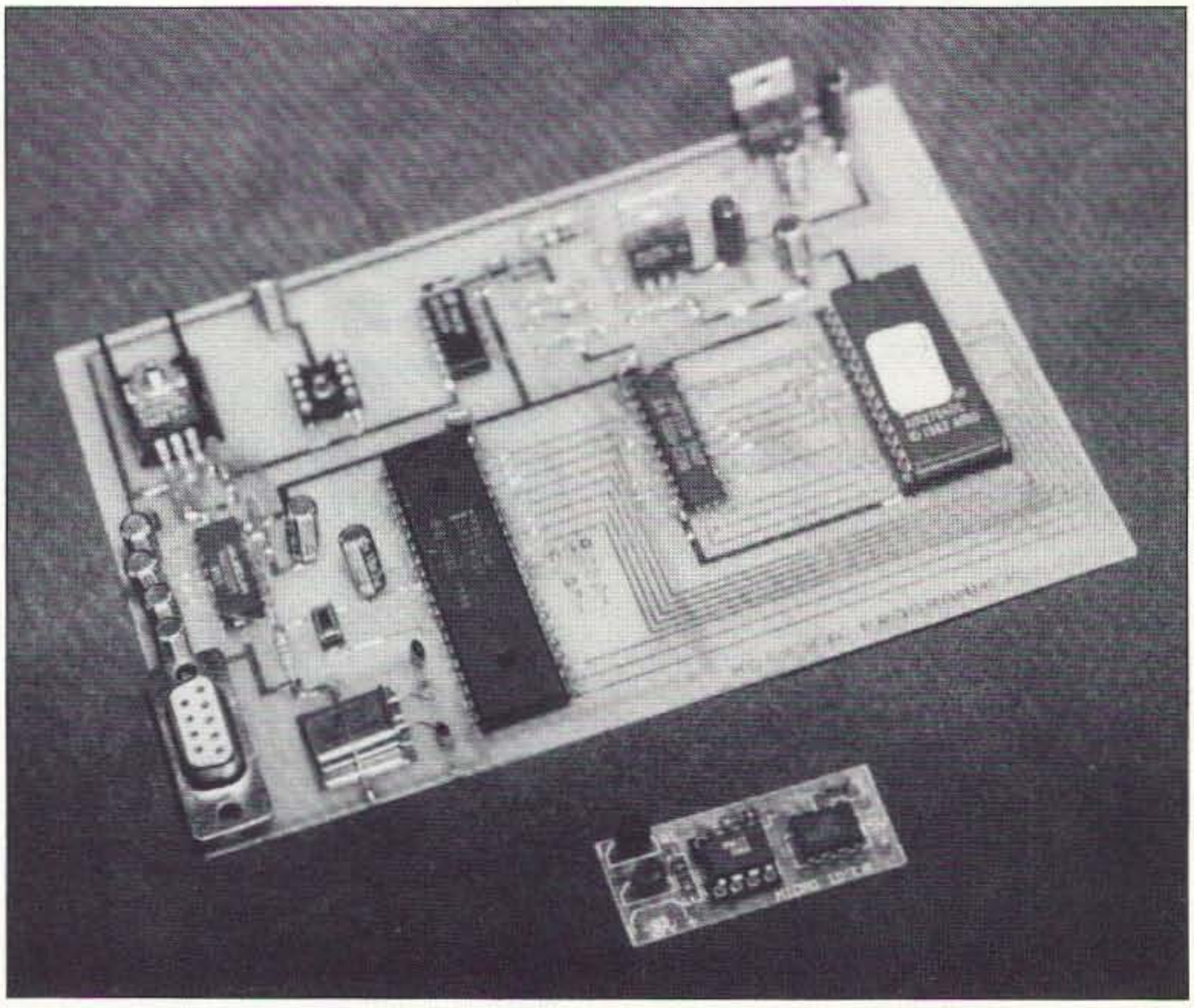

Photo A. Here is the completed Programmer (top) and the IDer.

mkid—A Morse Code Compiler

With this large memory space in the serial PROM available, two programs were written to simplify message generation.

You must first create a file with any text editor (or a word processor in ASCII mode) that contains the text of the Morse code you want to be sent. Be careful about your spelling as the 1736A is a one-time programmable part. All characters are supported, but not the prosigns. Two other characters are included to add a solid tone and silent pause function. A pound sign in your text file represents a solid one-second tone. Place as many of these in a row as you want the tone duration to be. An exclamation point in your text file represents a one-second silence. Place as many in a row as you want the silent period to be.

Text may be entered in upper or lower case as the software converts everything to upper case at compile time. Use a carriage return wherever you wish; they are ignored. When your message looks the way you want it to, save it to disk and exit your text editor.

A very simple example text file may look like:

ka9szw balloon #####

This would generate my (Steve's) call, space, "balloon," space, and then a five-second solid tone. Long periods of a solid tone

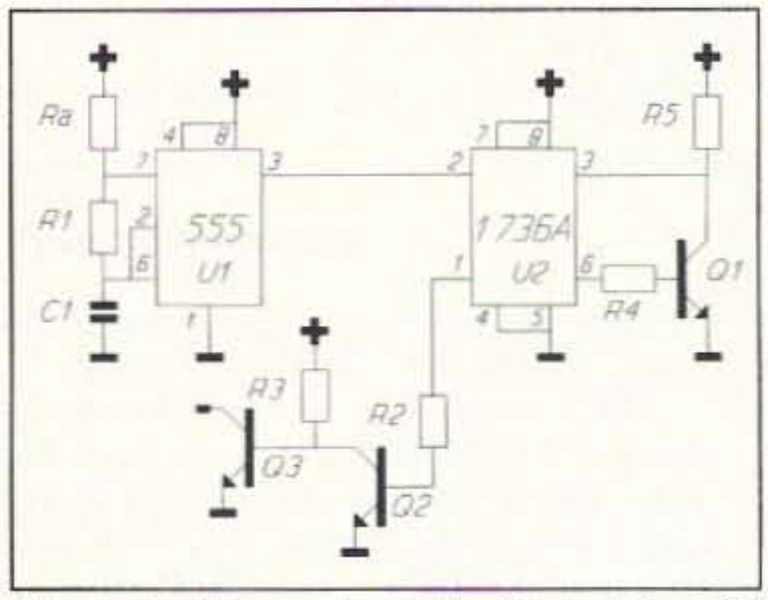

Figure 1. Schematic of the Micro IDer. Q3 and R3 are only used if keying must be inverted.

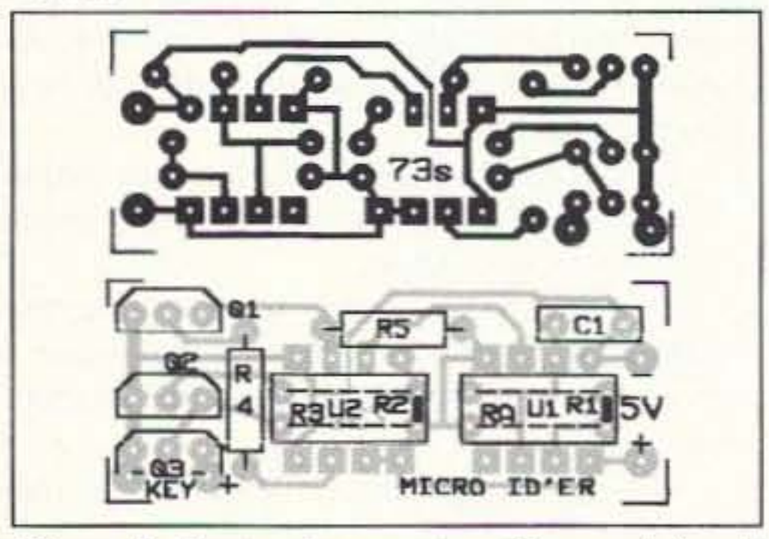

Figure 2. Parts placement outline and circuit board pattern.

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CIRCLE 41 ON READER SERVICE CARD

1. IC POWER CONNECTIONS

	+5V	GND
U1	40	20
U2	20	10
U3	28	14
U4	16	15
U5	14	7

2. All resistors are 5% 0.25W unless otherwise noted.

3. All capacitors are 20% unless otherwise noted.

4. Heat sink attached to Q1.

5. U3 is socketed.

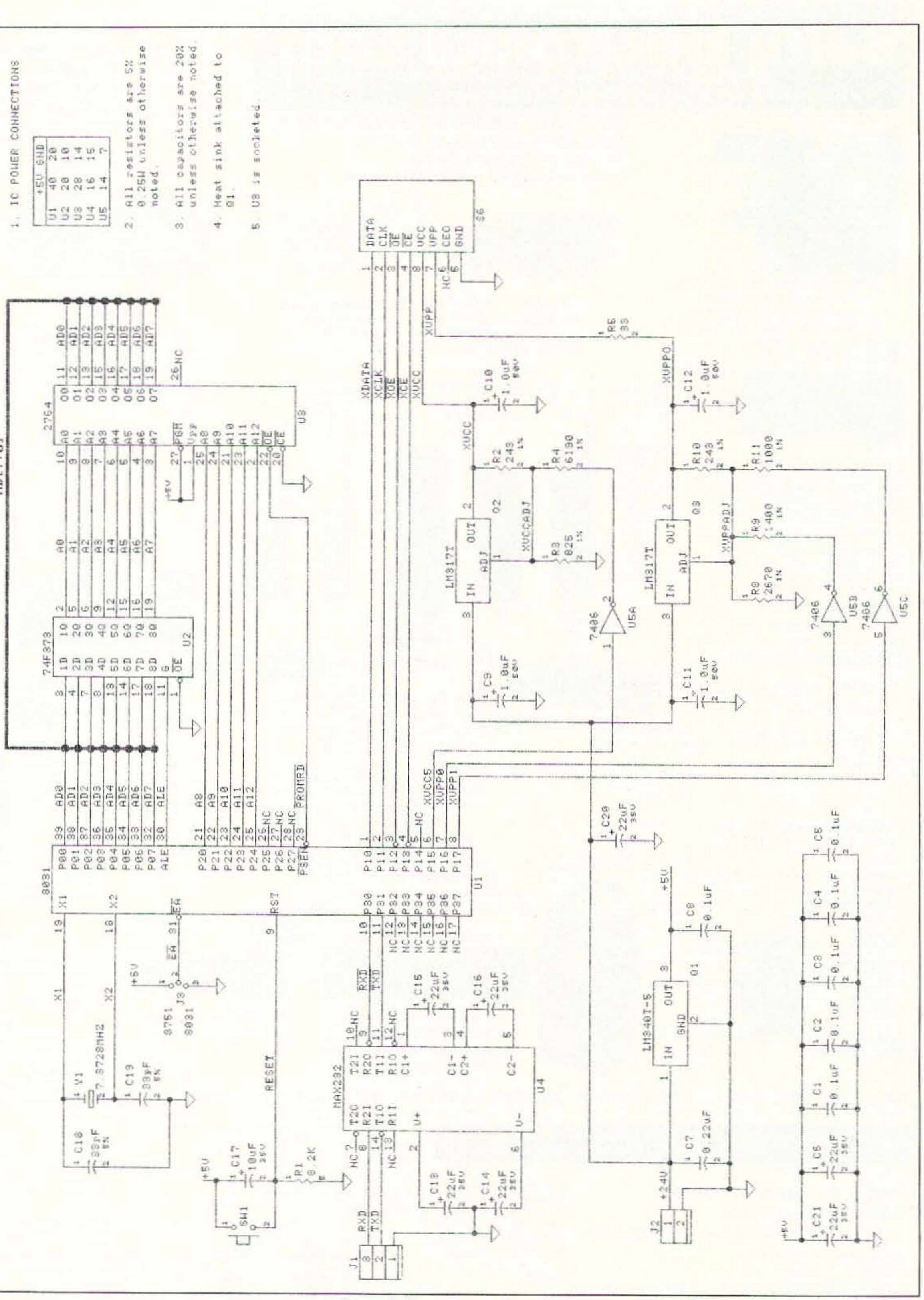
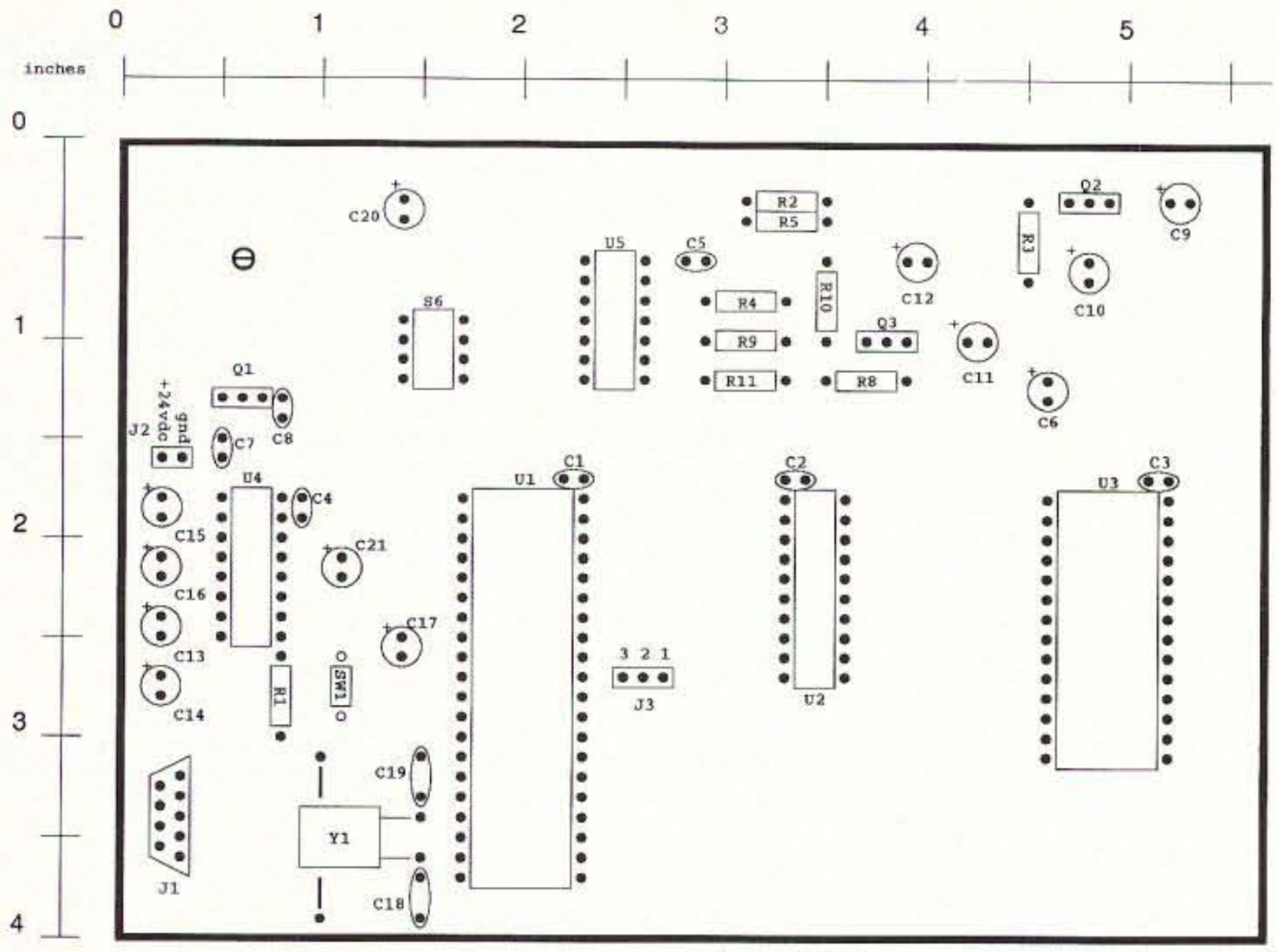


Figure 3. Programmer schematic.



1. Hole sizes (inch dia):
   - ⊖ 0.156 (1 place)
   - ○ 0.052 (2 places)
   - ● 0.040 (213 places)
2. Attach heat sink between board and Q1 using 6-32 x 3/8 machine screw, #6 lockwasher, and 6-32 nut.
3. Lay crystal Y1 flat on copper plane, and solder a bare wire strap over Y1 using the two holes provided.

Figure 4. Programmer parts placement @ 70%.

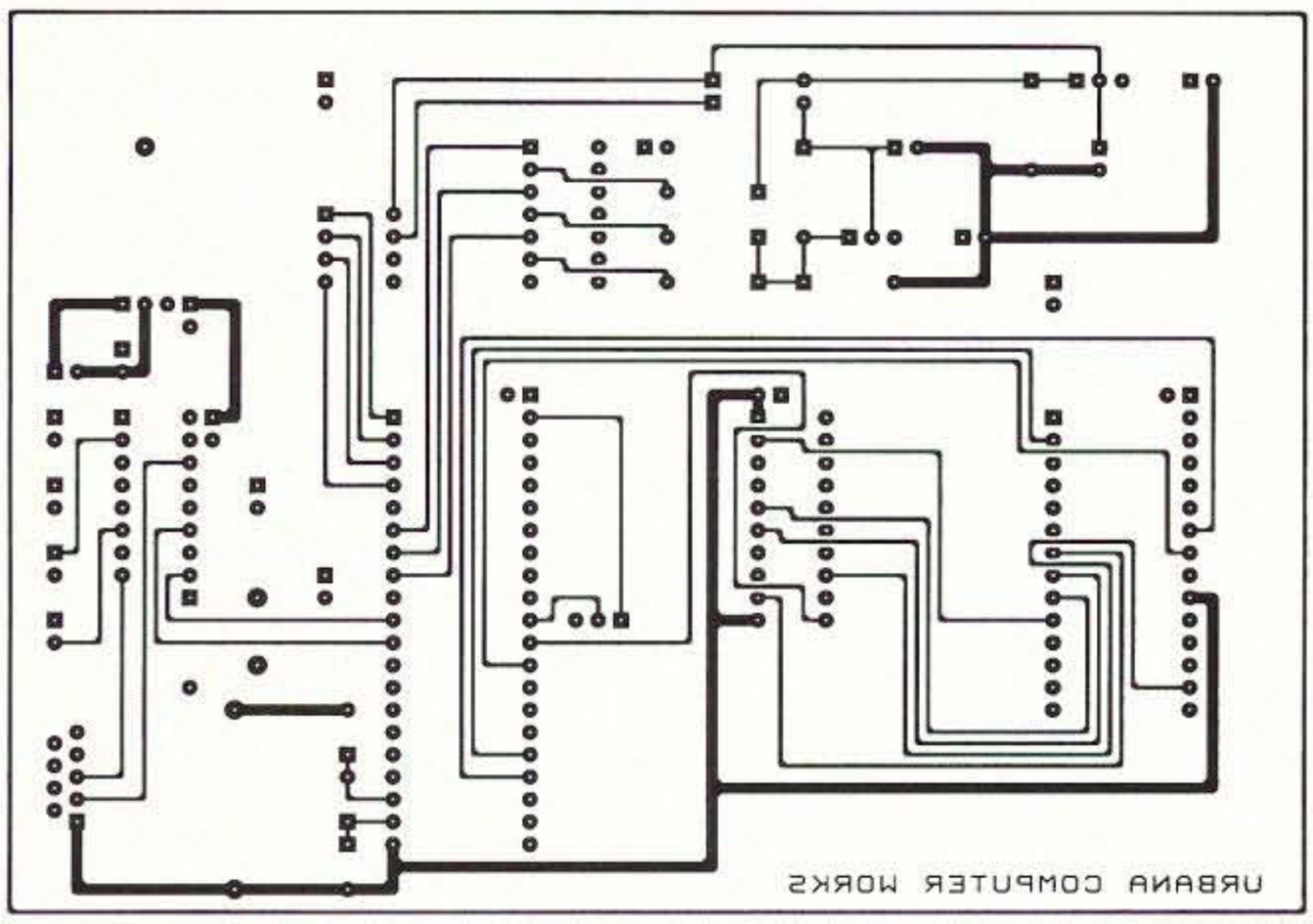


Figure 5. Programmer solder side circuit pattern @ 70%.

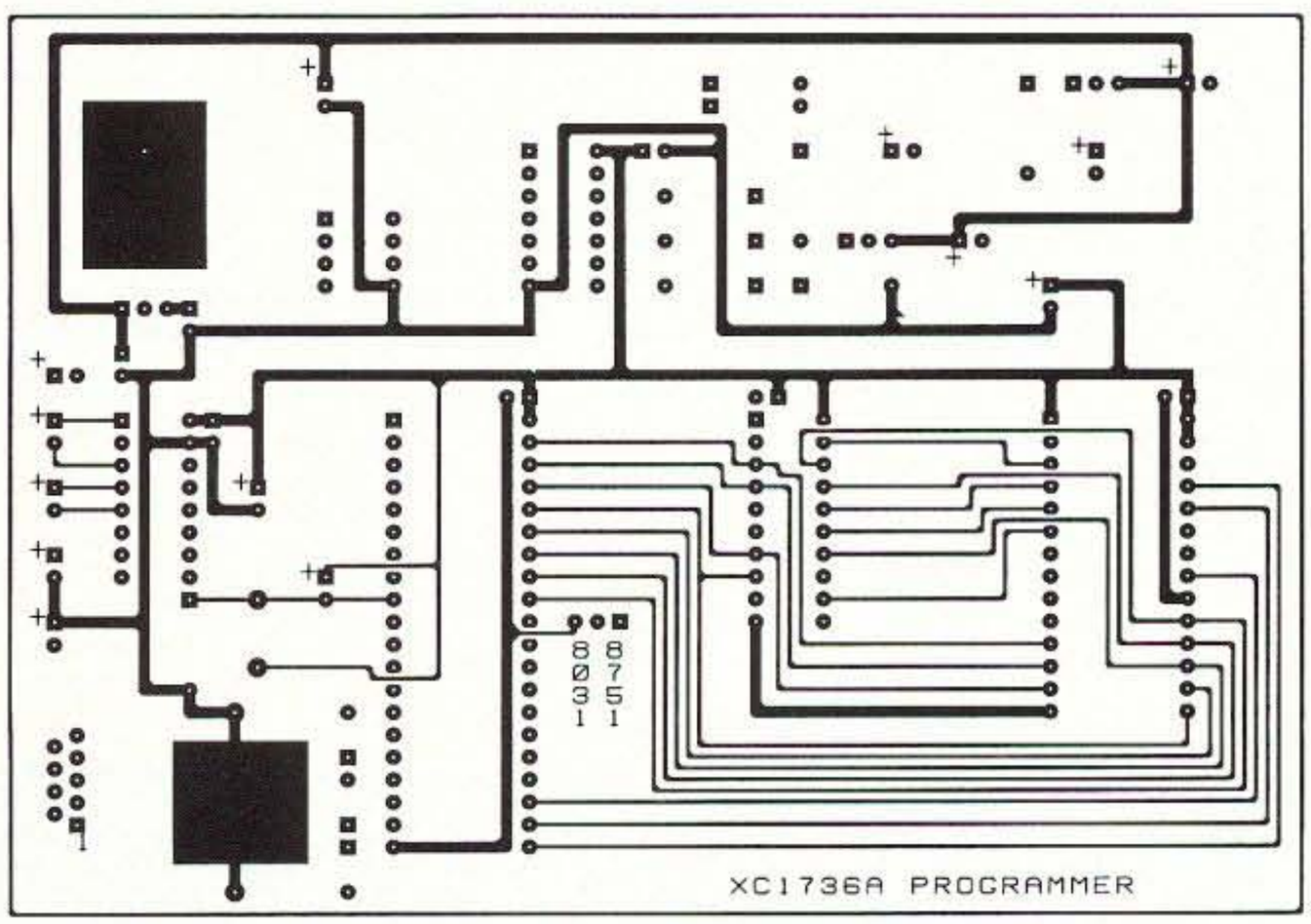


Figure 6. Programmer component side circuit pattern @ 70%.

are helpful to chasers trying to get a fix on a balloon package.

To run the compiler, type:

mkid <text_file>

where <text_file> is the name of the text file you created with the message. The program will display error messages if it cannot find the file. If it has found the file, it will load it while displaying it on the screen so you can check your work one more time. You will be prompted to enter how fast you want the code to be sent. After calculating for a bit you will see a list of available ID delay times. This is how often the message will repeat. Small messages generate large lists of delay times while large messages may offer only a few choices. Enter the number of the delay you wish to use.

After that is done the program opens a file with the same name as the input file, but with a ".jed" extension, and fills it with the keying pattern required for your message.

All the dot and dash timing is done along with key-downs for constant tones. The program will announce when it is done and display some statistics about the ID it just created. The program displays the frequency that the 1736A must be clocked at to get the correct timing, how long the ID will take to send, how long the ID will be silent before restarting, how much of the chip capacity was used, and what the value of the timing resistor (RA) must be.

The file created is in standard JEDEC format and should be accepted by any chip programmer that will handle the Xilinx 1736A, or you can build the companion programmer presented here. Follow the instructions in the manual on how to download a JEDEC file to your particular programmer.

jed2bin—A JEDEC File to Binary File Converter

If you have a programmer that will only accept binary or image files you will also need to use the program "jed2bin." This pro-

FOXHUNT HEADQUARTERS

Locate hidden or unknown transmitters fast. The Foxhound direction finder connects to the antenna and speaker jack on any radio receiver, AM or FM from 1 MHz to 1 GHz. The antenna (a pair of dipole telescopic whips) is rotated until the Null meter shows a minimum. A pair of LEDs indicate to turn Left or Right. The Foxhound is ideal to use with a walkie-talkie, if you wish to transmit, go ahead, a built-in T/R switch senses any transmitted RF and switches itself out of circuit while you talk. It doesn't get any easier than this! We provide all parts except for a few feet of 1/2 inch PVC pipe avialable at any hardwar e store for a dollar or two. Add our matching case set for a complete finished unit. Be the one with the answers, win those transmitter hunts and track down those jammers, you'll do it all with your Foxhound.

Add some fun to your club events by having a transmitter hunt! Foxhunting is a craze sweeping the nation, but many clubs are missing out on the action because they lack the expertise or time to develop their own foxhunt transmitter. We set one of our most devious and sneaky engineers to the task of designing an easy to build and use, yet highly capable Foxhunt transmitter. A snazzy microprocessor controller has both preset and programmable transmission characteristics allowing you to easily set the difficulty level from "beginner" to "know-it-all"! The SlyFox, FHT-1, is crystal controlled in the 2 meter band (crystal for 146.52 included) with a power output of 5 watts that is adjustable by the controller.The transmitter is programmed to ID in CW or add our voice option if you really want to aggravate the troops - "Ha ha, you can't find me!" Join the fun, get rid of those stuffy old meetings and picnics, have a foxhunt!

DF-1 Foxhound direction finder kit .....**$59.95** CDF Matching case set for DF-1 ....**$12.95**
FHT-1 SlyFox Foxhunt transmitter kit .**$129.95** FHID-1 Voice ID option.....**$29.95**
CFHT Heavy duty metal matching case set for FH T-1 .....**$29.95**

TOUCH-TONE DECODER

Grab Touch-Tone numbers right off the air, phone or tape. A simple hook-up to any radio speaker or phone line is all that is required to instantly decipher touch-tone phone numbers or codes. A 256 digit memory stores decoded numbers and keeps its memory even in the event of power loss. An 8 digit LED display allows you to scroll through the memory bank to examine numbers. To make it easy to pick out number groups or codes, a "dash" is inserted between sets of digits that were decoded more than 2 seconds apart. A "central-office" quality crystal controlled decoder is used allowing rapid and reliable detection of numbers at up to 20 digits per second! For a professionally finished look, add our matching case set. Start cracking those secret codes tomorrow with the Tone Grabber!

TG-1 Tone Grabber kit.....**$99.95** CTG Matching case set.....**$12.95**
TG-1WT Fully assembled TG-1 and case **$149.95**

TOUCH-TONE REMOTE CONTROL

Control virtually anything by Touch-Tone remote control. The URC-1 has 16 switched outputs, 4 adjustable voltage outputs (20 mV steps 0 to 5 VDC), two 10K digital pots (for volume, squelch, etc.) and 3 timers adjustable from 10 mS to 40 hours! Two level password control allows secure control and multi-level access. Six digit LED display shows currently entered codes and a crystal controlled touch-tone decoder provides reliable operation. There's nothing else like this unit, be in complete control of remote radios, thermostats, hi-fi's, homes or even factories with the URC-1. Add our matching case set for a handsome finish.

URC-1 Remote control kit .....**$129.95** CURC Matching case set.....**$12.95**
URC-1WT Fully assembled URC-1 and case **$189.95**

DIGITAL VOICE RECORDER

Chatterbox digital voice storage unit will record your message of up to 20 seconds. Time is split up into four 5 second blocks which can be played separately or cascaded for longer messages. An LED display shows message location and current mode for easy operation. Nifty built-in interfaces allow simple connection to transmitters for automatic keying when the PTT is initially closed or after it is released. You can even loop your rig's mike through the Chatterbox. For contest or fun use, the CB-1 can drive an external speaker. Includes a built-in electret mike. For that finishing touch, add our matching case set.

CB-1 Voice recorder kit .....**$59.95** CCB Matching case set **$12.95**

FM SUBCARRIER DECODER

Tap into the world of commercial-free music and data that is carried over many standard FM broadcast radio stations. Decoder hooks to the demodulator of FM radio and tunes the 50-100 KHz SCA subcarrier band. Many radios have a demod output, but if your radio doesn't, it's easy to locate, or use our FR-1 FM receiver kit which is a complete FM radio with a demod jack built-in. These "hidden" subcarriers carry lots of neat programming - from stock quotes to news to music, from rock to easy listening - all commercial free. Hear what you've been missing with the SCA-1.

SCA-1 Decoder kit.....**$24.95** CSCA Matching case set.....**$12.95**
FR-1 FM receiver kit.....**$19.95** CRR Matching case for FR-1.....**$12.95**

SCANNER CONVERTER

Tune in on the 800-950 MHz action using your existing scanner. Frequencies are converted with crystal referenced stabilty to the 400-550 MHz range. Instructions are even included on building high performance 900 MHz antennas. Well designed circuit features extensive filtering and convenient on-off/bypass switch. Easy one hour assembly or available fully assembled. Add our matching case set for a professional look.

SCN-1 Scanner converter kit .....**$49.95** SCN Matching case set.....**$12.95**
SCN-1WT Assembled SCN-1 and case.....**$89.95**

STEREO PEAK HOLD BARGRAPH

Finally a dual LED bar graph with a peak hold display! Bar graph displays are neat and eye catching but their speed is their downfall - they just can't capture the peaks. Our kit is like two units in one, a fast display to show the signal and a long persistance display to capture peaks, similar units go for hundreds of bucks! We offer 3 models: Linear for general use, Semi-Log for audio VU meters, and Log for power displays. Dual - for stereo! - 10 segment multi-colored LED display for snazzy, eye grabbing display and easily set ranges for virtually any signals, from voltmeters to audio VU meters to audio power amps to SWR meters. Complete intructions for easy hook-up to most any device. Add our matching case set for a sharp looking unit.

PH-14 Dual Linear bargraph kit.....**$39.95** PH-15 Dual Log bargraph kit.....**$39.95**
PH-16 Dual Semi-Log bargraph kit.....**$39.95** CPH Matching case set **$12.95**

SURROUND-SOUND/REVERB

Add concert hall realism to your stereo, TV or even 2-way radio! Easily sythesize a stereo effect from mono sources or richly enliven regular music. Add a big-voice reverb to your radio voice that others will envy! Our reverb/surround sound kit uses a Bucket Brigade IC Device for reliable solid-state performance. Adjustable reverb, delay and mix controls to customize your sound. Easily connected to radios, stereos, CB's and TV's. Plently of audio to drive a small speaker for stand-alone operation too. Experierence the fun and realism that surround sound provides - without spending hundreds! Add our case set for a neat, pro look.

RV-1 Surround Sound/Reverb kit.....**$59.95** CRV Matching case set.....**$12.95**
RV-1WT Assembled RV- 1 and case **$99.95**

SPEED RADAR

New low-cost microwave, Doppler radar kit "clocks" cars, planes, boats, horses, bikes or any large moving object. Operates at 2.6 GHz with up to 1/4 mile range. LED digital readout displays speed in miles per hour, kilometers per hour or feet per second! Earphone output allows for listening to actual Doppler shift. Uses two 1-lb coffee cans for antenna (not included) and runs on 12 VDC. Easy to build—all microwave circuitry is PC stripline. ABS plastic case with speedy graphics for a professional look. A very useful and full-of-fun kit.

SG-7 Complete kit.....**$89.95**

FM RECEIVERS & TRANSMITTER

Keep an ear on the local repeater, police, weather or just tune around. These sensitive superhet receivers are fun to build and use. Tunes any 5 MHz portion of the band and have smooth varactor tuning with AFC, dual conversion, ceramic filtering, squelch and plenty of speaker volume. Complete manual details how the rigs work and applications. 2M FM transmitter has 5W RF out, crystal control (146.52 included), pro-specs and data/mike inputs. Add our case sets for a nice finish.

FM Receiver kit Specify band: FR-146 (2M), FR-6 (6M), FR-10 (10M), FR-220 (220MHz).....**$29.95**
CFR Matching case set .....**$12.95** FT-146 Two Meter FM transmitter kit **$79.95**

20 METER SSB/CW TRANSCEIVER
DDS • DUAL VFO • BUILT-IN KEYER

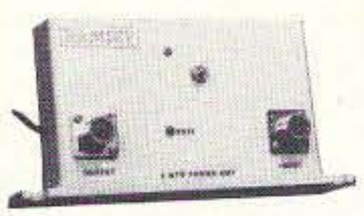
Imagine taking this cute little 20 Meter SSB/CW rig on business trips or vacations, there's feature galore with this beauty ! A DDS (Direct Digital Synthesis) synthesizer tunes in 10 Hz steps, two VFO with memory and digital RIT with freq display! Convenient features like a dial fast button allows you to hop around the band and dual selectable AGC allows comfortable operating. Instant, one-touch WWV reception for quick band condition checks and microprocessor control with built-in lambic CW keyer that has digital readout of speed! Perky 10 watt RF output (only 1 1/2 S units below 100 watts) can be turned down for QRP. Includes hand mike with handy Up/Down buttons for easy remote tuning. This rig's a joy to operate, with performance equal to units costing hundreds of dollars more and with some features not found on any rig at any price! Covers the 20 M band 14 -14.5 MHz plus 15 MHz WWV. Our easy to follow instructions have you assemble the kit in simple "bite-sized" sections that are tested as you build, assuring you of a rig that works first time. Experience the pleasure of saying the rig here is home-brew! Available in kit or fully wired.

SX-20 SSB/CW transceiver kit .....**$349.95** SX-20WT Fully assembled SX-20 .....**$429.95**

FANTASTIC FM TRANSCEIVERS SYNTHESIZED—NO CRYSTALS

Ramsey breaks the price barrier on FM rigs! The FX is ideal for shack, portable or mobile. The wide frequency coverage and programmable repeater splits makes the FX the perfect rig for Amateur, CAP or MARS applications. Packeteers really appreciate the dedicated packet port, "TRUE-FM" signal and almost instant T/R switching. High speed packet? ...No problem. Twelve diode programmed channels, 5W RF output, sensitive dual conversion receiver and proven EASY assembly. Why pay more for a used foreign rig when you can have one AMERICAN MADE (by you) for less. Comes complete less case and speaker mike. Order our matching case and knob set for that pro look.

FX-50 kit (6 Meters).....**$149.95** FX-146 kit (2 Meters) **$149.95**
FX-223 kit (1 1/4 Meters)....**$149.95** FX-440 kit (3/4 Meters) **$169.96**



2 MTR & 220 BOOSTER AMP

Here's a great booster for any 2 meter or 220 MHz hand-held unit. These power boosters deliver over 30 watts of output, allowing you to hit the repeater's full quieting while the low noise preamp remarkably improves reception. Ramsey Electronics has sold thousands of 2 meter amp kits, but now we offer completely wired and tested 2 meter, as well as 220 MHz units. Both have all the features of the high-priced boosters at a fraction of the cost.

PA-10 2 MTR POWER BOOSTER (10 X power gain)
Fully wired & tested **$89.95**
PA-20 220 MHz POWER BOOSTER (8 X power gain)
Fully wired & tested **$89.95**

STEREO FM TRANSMITTER

Run your own Stereo FM radio station! Transmits a stable signal in the 88-108 MHz FM broadcast band up to 1 mile. Detailed manual provides helpful info on FCC regs, antenna ideas and range to expect. Latest design features adjustable line level inputs, pre-emphasis and crystal controlled subcarrier. Connects to any CD or tape player, mike mixer or radio. Includes free tuning tool too! For a pro look add our matching case set with on-board whip antenna

FM-10A Stereo transmitter kit **$34.95** CFM Case,whip ant set..**$12.95**

FM WIRELESS MIKES

Pick the unit that's right for you. All units transmit a stable signal in the 88-108 MHz FM band up to 300' except for High power FM-4 and PB-1 Phone bug that go up to 1/2 mile.

FM-1 Basic unit **$5.95**
FM-2, as above but with added mike pre amp.....**$7.95**
FM-4, long range with very sensitive audio pickup ..**$14.95**
PB-1, Phone bug needs no battery, hooks t o phone line.**$14.95**
MC-1, Micro size sensitive mike cartridge
for FM-1,2,4 .....**$2.95**

SPEECH SCRAMBLER

Descramble most scramble systems heard on your scanner radio or set up your own scambled communication system over the phone or radio. Latest 3rd generation IC is used for fantastic audio quality - equivalent to over 30 op-amps and mixers! Crystal controlled for crystal clear sound with a built-in 2 watt audio amp for direct radio hook-up. For scramble systems, each user has a unit for full duplex operation. Communicate in privacy with the SS-70. Add our case set for a fine professional finish.

SS-70 Scrambler /descramblerkit.....**$29.95**
CSSD matching case set **$12.95**
SS-70WT Assembled SS-70 and case set.....**$69.95**

AIRCRAFT RECEIVER

Hear exciting aircraft communications—pick up planes up to 100 miles away! Receives 110-136 MHz AM air band, smooth varactor tuning superhet with AGC, ceramic filter, adjustable squelch, excellent sensitivity and lots of speaker volume. Runs on 9V battery. Great for air shows or just hanging around the airport! New 30-page manual details pilot talk, too. Add case set for "pro" look.

AR-1 kit.....**$24.95**
Matching case set, CAR **$12.95**

AM TRANSMITTER

High quality, true AM broadcast band transmitter is designed exactly like the big commercial rigs. Power of 100 mW, legal range of up to 1/4 mile. Accepts line level inputs from tape and CD players and mike mixers, tunable 550-1750 KHz. Complete manual explains circuitry, help with FCC regs and even antenna ideas. Be your own Rush Limbaugh or Rick Dees with the AM-1! Add our case set for a true station look.

AM-1 Transmitter kit **$24.95**
CAM Matching case set.....**$12.95**

MICRO-MIKE

World's smallest FM wireless mike. Smaller than a sugur cube - including battery and mike. Two sets of SMT parts supplied in case you are clumsy! Terrific audio pick-up (pin drop at 5 ft) and transmit range of 300 ft. We include the battery (watch style), electret mike and even a tuning tool! Be a James Bond and learn SMT too!

FM-5 Micro mike kit **$19.95**

CRYSTAL RADIO

Relive the radio past with a crystal set like your grandfather built. Uses genuine Galena crystal and catwhisker. Several different types of radios are built, including standard AM broadcast, shortwave and even WW II foxhole style. To compare modern semiconductor detectors, we include a diode for comparison. No soldering required and we even give antenna ideas. Radio for free, get it now before Clinton taxes it!

CS-1 Crystal set kit **$19.95**

SHORTWAVE RECEIVER

Fantastic receiver that captures the world with just a 12" antenna! Can receive any 2 MHz portion from 4-11 MHz. True superhet, has smooth varactor tuning. AGC, RF gain control, plenty of speaker volume and runs on a 9V battery. Fascinating Scout, school or club project, provides hours of fun for even the most serious DXer. For the car, consider our shortwave converter. Two switchable bands (in 3-22 MHz range), each 1 MHz wide—tunable on your car radio dial. Add some interest to your drive home!

Shortwave receiver kit, SR1 .....**$29.95**
Shortwave converter kit, SC1.....**$27.95**
Matching case set for SR1, CSR..... **$12.95**
Matching case set for SCI, CSC **$12.95**

QRP TRANSMITTERS RECEIVERS LINEAR AMPLIFIERS

20, 30, 40, 80M CW TRANSMITTERS

Join the fun on QRP! Thousands of these mini-rigs have been sold and tons of DX contacts have been made. Imagine working Eastern Europe with a S30 transmitter—that's ham radio at its best! These CW rigs are ideal mates to the receivers at right. They have two-position variable crystal control (one popular QRP XTAL included), one watt output and built-in antenna switch. Runs on 12VDC. Add our matching case and knob set for a handsome finished look.

Your choice of bands(Specify band: QRP-20, 30, 40, or 80) **$29.95**
Matching case
knob set.CQRP **$12.95**

20, 30, 40, 80M All Mode RECEIVERS

Build your own mini ham station Sensitive all-mode AM, CW, SSB receivers use direct conversion design with NE602, IC as featured in *QST* and ARRL handbooks. Very sensitive varactor tuned over entire band. Plenty of speaker volume. Runs on 9V battery. Very EASY to build, lots of fun and educational—ideal for beginner or old pro. New 30-page manual. Add the case set for well-fitted professional look.

(Specify band: HR-20, HR-30, HR-40, HR-80) **$29.95**
CHR, Matching case **$12.95**

QAMP

For a slick little QRP boost, use one of the 20 Watt amplifiers. Needs only 1/2-2 watts of drive for full output, linear for SSB, AM or CW operation, power MOSFETs for high effieciency and multistage low pass filter for a clean signal. Built-in T/R relay for automatic switching, runs on 12-15 VDC at 2-4 amps. Add our matching case set for a complete station look.

Your choice of bands.....**$49.95**
Specify band: (QAMP-20, 30, 40, 80)
CQAMP Matching case set **$12.95**

gram accepts the ".jed" file and converts it to a binary file. The program prompts you for file names.

All the above programs have been written in generic "C" language to be portable to any computer with a "C" compiler. An executable MSDOS version of each program is available along with the source code.

The Micro IDer XC1736A PROM Programmer

The Micro IDer XC1736A PROM programmer is an inexpensive alternative for those who want to program an ID into the Micro IDer PROM. Since the least expensive commercial programmer that we know of that can program the XC1736A costs $475, we decided to make this special purpose programmer available to users of the Micro IDer.

The programmer that we developed consists of a board and a host computer program. Communication between the host program and the programmer is through an RS-232 serial port. Power to the board is provided by a 24 VDC wall transformer.

Theory of Operation

The host program "xprog" takes the standard JEDEC file that was produced by the mkid program and sends it to the programmer. An Intel 8031 microcomputer on the programmer board (U1) handles this communication and provides control on the board.

The programmer's 8031 code is contained in a 2764 EPROM (U3). This code has all the programmer's communication routines and the routines that implement the algorithm needed to program the XC1736A. This code is available as an INTEL hex file or already programmed into a 2764 EPROM. The 8751, (which is an 8031 with an EPROM on-chip), may also be used instead of the 8031-latch-2764 combination. Some users may find the 8751 a less expensive alternative to the three-chip combination. A strap on the board (J3) allows for the use of either the 8031 or the 8751.

The XC1736A programming algorithm is complicated. It requires that voltages on two pins be varied between 15V, 6V, 5.5V, and 5V. The programmer controls these voltages by switching various feedback resistors on two LM317 variable voltage regulators. In addition, these voltages must be switched in various combinations before and after serial data is clocked into the device in socket S6. The clock, control, and data lines to the programming socket S6 are connected directly

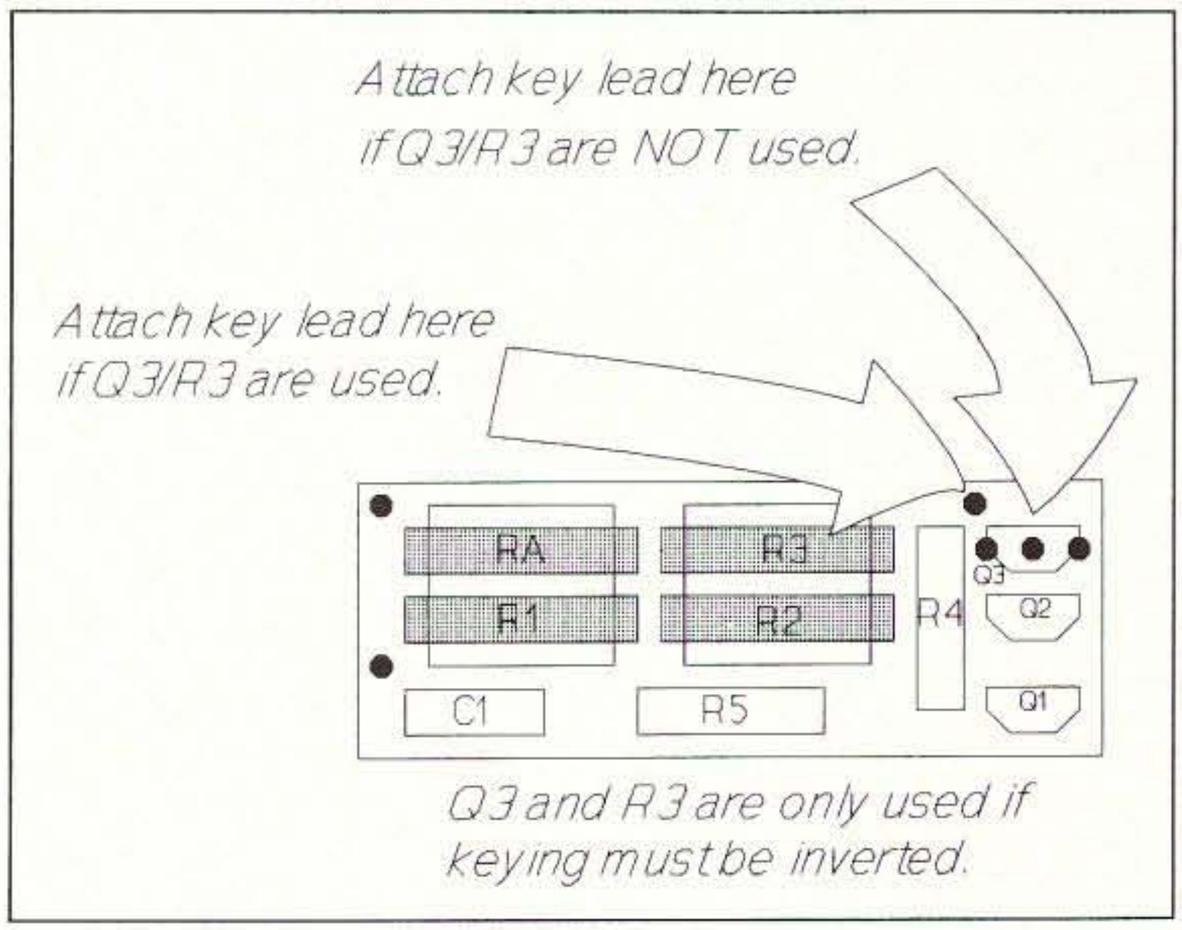


Figure 7. Key wire placement on completed Micro IDer.

to the 8031 microcomputer.

Q2 can be switched between 5V and 5.5V for the VCC pin of the programming socket. This is controlled by the 8031 microcomputer, which switches R4 in and out of the Q2 resistor network via switching the input of the high voltage open collector inverter U5A.

Q3 can be switched among 5V, 6V, and 15V for the VPP pin of the programming socket. This is also controlled by the 8031, which switches R9 and R11 in and out of the Q3 resistor network using two inverters from the U5 package. R5 provides series damping for VPP, as the overshoot on the VPP pin must never exceed 15.5V.

Construction

The parts placement of the programmer board can be seen in Figure 4. Even though the bare board is two-sided without plated-through holes, it is assembled by soldering all connections that have traces on both sides of the board. The board, which was too complicated to be a single-sided board, was considered too expensive as a double-sided plated-through board. So, we struck a compromise by making sure that all traces could be interconnected by soldering component holes with traces on both sides of a non-plated through hole printed circuit board. This is easily accomplished except in the case of the programming socket S6 and the socket for the EPROM, S3. If the machine screw sockets specified in the Parts List are used, approximately 0.05" of bare metal of the barrel of the socket pin is available for soldering on the component side of the board.

Q1 must have a heat sink attached to it as this device converts the 24 VDC input into 5 VDC, producing a lot of heat in the process. In addition, the crystal Y1 needs to be laid flat and have a bare wire strapped across it. Two holes connected to ground are provided for this purpose.

J2 provides the power connection. A wall transformer that provides unregulated 24 VDC with at least 500 mA of current is re-

XC1736A Prom Programmer Parts List

Reference	Part Description	Manufacturer	Part Number	Digi-Key	Quantity
C1-C5,C8	Cap 0.1µF 63V 20%	Panasonic	ECU-S1J104ZU	P4917	6
C7	Cap 0.22 µF 63V 20%	Panasonic	ECU-S1J224ZU	P4918	1
C9-C12	Cap 1 µF 50V 20%	Panasonic	ECE-A1HU010	P6260	4
C17	Cap 10 µF 35V 20%	Panasonic	ECE-A1VU100	P6248	1
C6	Cap 22 µF 35V 20%	Panasonic	ECE-A1VU220	P6249	7
C13-16,C20, C21 C18,C19	Cap 33 pF 100V 5%	Panasonic	ECC-F2A330JCE	P4450	2
Y1	Xtal	7.3728 MHz	CTS	MP074, CTX074	1
R1	Res 8.2k 5% 1/4W			8.2KQ	1
R5	Res 33 5% 1/4W			33Q	1
R2,R10	Res 243 1% 1/4W			243X	2
R3	Res 825 1% 1/4W			825X	1
R11	Res 1000 1% 1/4W			1.00KX	1
R9	Res 1400 1% 1/4W			1.40KX	1
R8	Res 2670 1% 1/4W			2.67KX	1
R4	Res 6190 1% 1/4W			6.19KX	1
U2	IC 74F373 latch	NSC	74F373PC	74F373PC	1
U3	IC 2764 8Kx8 EPROM	Microchip	27C64-15/J-ND	27C64-15/J-ND	1
U5	IC 7406 hex oc inv	NSC	DM7406N	DM7406N	1
U1	IC 8031 micro	Signetics	SCN8031HCCN40		1
U4	IC MAX232 RS232	Maxim	MAX232CPE		1
Q1	LM340 5V 1.5A reg	NSC	LM340T-5	LM340T-5	1
Q2-Q3	LM317 1.5A adj reg	NSC	LM317T	LM317T	2
S3	Skt 28-pin 0.6"	Mill-Max	110-93-628-41-001	ED3628	1
S6	Skt 8-pin 0.3"	Mill-Max	110-93-308-41-001	ED3308	1
J1	Conn 9-pin D-Sub	Norwesco	09S1	509F-ND	1
SW1	Sw mom push-button	Panasonic	EVQ-QEC04K	P8027S	1
	TO-220 heat sink	AAVID	577202B00000	HS107-ND	1
	6-32 x 3/8 mach screw				1
	6-32 hex nut				1
	#6 ext. tooth lock washer				1

Micro IDer Parts List

Reference	Description	Manufacturer	Part #	Digi-Key	Quantity
U1	IC CMOS timer	NSC	LMC555CN	LMC555CN	1
U2	IC serial PROM	Xilinx	XC1736A		1
S2	Skt., 8-pin, 0.3"	Mill-Max	110-93-308-41-001	ED3308	1
Q1-Q3	Transistor, NPN	NSC	2N3904	2N3904	3
RA	*Value determined by software, see text.				1
R1-R5	Res 10k 5% 1/4W			10KQ	5
C1	Cap 0.1 µF 63V 20%	Panasonic	ECU-S1J104ZU	P4917	1

These products available from the authors at Monticello Micro, 727 West Wilson, Monticello IL 61856.

IDER-AT: Assembled and tested, Micro IDer complete with programmed XC1736A PROM, $20 (please include message to be programmed, the time delay between IDs, and code speed).

IDER-CD: Programmed XC1736A PROM alone, $8 (please include message to be programmed, the time delay between IDs and code speed).

XPROG-AT: Assembled and tested XC1736A programmer, $79.

XPROG-CD: Programmed 2764 EPROM with 8031 code, $10. IDER-DISK: 5.25" 360K diskette containing mkid 'C' program source code, mkid program .EXE executable, jed2bin 'C' program source code, jed2bin program .EXE executable, xprog 'C' program source code, xprog program .EXE executable, IBM PC compatible serial port driver source code, XC1736A programmer 8031 object code (Intel HEX format), $5.

Shipping and handling is included in the above.

We assume that you can acquire the 24 VDC 500 mA wall transformer at a hamfest far cheaper than we could provide it to you. For that matter, you probably already have one stashed in your junk box.

The IDer circuit board alone is available from FAR Circuits, 18N640 Field Court, Dundee IL 60196 for $3 plus $ 1.50 S&H. The XC1736A programmer circuit board alone is also available from FAR Circuits for $11 plus $1.50 S&H.

For all orders, please include your name, address, and phone number. Illinois residents please include 6.25% sales tax.

quired to power the programmer board. The wall transformer leads may be soldered directly into the board. You must take care to make sure that the +24 VDC wire of the transformer connects to pin 1 (marked with a "+") on J2.

xprog—a JEDEC to IDer Programmer Board Communication Program

The host program xprog, which is written in "C", is completely portable and can be compiled on any computer that has a serial port and a "C" compiler. The hardware dependent code for the serial port is written as a separate piece of code so that a person may add a serial port driver appropriate for their particular computer. A driver for IBM PC and compatible COM1 and COM2 ports is provided along with the host program source code. Instructions detailing what is required for other serial port drivers is also provided. The program is invoked by:

xprog <filename>.jed

where <filename> is the name of the JEDEC file produced by mkid. 73

References:

1) *ABEL Design Software User Manual*, September 1990, DATA I/O Corp., Appendix B: JEDEC Standard Number 3A.

2) *Programmable Gate Array Design Handbook*, 1986, Xilinx Inc., pp. 1-50 to 1-60.

3) *Radio Amateurs Handbook*, 1985, Amateur Radio Relay League, pp. 9-8.

Program 1.

```
/* mkid ver 1.0 - Morse code to JEDEC file convertor.
Copyright (c) 1991 Stephen R. Look
This program is available for unlimited non-commercial
distribution. Modifications, bug reports and questions
(SASE please) may be sent to:
Stephen R. Look
727 W Wilson
Monticello, IL 61856
*/

#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <ctype.h>
struct id
{
int     key[1];
char    morse[25];
```

Program 1 continues

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Irvine, CA 92718
(714) 458-7277 • FAX (714) 458-0826

ASTRON POWER SUPPLIES

• HEAVY DUTY • HIGH QUALITY • RUGGED • RELIABLE •

MODEL VS-50M

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: 11-15 VDC)
- RIPPLE Less than 5mv peak to peak (full load & low line)
- All units available in 220 VAC input voltage (except for SL-11A)

SL SERIES

- LOW PROFILE POWER SUPPLY

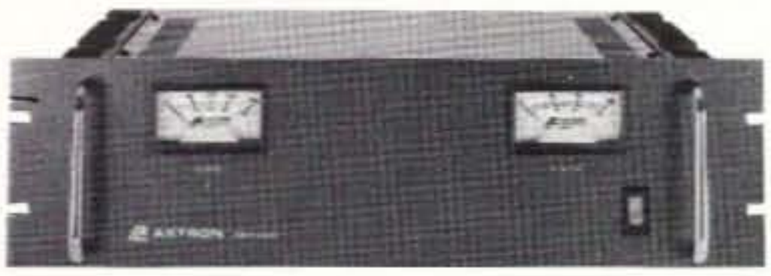
MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
SL-11A	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R	•	•	7	11	2⅝ × 7 × 9¾	12
SL-11S	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R-RA		•	7	11	4¾ × 7 × 9¾	13

RS-L SERIES

- POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-4L	3	4	3½ × 6⅛ × 7¼	6
RS-5L	4	5	3½ × 6⅛ × 7¼	7

RM SERIES



MODEL RM-35M

- 19" RACK MOUNT POWER SUPPLIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

MODEL RS-7A

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-7B	•	•	5	7	4 × 7½ × 10¾	10
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½ × 8 × 9	13
RS-12B		•	9	12	4 × 7½ × 10¾	13
RS-20A	•	•	16	20	5 × 9 × 10½	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13¾ × 11	46
RS-70A	•		57	70	6 × 13¾ × 12⅛	48

RS-M SERIES

MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46
RS-70M	57	70	6 × 13¾ × 12⅛	48

VS-M AND VRM-M SERIES

MODEL VS-35M

- Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

- Built in speaker

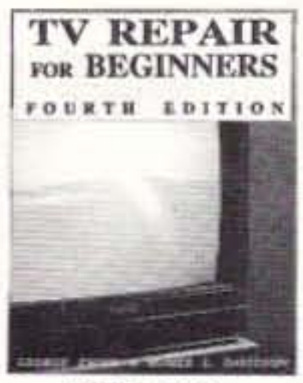
MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	•	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	•	9	12	4½ × 8 × 9	13
RS-20S	•	•	16	20	5 × 9 × 10½	18
SL-11S	•	•	7	11	2¾ x 7⅝ x 9¾	12

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

CIRCLE 16 ON READER SERVICE CARD

```
};
char bits[20000];
char dits[36288];
/*--- function to exit upon invalid character detection ---*/
void char_error()
{
printf("\nerror - the last character displayed is invalid!");
printf("\n        please correct the message text and retry\n");
exit(-1);
}
/*--- function to return correct unit of time ---*/
void time_frame(t,p)
float t;
char *p;
{
if(t>=3600) sprintf(p,"%.1f hrs",t/3600);
else if(t<3600&&t>=60) sprintf(p,"%.1f mins",t/60);
else sprintf(p,"%.1f secs",t);
}
/*---------- main function ----------*/
main(argc,argv)
int argc;
char *argv[];
{
static  struct id reference[44] = {
{ 32 , "00"},            /* SP */
{ 33 , "0"},             /* !  1 second silence marker */
{ 35 , "1"},             /* #  1 second tone marker */
{ 44 , "1111110101011101110"},/* , */
{ 45 , "111010101010110"},/* - */
{ 46 , "1011101011101011110"},/* . */
{ 47 , "111010101110"},        /* / */
{ 48 , "11101110111011101110"},/* 0 */
{ 49 , "1011101110111011110"},/* 1 */
{ 50 , "10101110111011110"},/* 2 */
{ 51 , "101010111011110"},        /* 3 */
{ 52 , "1010101011110"},          /* 4 */
{ 53 , "10101010110"},            /* 5 */
{ 54 , "1110101010110"},          /* 6 */
{ 55 , "1110111010110"},          /* 7 */
{ 56 , "11101110111010110"},/* 8 */
{ 57 , "11101110111011010"},/* 9 */
{ 63 , "10101110111010110"},/* ? */
{ 65 , "101110"},                 /* A */
{ 66 , "111010101010"},           /* B */
{ 67 , "11101011101010"},         /* C */
{ 68 , "1110101010"},             /* D */
{ 69 , "10"},                     /* E */
{ 70 , "1010111010"},             /* F */
{ 71 , "111011101010"},           /* G */
{ 72 , "10101010"},               /* H */
{ 73 , "1010"},                   /* I */
{ 74 , "1011101110111010"},       /* J */
{ 75 , "111010111010"},           /* K */
{ 76 , "101110101010"},           /* L */
{ 77 , "1110111010"},             /* M */
{ 78 , "11101010"},               /* N */
{ 79 , "11101110111010"},         /* O */
{ 80 , "10111011101010"},         /* P */
{ 81 , "1110111010111010"},       /* Q */
{ 82 , "1011101010"},             /* R */
{ 83 , "10101010"},               /* S */
{ 84 , "111010"},                 /* T */
{ 85 , "1010111010"},             /* U */
{ 86 , "101010111010"},           /* V */
{ 87 , "101110111010"},           /* W */
{ 88 , "11101010111010"},         /* X */
{ 89 , "1110101110111010"},       /* Y */
{ 90 , "11101110101010"} };       /* Z */
long cntr;
int tone,ch,bitcnt,num,refcntr,mcntr,message[1000];
float wpm,time,clk,expandobits,expandoclk;
FILE *in,*out;
char c[20],*ptr;
ptr=c;
if(argc!=2)
{
printf("Usage: mkid [source_file_name]\n");
exit(-1);
}
in=fopen(argv[1],"r");
if(in==NULL)
{
printf("mkid: %s doesn't exist!\n",argv[1]);
exit(-1);
}
/*----------clear the screen----------*/
for(cntr=0;cntr<=25;cntr++) printf("\n");
/*----------roll the credits----------*/
printf("\nMake ID - Version 1.0");
printf("\nMorse Code to JEDEC compiler");
printf("\ncopywrite (c) 1991 by Stephen R. Look  ka9szw\n\n");
/*--read in the text file to memory and echo it to the screen--*/
printf("\nFile read in:\n");
cntr=0;
while(ch!=EOF)
{
ch=getc(in);
if(ch=='\n') ch=32;
message[cntr]=toupper(ch);
printf("%c",message[cntr]);
if(message[cntr]>=0&message[cntr]<10) char_error();
if(message[cntr]==11) char_error();
if(message[cntr]>12&message[cntr]<26) char_error();
if(message[cntr]>26&message[cntr]<32) char_error();
if(message[cntr]==34) char_error();
if(message[cntr]>35&message[cntr]<44) char_error();
if(message[cntr]==64) char_error();
if(message[cntr]>90) char_error();
cntr++;
}
fclose(in);
/*--get code speed and calculate clock speed per ARRL Handbook-*/
printf("\n\ncode speed in wpm: ");
wpm=atoi(gets(c));
clk=wpm/1.2;
/*--use the lookup table to generate bit patterns--------*/
for(mcntr=0;message[mcntr]!=EOF;mcntr++)
{
for(refcntr=0;refcntr<=43;refcntr++)
{
if(reference[refcntr].key[0]==message[mcntr]) break;
}
if(message[mcntr]==35)
{
for(tone=0;tone!=(int)clk;tone++) strcat(bits,"1");
if(message[mcntr+1]!=35) strcat(bits,"000");
}
else if(message[mcntr]==33)
{
for(tone=0;tone!=(int)clk;tone++) strcat(bits,"0");
if(message[mcntr+1]!=33) strcat(bits,"000");
}
else
{
strcat(bits,reference[refcntr].morse);
strcat(bits,"00");
}
}
/*--get timing desired and calculate the number of bits needed--*/
bitcnt=0;
bitcnt=strlen(bits);
cntr=1;
ch=1;
while(1)
```

Program 1 continues



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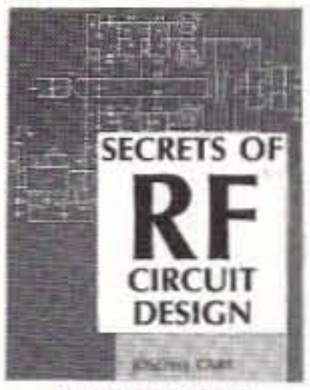

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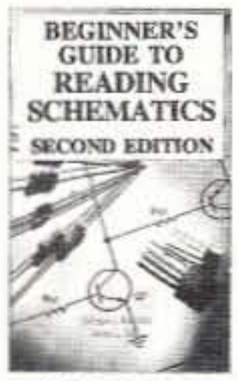

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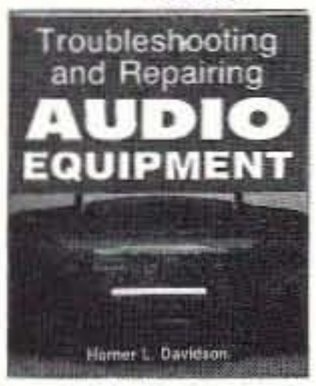

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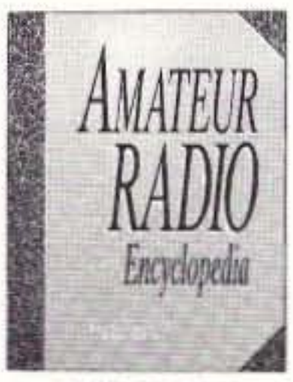

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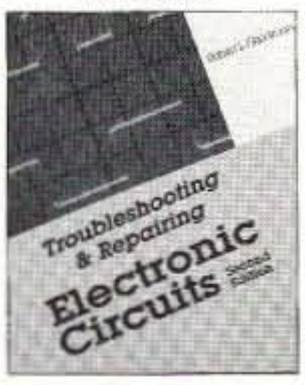

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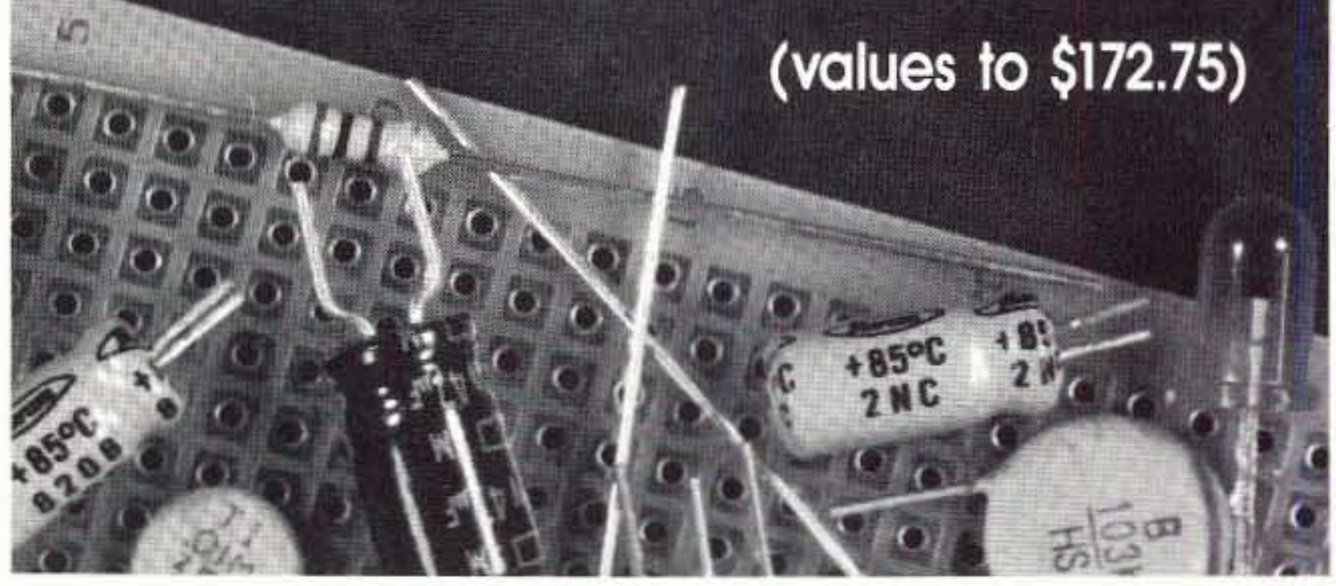

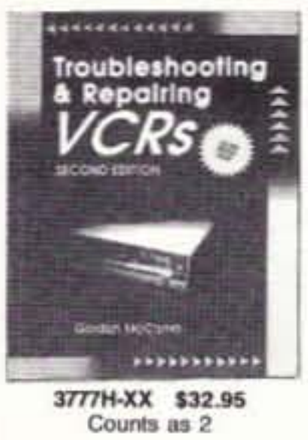

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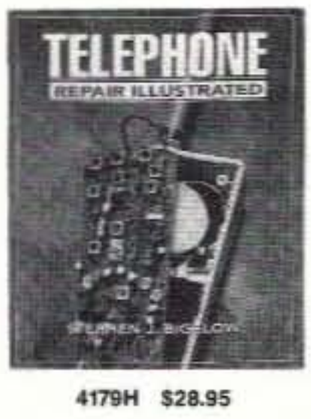

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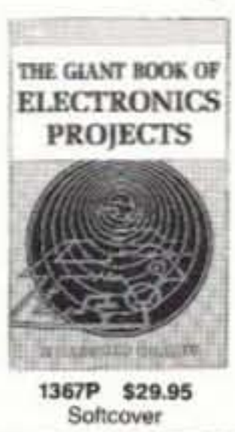

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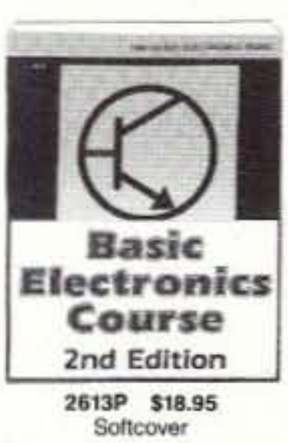

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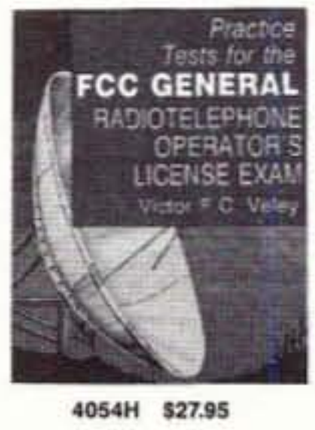

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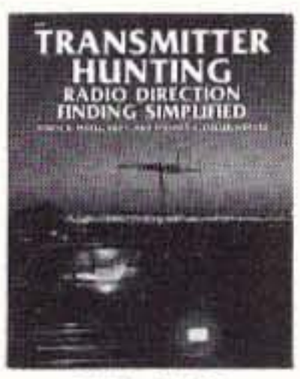

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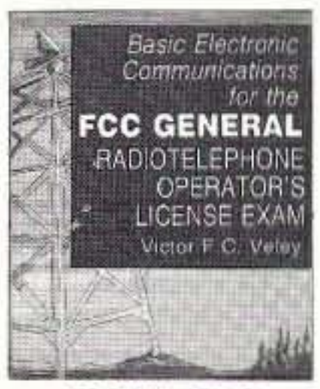

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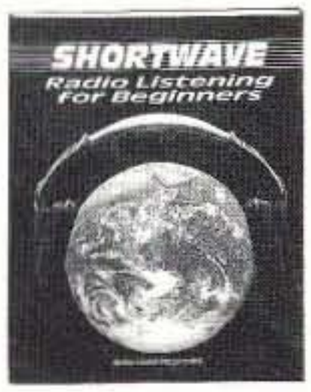

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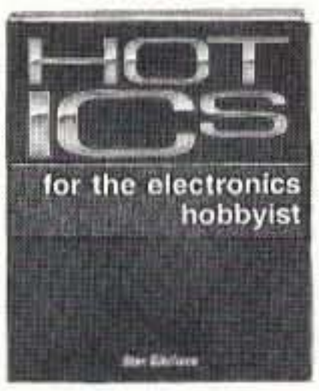

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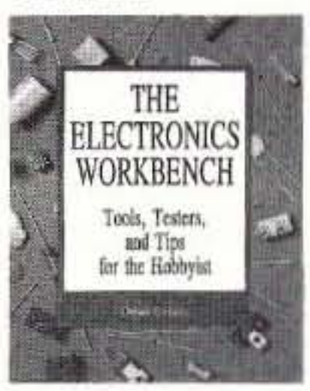

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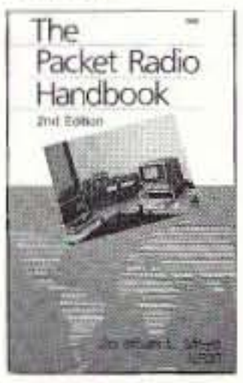

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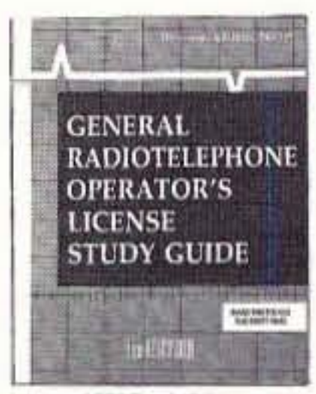

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STAR194

```
{
expandobits=(float)cntr*(float)bitcnt;
expandoclk=(float)cntr*clk;
time=(36288.-expandobits)/expandoclk;
if(expandobits>36288)
{
printf("\nChoose ID delay time - ");
printf("<number> or [Enter] to quit->");
gets(c);
num=atoi(c);
if(num<=0) exit(0);
else break;
}
time_frame(time,ptr);
printf("<%ld> %s\t",cntr,c);
if(ch%4==0) printf("\n");
ch++;
if(cntr%88==0)
{
printf("\nChoose ID delay time - ");
printf("<number> or [Enter] for more->");
gets(c);
num=atoi(c);
if(c[0]!=NULL) break;
}
cntr++;
}
/*----------generate JEDEC file----------*/
strcat(argv[1],".jed");
printf("\nCreating file: %s\n",argv[1]);
out=fopen(argv[1],"w");
ch=0;
for(cntr=0;bits[cntr]!=NULL;cntr++)
{
for(mcntr=0;mcntr<num;mcntr++)
{
dits[ch]=bits[cntr];
ch++;
}
}
fprintf(out,"ider JEDEC file produced by Mkid\n");
fprintf(out,"The 555 timer frequency needs to be %.1f Hz\n",(float)num*clk);
fprintf(out,"Resistor RA = %.1f Ohms",(14400000/((float)num*clk))-2000);
fprintf(out,"%c%c\n*\nL0\n",0x0a,0x02);
mcntr=0;
for(cntr=0;dits[cntr]!=NULL;cntr++)
{
fprintf(out,"%c",dits[cntr]);
if(mcntr==63)
{
fprintf(out,"\n");
mcntr=0;
}
else mcntr++;
}
fprintf(out,"*\n%c0000\n",0x03);
fclose(out);
printf("\nFile complete\n");
/*---------calculate timer frequency and device stats---------*/
printf("\nThe 555 timer frequency needs to be %.1f Hz",(float)num*clk);
printf("\nResistor RA = %.1f Ohms",(14400000/((float)num*clk))-2000);
time_frame((float)cntr/((float)num*clk),ptr);
printf("\nID will take %s to send",c);
time_frame((36288-cntr)/(num*clk),ptr);
printf(" with a delay of %s before it repeats\n",c);
printf("and uses %.1f%% of the chip capacity.\n",(float)cntr/36288*100);
exit(0);
}
```

Program 1 ends

Program 2.

```
/* jed2bin v1.0 - JEDEC to binary file convertor for stupid prom programmers.
Copyright (c) 1992 Stephen R. Look
This program is available for unlimited non-commercial
distribution. Modifications, bug reports and questions
(SASE please) may be sent to:
Stephen R. Look
727 W Wilson
Monticello, IL 61856
*/
#include <stdio.h>
/*---------- main function ----------*/
main()
{
FILE *in,*out;
int num,ch,cntr;
unsigned x;
char bucket[80];
char one[20],two[20];
printf("\nEnter input file name: ");
scanf("%s",one);
printf("\nEnter output file name: ");
scanf("%s",two);
in=fopen(one,"r");
out=fopen(two,"wb");
/*----------roll the credits----------*/
printf("\nJEDEC to Binary file converter - Version 1.0");
printf("\n     -a program of limited usefulness-");
printf("\n   copywrite (c) 1992 by Stephen R. Look\n\n");
/*-----read in the text file to memory and echo it to the screen-----*/
printf("\nStripping header text:\n");
for(cntr=0;cntr<=5;cntr++)
{
fscanf(in,"%[^\n]\n",bucket);
printf("%s",bucket);
}
printf("\nStarting conversion:\n");
x=0;
while(1)
{
num=0;
for(cntr=0;cntr<=7;cntr++)
{
ch=getc(in);
if(ch==0x0a) ch=getc(in);
if(ch==0x0d) ch=getc(in);
if(ch==0x2a) break;
num>>=1;
x++;
if(ch=='1') num |= 128;
}
if(ch!=0x2a)
{
putc(num,out);
printf("\r%u ",x);
}
else
{
printf("\nFilling out file space with 0's:\n");
num=0;
while(x<36288)
{
putc(num,out);
printf("\r%u ",x);
x+=8;
}
exit(0);
}
}
}
```

Program 2 ends

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The "Hula Loop"

A stationary bidirectional hybrid three-element delta loop.

by Dean Frazier NH6XK

Conventional wisdom preaches that directors and reflectors must be on opposite sides of a driven antenna element to achieve best performance in one direction; hence the advent of the rotating beam antenna (Yagi-Uda, Moore Quad, etc.). But by its very definition, "conventional" wisdom may only describe what has worked in the past. It does not allow that something else may work as well, or better; now, or in the future. Conventional wisdom may lack vision. It may be incomplete.

The rules of my QTH environment (a planned community in Hawaii) preclude my erecting a tower or rotatable beam of any kind, yet out here in the ocean, at (about) 21 degrees north latitude, 158 degrees west longitude, I like to propagate mainly to the NE/SW. For several years I have used a commercial half-wave vertical to do just that, but the declining solar cycle has forced me to seek a bit more gain than produced by said vertical, a bit less noise on receive . . . but how to do it with a low launch angle, in at least two directions simultaneously?

Many solutions are well-known, such as using two driven radiators separated one half-wave and fed in phase; or spaced one quarter-wave, fed 180 degrees out of phase. I wanted a simpler solution because I wanted to avoid two driven elements and the requirement for proper electrical phasing.

Any bidirectional antenna I might erect would have to have more gain than my half-wave vertical. It would have to be put up in the trees of the forest to the NE behind my back fence. It would have to be fixed in location and non-rotatable. It would have to have sufficient gain both to the NE (to the mainland US and Europe) and SW (to ZL-VK and Africa) to make up for feedline losses resulting from a roughly 300-foot run from shack to antenna. Virtually loss-less open wire feeder was out of the question due to "visual impact," and the antenna had to "blend" into the forest scenery. The vertical loop was the obvious choice fed by low-loss high quality coax, and the delta loop, apex down, high current region "up," was chosen so I could take advantage of the simplicity of available (and minimum) supports . . . the trees.

Gain would be easily enhanced in one direction with a reflector "behind" the driven element (à la conventional wisdom), but how to get some signal "out the back" at the same time? Electronic switching, grounding out elements, multi-driven elements, and pausing were ruled out preemptorily. This had to be a "no-fuss," simple antenna.

So I again considered conventional wisdom as I poured over my textbooks in search of a solution. Then I closed the books, and closed my mind to conventional wisdom . . . and the solution was obvious: Put a reflector (or reflectors) on the west side of the driven element for gain to the east toward the US mainland, and put a director (or directors) also on the west for a boost to the west, (e.g. VK-ZL).

So, after much trial and error, working with as many as two reflectors and four directors nested within the reflector(s), and varying their lengths (perimeters) and their spacing from the driven element, the Hula Loop evolved. It's not very fancy or sophisticated, but its simple form should not be underestimated.

The final configuration survived the skepticism of many fellow hams. It is explained below and shown in Figure 1. First, let me point out that prior to the utilization of the Hula Loop, the best I could do to the East Coast of America was 5/6 with the 3 dBd gain half-wave vertical, whereas now I consistently re-

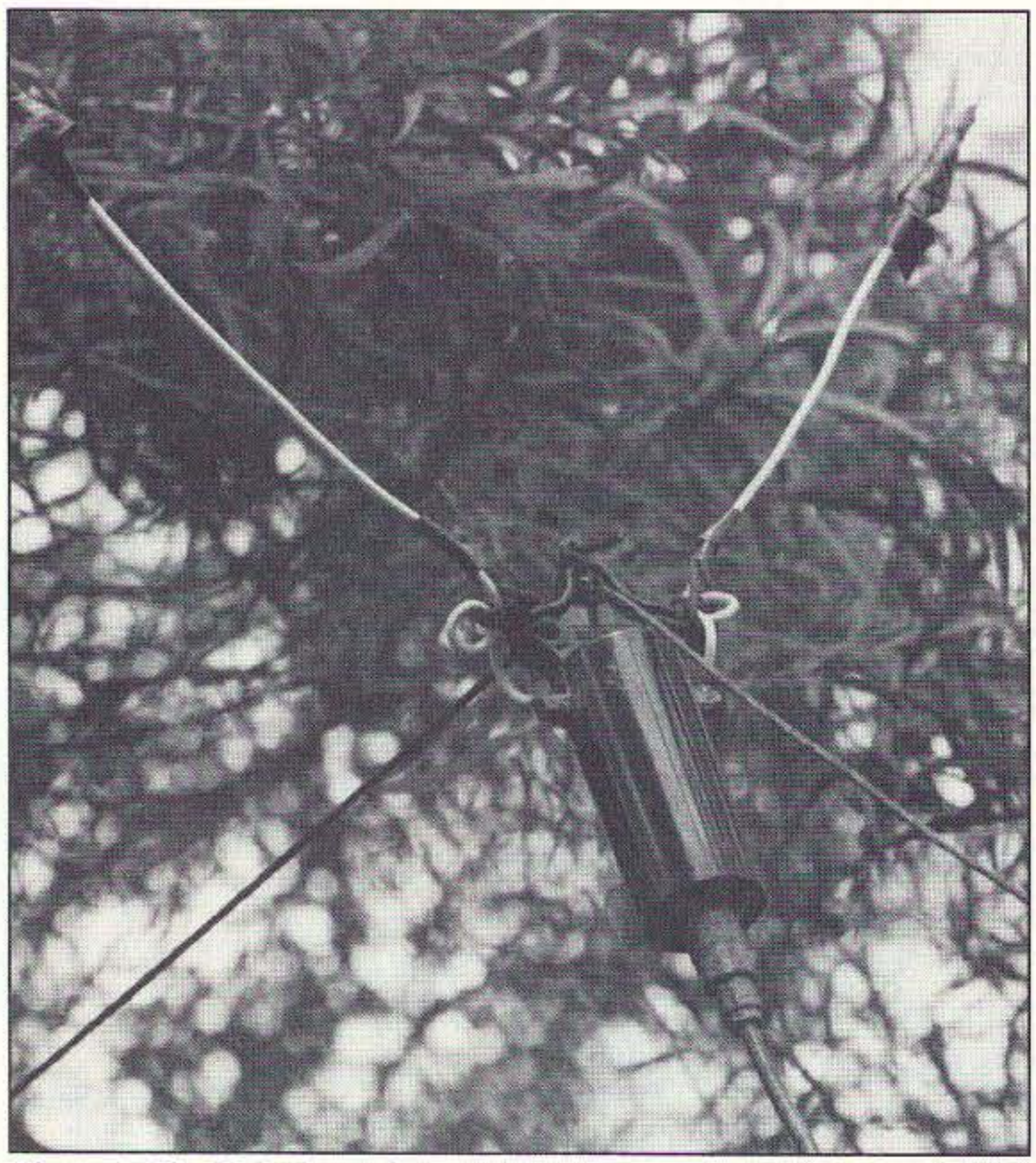

Photo A. The Hula Loop driven element at its feed point. Note the 1:1 balun.

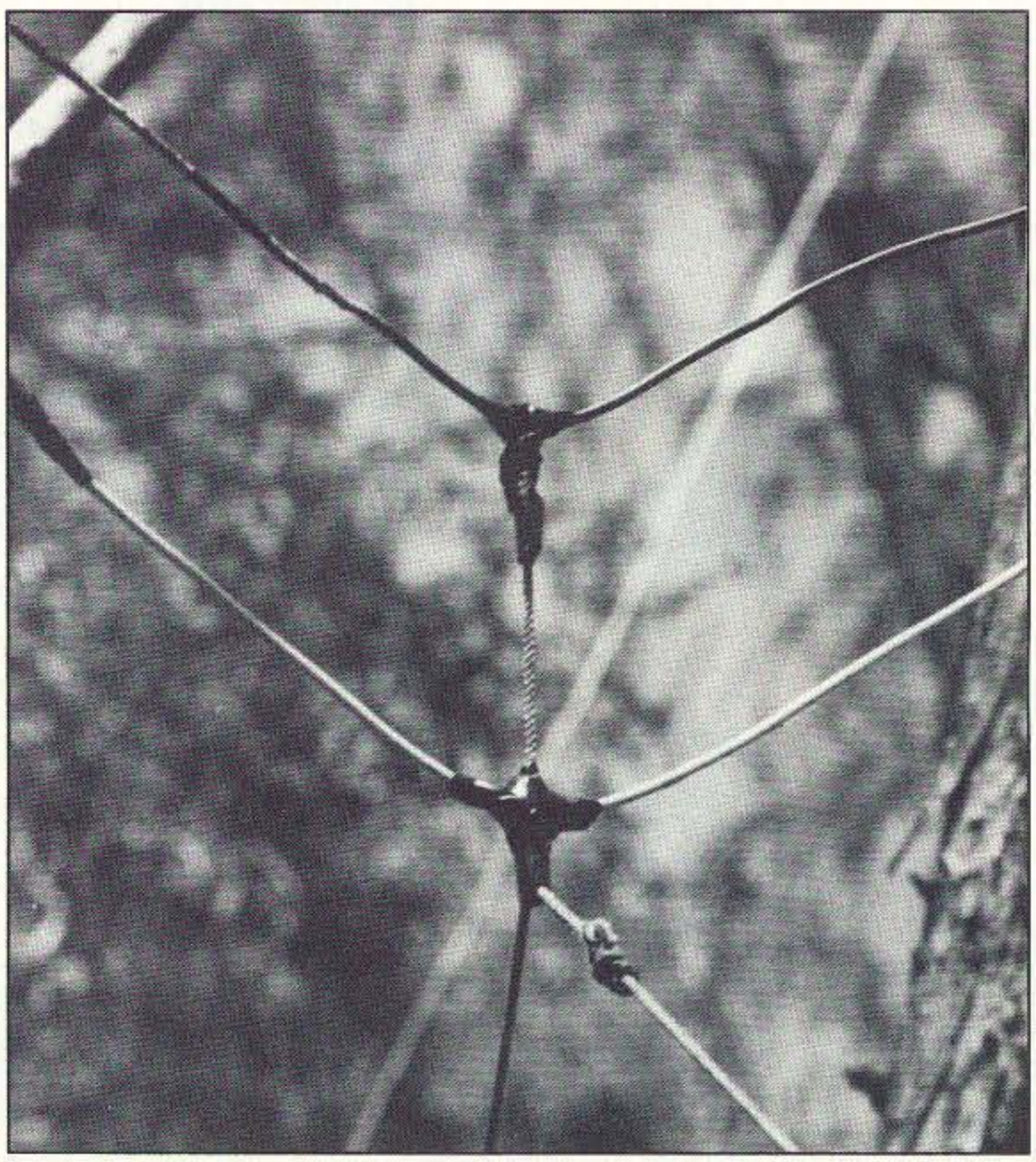

Photo B. The bottom apex of the Hula Loop's diflector. Note that nylon cord is used to secure the antenna.

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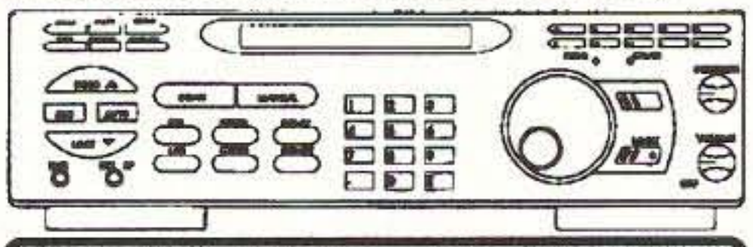

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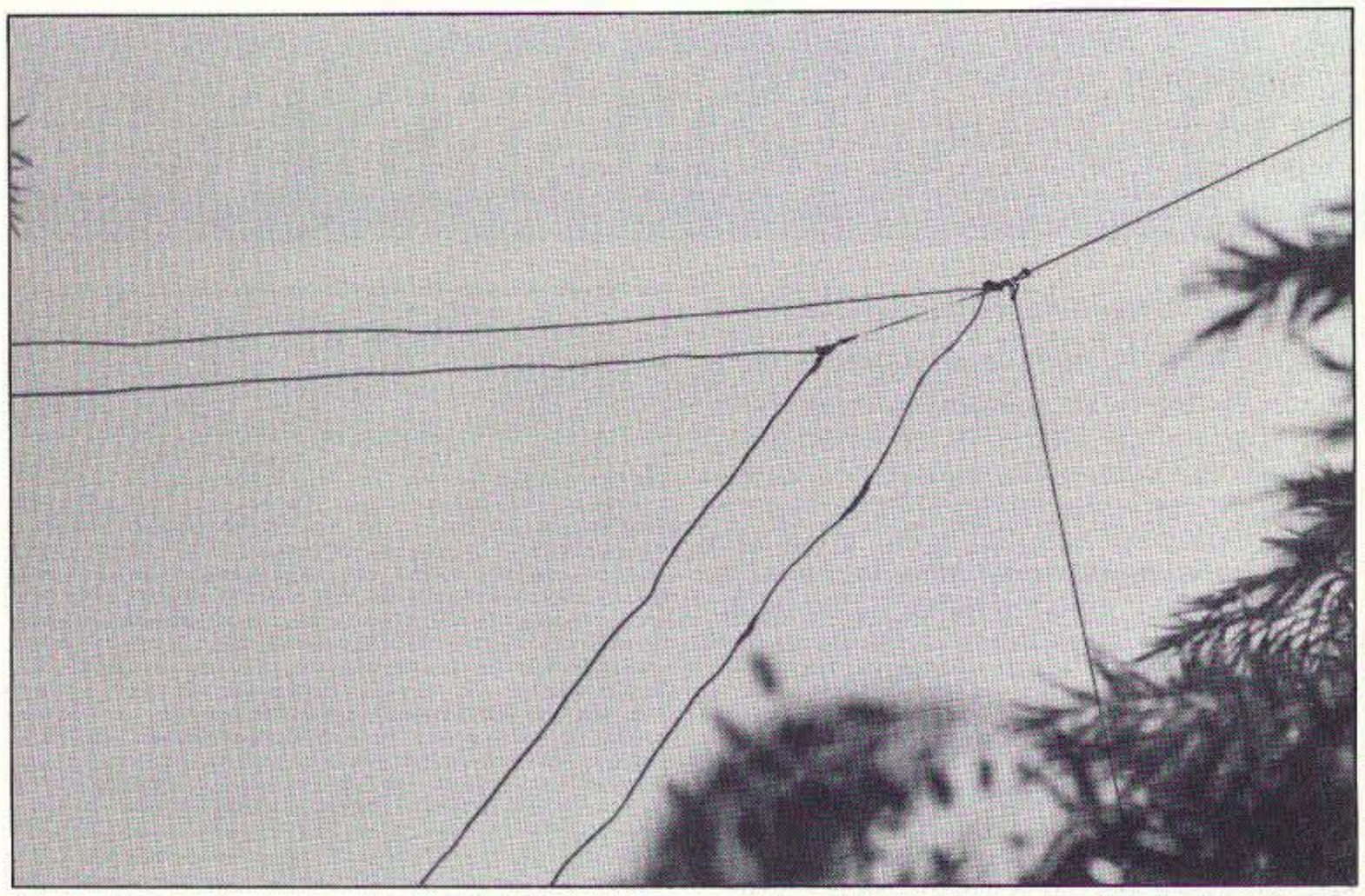

Photo C. Another view of the Hula Loop's construction. The antenna blends into the scenery when viewed from a distance.

ceive 5/9 or 5/9+ reports. To Australia and New Zealand, the vertical consistently beat my original single-element and eventual two-element delta loop, but now it's the other way around by 2 S-units. Short path to South Africa over Antarctica, I'd get 5/3 on the vertical and 5/2 on the conventional two-element delta loop, and now it's more like 5/7-5/8 on the three-element loop. To Europe over the North Pole, it used to be 5/5-5/6 with the vertical, and now it's 5/8-5/9-5/9+, even as the solar cycle declines, with the hybrid delta loop.

I can still communicate to Asia and South America with the vertical and a Loop Skywire, but not as well as the Hula Loop does to the northeast and southwest, from Hawaii.

The Hula Loop's Design

The Hula Loop consists of a driven delta loop, apex down, behind which is a passive reflector 3% longer around than the driven, in which is nested a director cut 3% shorter than the driven. The reflector-director combination (which I call the Diflector) is spaced 0.16 wave (about 8'8" on 17 meters) from the driven element. This wide spacing results in the feed point impedance being in the 80-100 ohm range, as usual for a full-wave single-element loop, so feeding with 50 ohm coax (Belden 9913) terminating in an odd multiple of 75 ohm coax is appropriate ($\sqrt{50 \times 100}$ = 71 ohms). Moving the diflector towards the driven element would eventually bring down the feed point impedance to 50 ohms at some particular spacing, allowing a "straight infeed" with 50 ohms, but the forest in which the loop is erected does not allow this luxury.

After cutting the driven element by using the formula (1005/f MHz = length in feet) and forming an equilateral triangle with the feed point at the bottom apex, and after having put the element "in situo," I then tuned this driven element to resonance, then measured its final length (or perimeter). Then I cut and placed the diflector by this formula: If the final tuned length of wirc in the driven

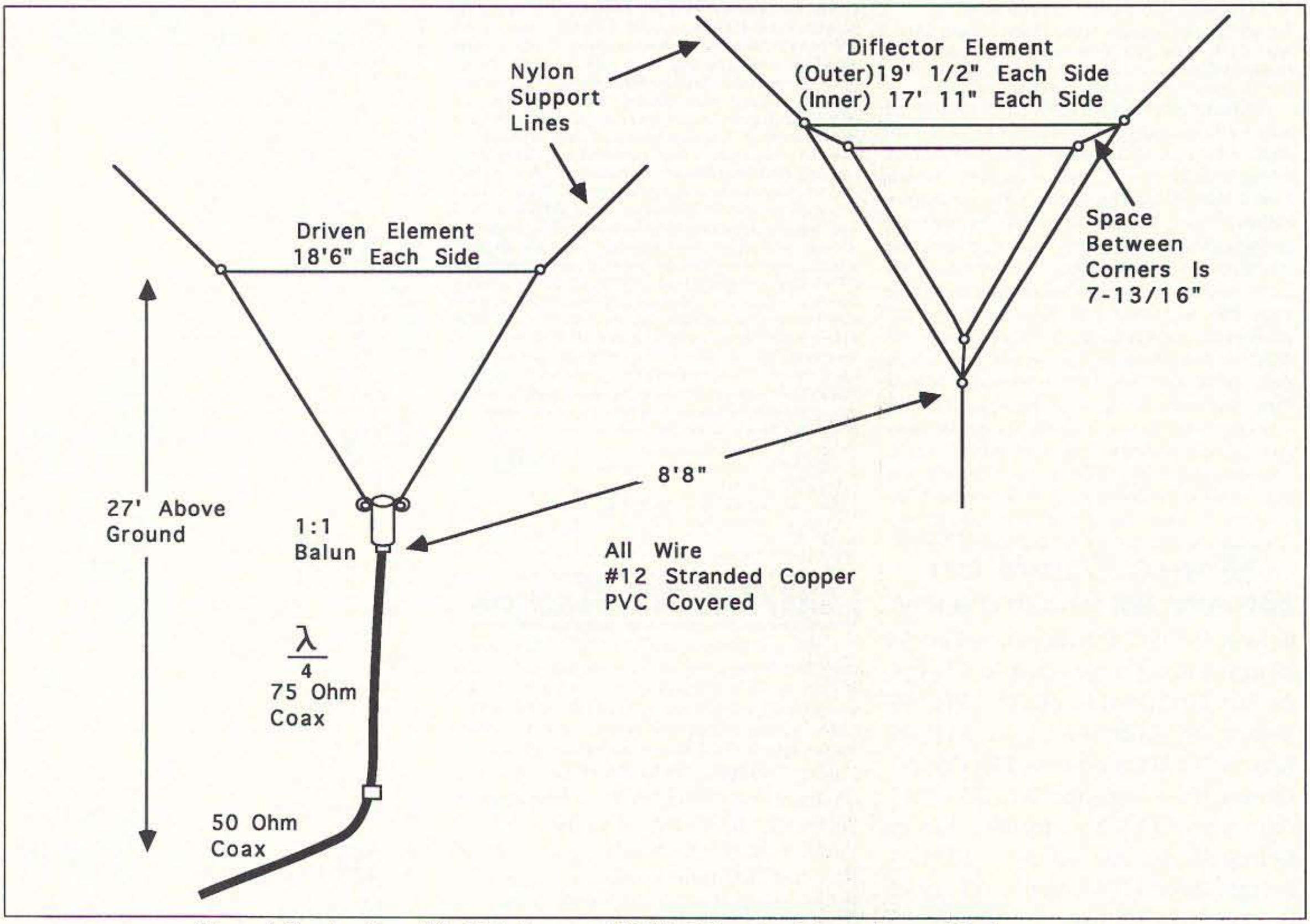

Figure 1. Construction of the Hula Loop, an 18 MHz bidirectional three-element delta loop antenna.

element comes out to be "L" feet, then cut the reflector according to 1.03 x L, and cut the director according to 0.97 x L. Both the reflector and director are then shaped into equilateral triangles, and the director is nested into the reflector using non-conductive material (nylon line) at the corners.

The reflector and director are closed parasitic loops; the driven element is open at its bottom. One end of the wire connects to one side of a 1:1 current balun, the other wire end to the other side of the balun. The quarter wave of 75 ohm coax then connects (screws) to the base of the balun, and its other end joins to 50 ohm coax (thence back to the shack) via a barrel connector. The balun is not a necessity, but if not used, I suggest that you wind and tape about six turns of coax (roughly six inches in diameter), directly at the feed point to act as an air-choke to RF. This will help to decouple the coax braid from the antenna to aid canceling RFI-TVI causing currents on the coax braid. Whatever method of putting power into the antenna is used, seal all exposed conductors from the elements. I use #12 stranded copper wire, PVC covered, for the driven element, director, and reflector. Be advised that the beginning length around the driven element (1005/f MHz = feet) probably won't work out quite right due to the detuning effects of not only the diflector (a small effect at 0.16-wave spacing), but primarily due to the particular final antenna environment . . . proximity to metal, wood, etc., and due to variation in length from the formula (1005/f) because of different wire gauges.

The driven element and the diflector are hung vertically, using nylon line attached to the upper corners. The driven feed point and the bottom apex of the diflector are prevented from swaying in the wind with light nylon line tied off to low bushes or ground stakes. As the figure shows, the Hula Loop is simply constructed.

Results

On-the-air signal reports indicated the following: To the NE (US mainland and Europe) signal reports are about the same as when the loop was configured as a conventional two-element delta loop (driven and reflector), and 3 to 4 S-units stronger than the commercial half-wave vertical (very nearly the same coax line loss at 18.113 MHz, to both antennas). To the SW (VK-ZL and Africa), the conventional half-wave vertical beat the two-element delta loop by 1 to 1-1/2 S-units, but with the diflector in place, the three-element Hula Loop is better than the vertical by 2 S-units.

I suspect I may have "lost" 1/2 to 1 dB to the NE with the Hula Loop, compared to a two-element delta loop. I now have a narrower half-power beamwidth, but the gain "out the back" is startling.

In any event, with the Hula Loop I now put more signal both NE and SW than ever before with a 3 dBd half-wave vertical or with a conventional two-element delta loop.

All work was performed on the 17 meter band, at 350 watts.

I encourage others to experiment with directors nested within reflectors to see the effect on forward and rearward gain, compared to that of a conventional two-element loop antenna, keeping all antennas at the same height over the same ground. The flat-top of my Hula Loop is at 27 feet which puts the centroid of the triangles at about a third wave . . . raising the top to perhaps 35 feet would more nearly place the centroids near half-wave, with a resultant lowering of launch angle, but such may not be possible in the forest within which I work. In any experimentation with the diflector concept, however, as many variables must be eliminated from the problem. Conditions should be made the same for both the antenna under experimentation and with the control antenna, to allow any differences between the test and control antennas to become apparent.

Special thanks to Ron Turner KD6FZ, Del Mar, California, and Tony Thomas ZL2ANT and Jock Campbell ZL1ACW of North Island, New Zealand, for their help in extensive on-the-air testing of the Hula Loop against the two-element delta loop and the commercial half-wave vertical. 73

The Quad Charger

A constant current NiCd charger.

by Marion D. Kitchens K4GOK

Every ham I know uses NiCd batteries at one time or another. "Nicads" are nice, but they pose the never-ending challenge of keeping a charged set on hand. This often requires keeping a number of various battery packs or individual cells in ready-to-use condition. Most battery chargers are designed for one particular size individual cell, or for particular battery packs. It can be agonizing to have the wrong battery pack on the charger while the one needed is yet to be charged.

Finding the correct charger or setting a variable voltage charger to the proper voltage is an unnecessary hassle. A more useful charger would allow for charging several battery packs or individual cells simultaneously, and would accommodate battery pack voltages ranging from one cell up to eight or more cells; that is, 1.25 volts up to about 12 volts.

The Quad Charger described here was designed and built to take the hassle out of using NiCds. The unit as described provides charge rates for most common NiCds, and provides several trickle charge rates too. Since this unit provides a constant charge current, the output voltage automatically adjusts to that necessary for the battery or pack being charged. NiCds are charged based on the amount of current and the duration (time) that current is injected into the NiCd, so a constant current is a good way to charge them.

The Quad Charger will charge up to four different NiCd cells or battery packs at the same time. It is easy to build via the PCB layout provided, or via point-to-point wiring on perf board. The circuit is straightforward and without gimmicks or tricky adjustments.

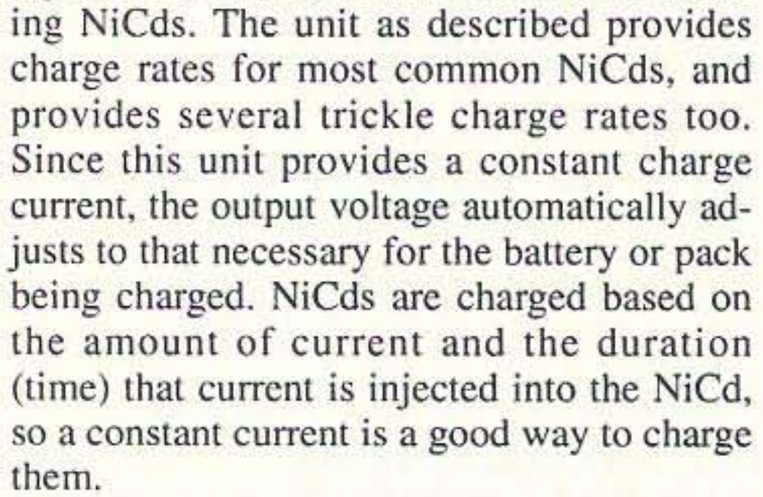

Figure 1. LM317 as a constant current source.

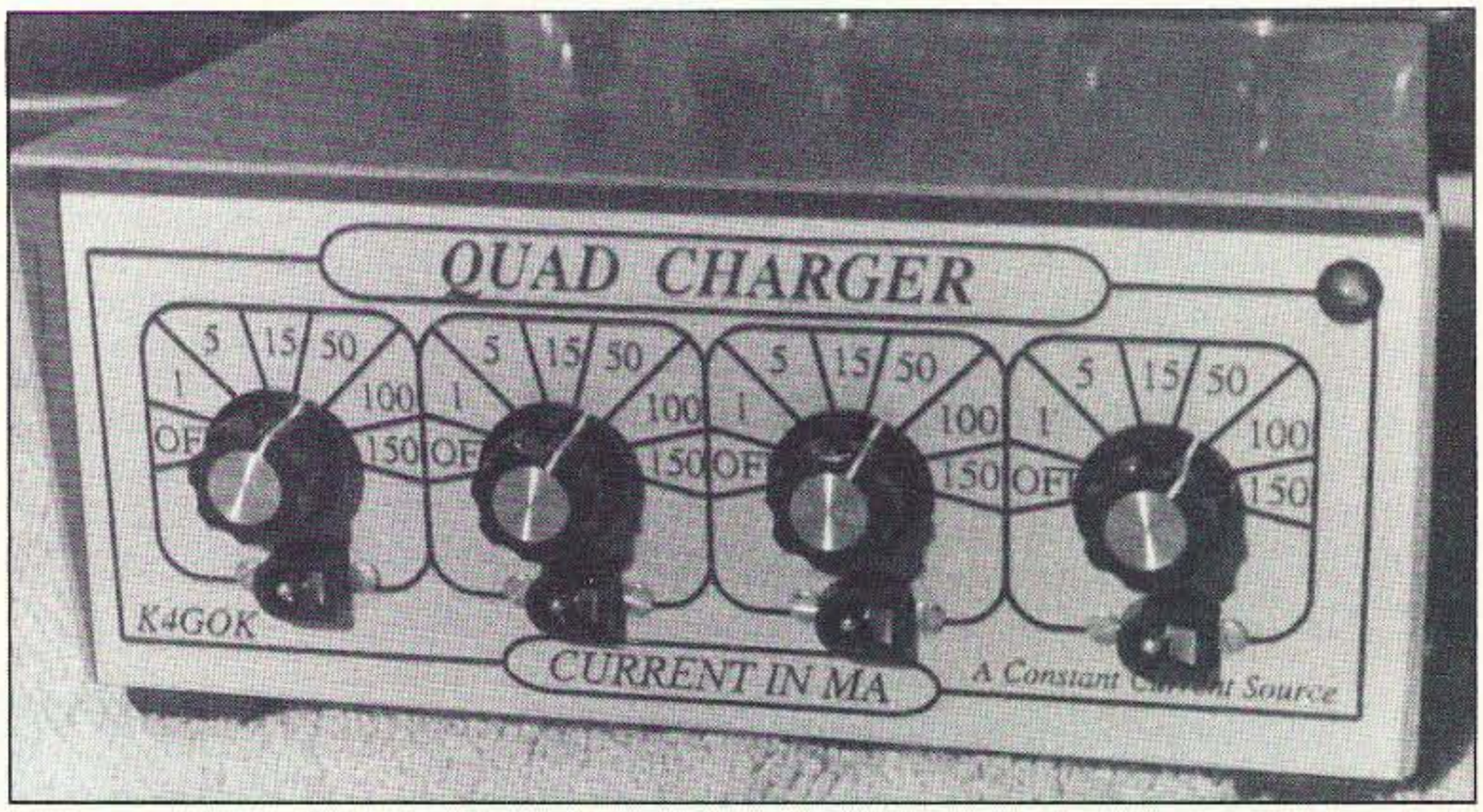

Photo A. Finished Quad Charger.

All parts are readily available from suppliers such as Digi-Key.

Theory of Operation

The versatile LM317 voltage regulator is readily usable as a constant current regulator by simply connecting the IC to a resistor. The LM317 is designed to maintain 1.25 volts between its output pin and its "adjust" pin. The electronics within the IC will react to assure that this condition exists at all times (as long as it is physically possible). That means you can put a resistor between those two pins and the LM317 will deliver a constant current through the resistor. The current will then be regulated by the IC in accord with Ohm's Law. All we have to do is connect the desired load, in this case the battery or pack to be charged, in series with this constant current.

Examine Figure 1. The voltage from the supply is applied through the LM317, through the resistor, and to the load. The internal circuitry of the LM317 maintains a constant 1.25 volts across the resistor. If the resistor is 125 ohms, the current will be 10 mA. If it is 12.5 ohms, the current will be 100 mA. Since the current in a series circuit is the same in all parts of the circuit, the load will also have a regulated, constant current. The value of that current will be determined by the value of the resistor.

Note that the current is independent of the load. The current through a single 1.25 volt AA cell will be the same as that through a 9 volt battery pack. And to the obvious question, yes, it is the same for a zero ohm load, i.e. a short circuit. (A constant current supply

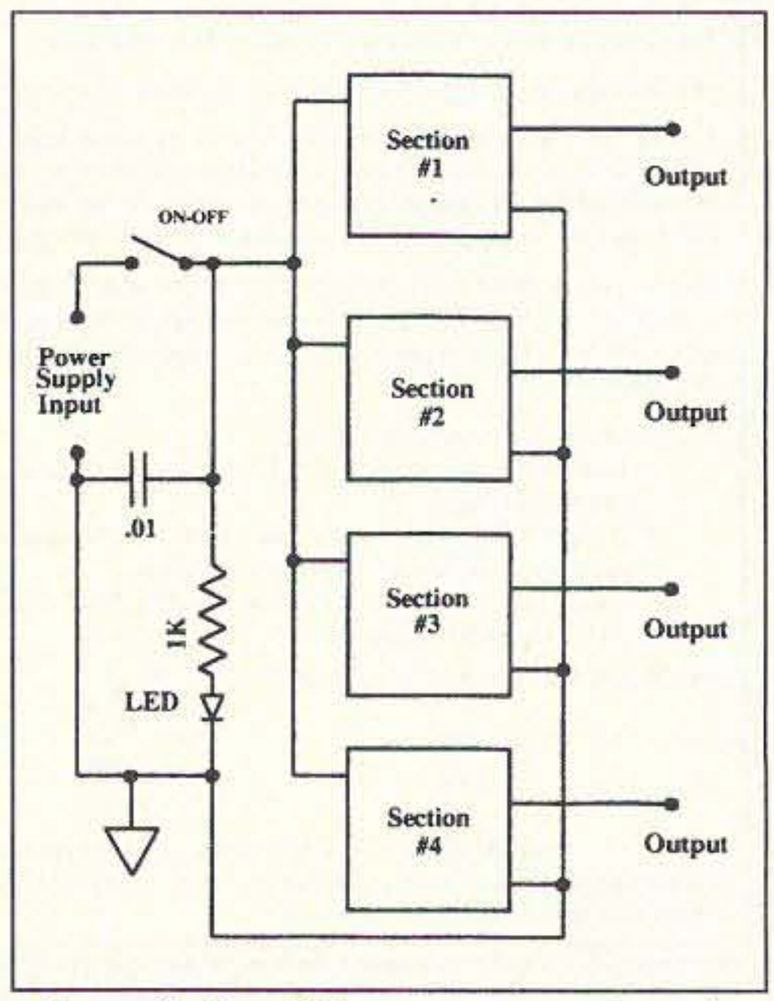

Figure 2. Quad Charger system schematic.

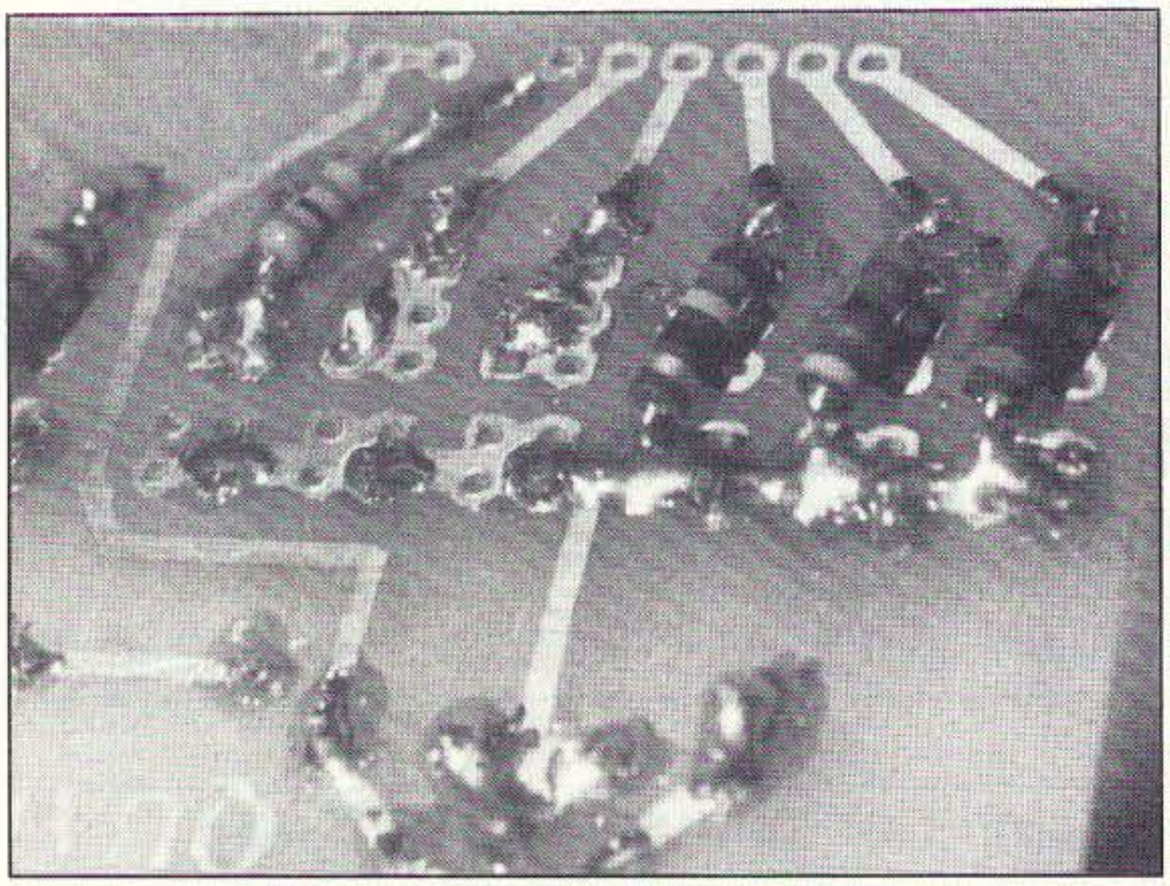

Photo B. Resistors on foil side of PCB.

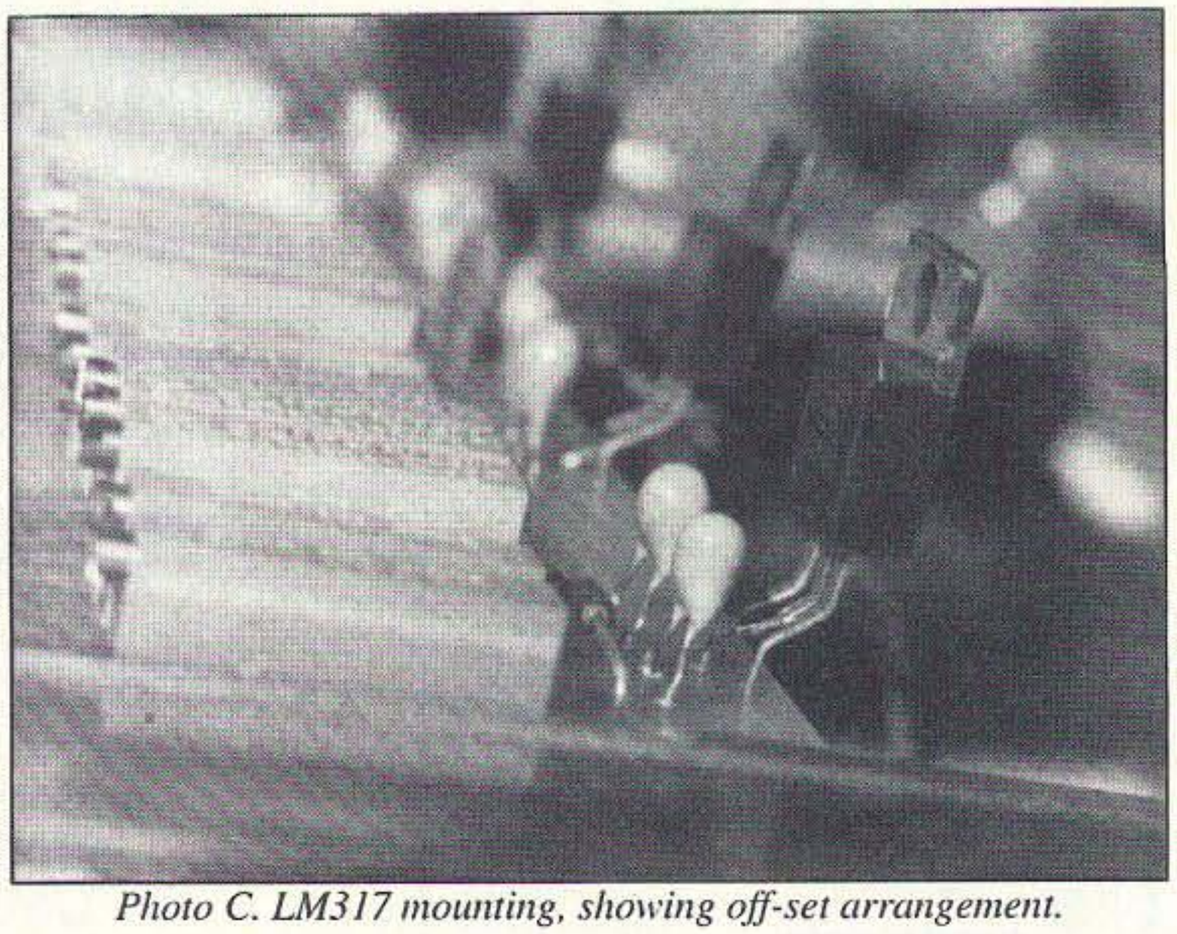

Photo C. LM317 mounting, showing off-set arrangement.

is pretty neat because a short across the output is perfectly acceptable and causes no harm!)

The LM317 requires a certain amount of current in and of itself to operate. This is identified as the "quiescent" current in the literature. The quiescent current flows from the supply through the LM317, out of the "adjust" pin, and into the load. Its value is typically around 0.35 mA, and can be neglected in most cases. If you want exact currents, however, you will have to account for that current in any analysis or adjustment of the circuit. Using pots in the circuit allows for exact setting of the current, including effects of the LM317 quiescent current. Because of the quiescent current, the OFF position of the rotary switches will result in a small current in any connected load.

The LM317s must be able to dissipate the heat generated when they are used in the Quad Charger. The thermal "design point" is reached when operating at the maximum supply voltage and maximum output current, with the output shorted to ground. Assuming a 13.8 volt supply and 150 mA, the maximum power the LM317 must dissipate as heat is just under 2 watts. It requires a heat sink to do that without overheating.

Figure 2 shows the system schematic of the Quad Charger. Figure 3 shows the detailed schematic of one of the four identical charger sections.

Construction

The Quad Charger is basically a simple circuit, but with lots of connections. PCB construction is recommended because of the number of solder connections involved; however, point-to-point wiring on perf board is quite feasible. See Figure 4 for the PCB layout and parts placement. The parts placement drawing shows where the parts are located on the PCB. The pots can be replaced with fixed resistors if exact currents are not required—see "Alternate Construction" below.

It is good practice to build one portion of the Quad Charger at a time. Install the pots first. Trimmer pots R4, R5, and R6 have fixed resistors in parallel. These resistors are mounted on the solder side of the PCB. Install the fixed resistors after installing the pots.

Note the orientation of the four diodes, and install them correctly. Observe polarity when installing the eight tantalum capacitors. Don't forget to install the jumper wire.

Make all the connections to the output jacks and rotary control switches. If using coaxial output jacks, make sure you match the jacks and plugs. Many coaxial jacks and plugs look alike but are not compatible. Note that there is no connection to the first (OFF) position of the control switches. The

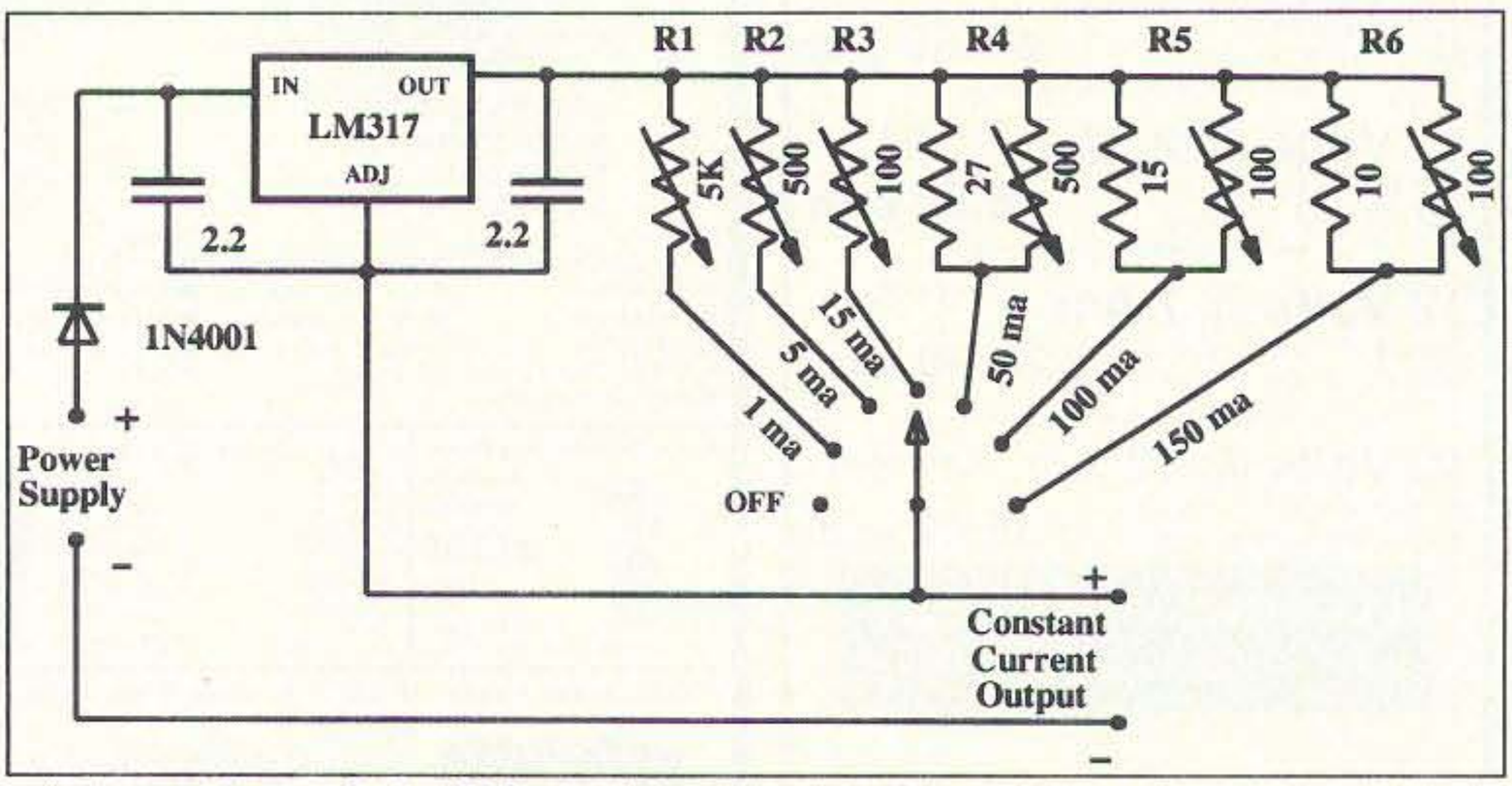

Figure 3. Quad Charger schematic (one of four identical sections).

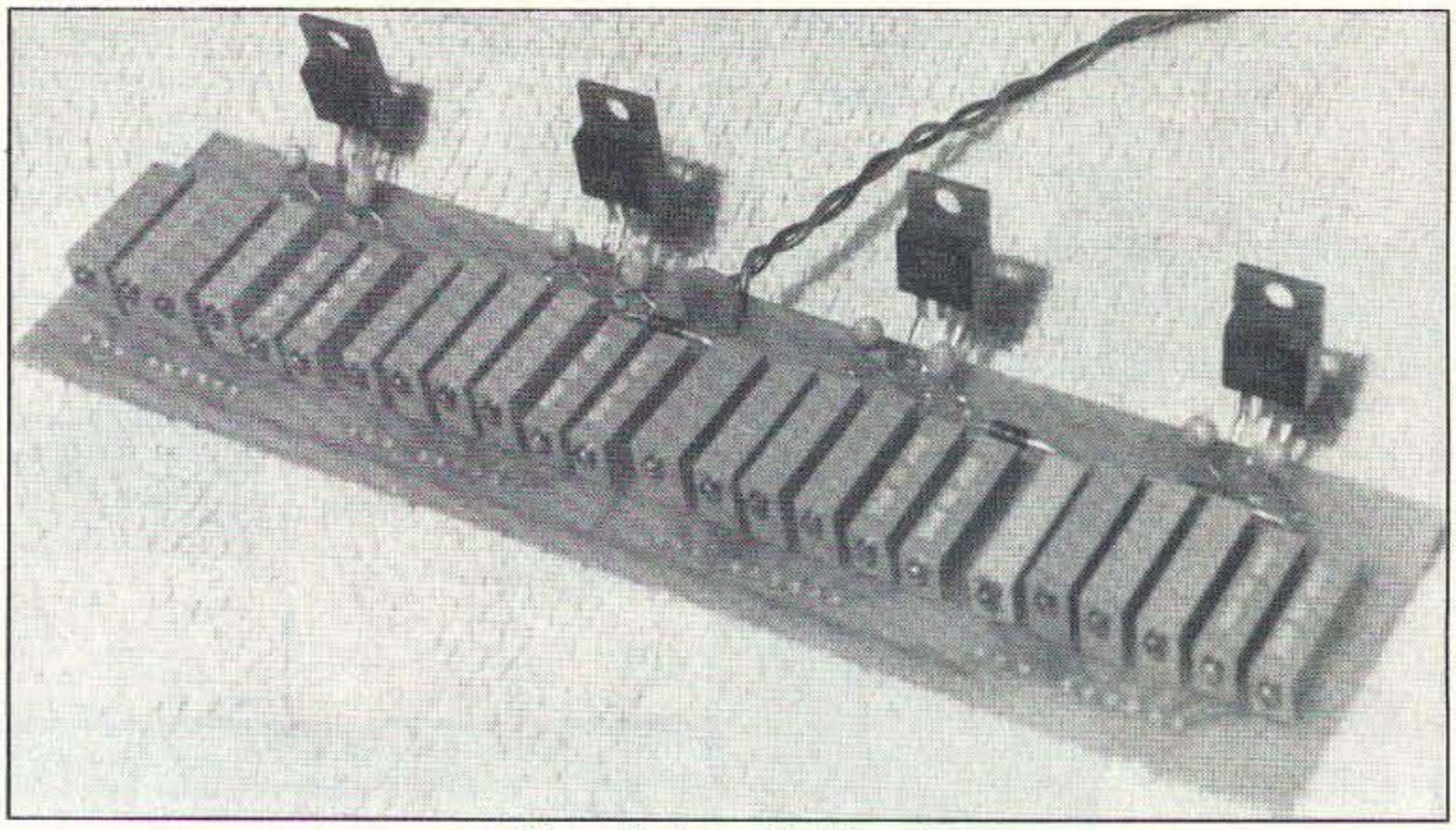

Photo D. Assembled board.

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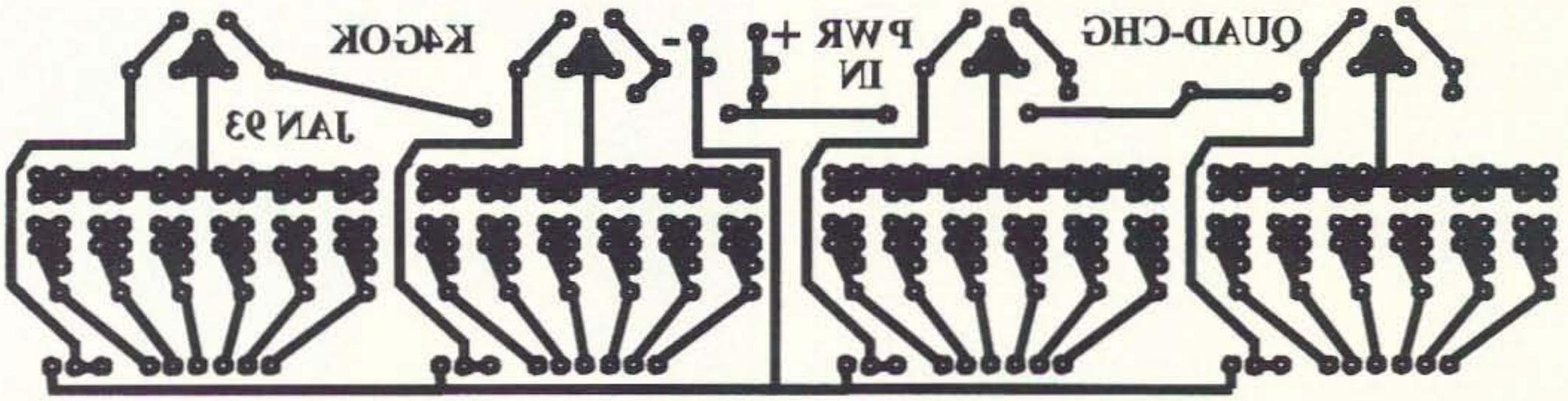

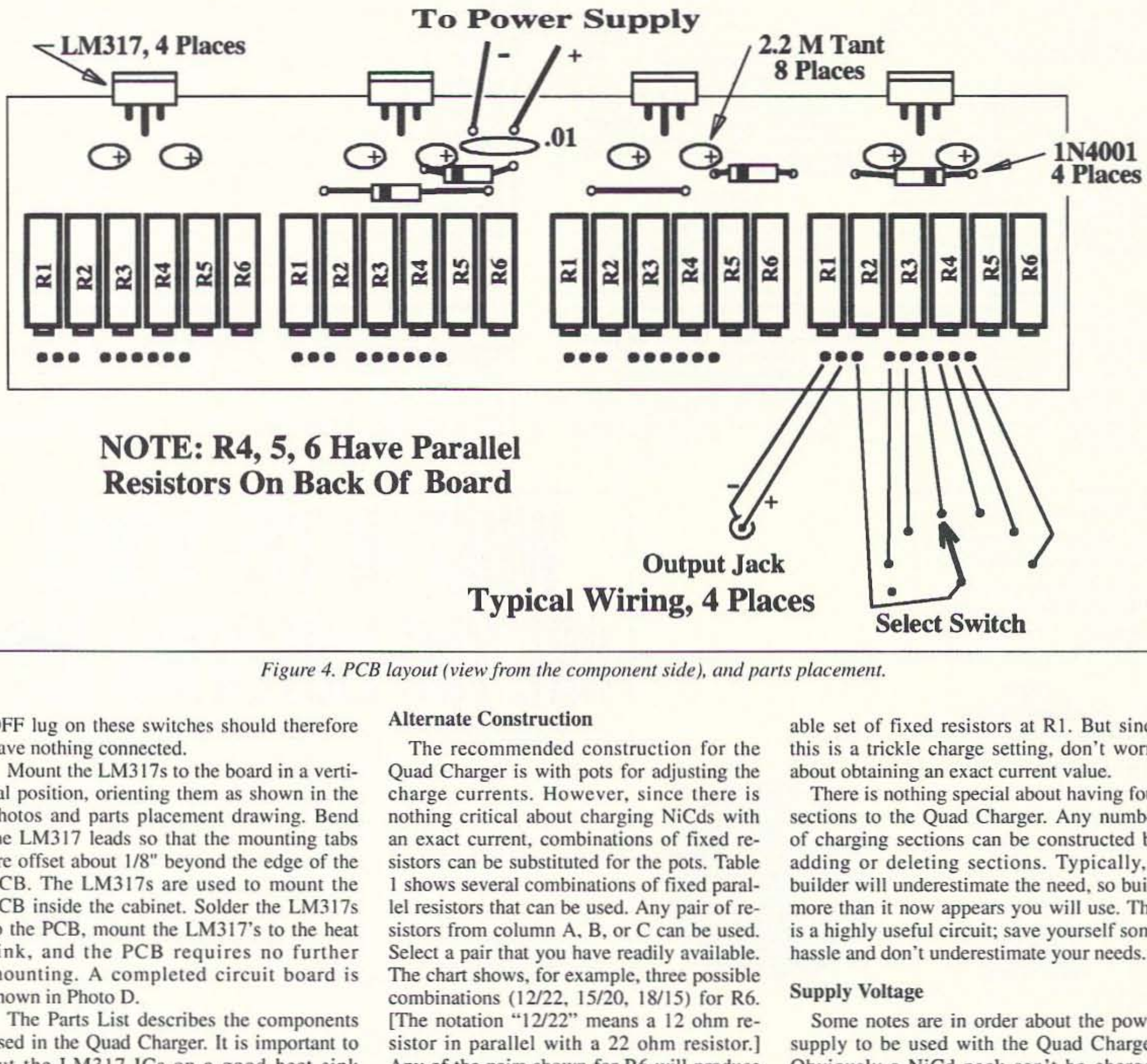

Figure 4. PCB layout (view from the component side), and parts placement.

OFF lug on these switches should therefore have nothing connected.

Mount the LM317s to the board in a vertical position, orienting them as shown in the photos and parts placement drawing. Bend the LM317 leads so that the mounting tabs are offset about 1/8" beyond the edge of the PCB. The LM317s are used to mount the PCB inside the cabinet. Solder the LM317s to the PCB, mount the LM317's to the heat sink, and the PCB requires no further mounting. A completed circuit board is shown in Photo D.

The Parts List describes the components used in the Quad Charger. It is important to put the LM317 ICs on a good heat sink (Photo E). Be sure to use insulators between the LM317s and the heat sink. The LM317 mounting tabs must not make electrical connection to the heat sink or to each other. If a metal enclosure is used, the rear panel might make a suitable heat sink. Photo E shows the heat sink I used. It is considerably more than adequate.

Alternate Construction

The recommended construction for the Quad Charger is with pots for adjusting the charge currents. However, since there is nothing critical about charging NiCds with an exact current, combinations of fixed resistors can be substituted for the pots. Table 1 shows several combinations of fixed parallel resistors that can be used. Any pair of resistors from column A, B, or C can be used. Select a pair that you have readily available. The chart shows, for example, three possible combinations (12/22, 15/20, 18/15) for R6. [The notation "12/22" means a 12 ohm resistor in parallel with a 22 ohm resistor.] Any of the pairs shown for R6 will produce approximately 150 mA charge current. A current variation of +/-10% from that recommended will not be significant in charging NiCds.

Because the quiescent current mentioned above is a substantial part of 1 mA and varies between individual LM317s, a bit of trial and error may be required to get a suitable set of fixed resistors at R1. But since this is a trickle charge setting, don't worry about obtaining an exact current value.

There is nothing special about having four sections to the Quad Charger. Any number of charging sections can be constructed by adding or deleting sections. Typically, a builder will underestimate the need, so build more than it now appears you will use. This is a highly useful circuit; save yourself some hassle and don't underestimate your needs.

Supply Voltage

Some notes are in order about the power supply to be used with the Quad Charger. Obviously a NiCd pack can't be charged from a supply of lesser voltage. Further, the LM317 requires about 3 volts across its terminals for proper operation. So the minimum supply voltage is that of the fully-charged NiCd, plus 3 or more volts. There is also an upper limit of 37 volts dictated by the LM317. The LM317 is designed to handle 1.5 amps of current, so that is not a prob-

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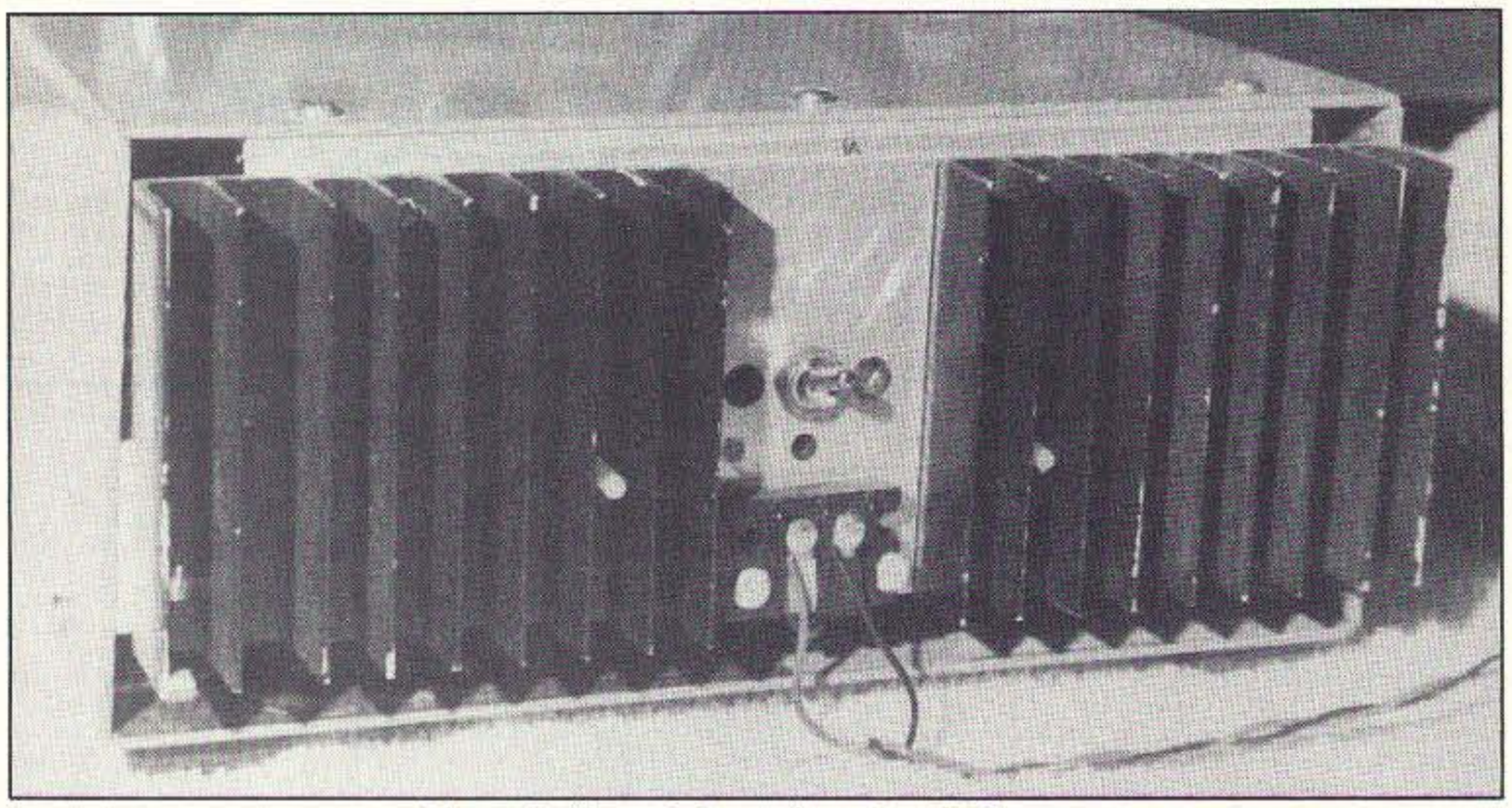

Photo E. Heat sink used on Quad Charger.

lem in the Quad Charger circuit.

The supply voltage will be a determining factor in the size of the necessary heat sink. The lower the supply voltage the smaller the required heat sink, and vice versa.

Checkout and Adjustment

After soldering all the components in place, carefully check for solder bridges and open connections. Check carefully at the PCB where the connections to the switches are made. Remove any solder bridges before proceeding.

Set all the pots near their mid-range position. The exact setting is not important, but the pots should not be at zero ohms. Select the 1 mA position for all the control switches. Remove anything connected to the output jacks. The LM317s should be mounted to their heat sink to prevent excessive heating during checkout. Connect a 12 volt power supply to the Quad Charger through your mA meter. The Quad Charger (without the LED connected) should draw no current. Note that the LED will draw about 10 mA if used. Check for bad connections if the total current is beyond that for the LED.

Connect a 100 ohm resistor in series with your mA meter and plug it in the output jack of the first charger section, then immediately note the meter reading. It should not be more than a few mA. Adjust R1 until the meter reads 1 mA. Switch to the 5 mA position and adjust R2 for a 5 mA reading on the meter. Adjust R3 and R4 for 15 mA and 50 mA respectively at the appropriate switch positions. With the switch set in the 50 mA position, short across the 100 ohm resistor to verify that the current remains at 50 mA with and without the resistor in the circuit. Remove the 100 ohm resistor, and adjust R5 and R6 for 100 mA and 150 mA with the switch in the respective positions.

Repeat this procedure for each of the remaining three sections.

Check the LM317s for any signs of excessive heating during and after the above adjustments; they should stay cool enough to touch comfortably. As a final check of the heat sink size, put a short across all four output jacks and set all four switches for 150 mA. Check the temperature of the LM317s. If they get too hot to touch comfortably, a more capable heat sink is required. A reasonable way to estimate temperature is to remember that your body (finger) temperature is about 98 degrees F, and that 105-110 degrees feels warm to the touch. A temperature of about 120-130 degrees is too hot for me to touch comfortably for very long.

When your Quad Charger checks out OK as described above, it is ready to use!

Conclusion

The Quad Charger has been in use at this QTH for a couple of years. It has proven highly useful, and is in daily use. It saves a good bit of hassle and concern, and provides a set of charged NiCds any time they are needed. 73

Table 1. Some Useful Parallel Fixed Resistor Values (All 1/4 Watt Resistors)

Charge Current	Resistor	Parallel Combinations A	B	C
1 mA	R1	2.2k	2.7k/6.8k	3.3k/4.7k
5 mA	R2	270	330/1.5k	470/680
15 mA	R3	110/560	150/200	150/200
50 mA	R4	27/330	33/100	47/51
100 mA	R5	12	15/68	22/27
150 mA	R6	8.2	10/47	15/18

"XX/YY" means parallel a resistor of XX ohms with one of YY ohms. A single number in a column means use a single resistor of that value. Select any combination from column A,B, or C.

Parts List (For One of Four Identical Sections)

IC-1	LM317T
C1, C2	2.2 µF tant.
D1	1N4001 or similar
R1	5k pot
R2	500 ohm pot
R3	100 ohm pot
R4	500 ohm pot paralleled with 27 ohm resistor
R5	100 ohm pot paralleled with 15 ohm resistor
R6	100 ohm pot paralleled with 10 ohm resistor

Note: All pots are Bourns series 3006P or similar

Output jack and plug of builder's choice

Rotary switch, 12 positions, one pole (seven positions used)

Single items needed for the entire Quad Charger:

- ON/OFF switch, SPST
- LED and 1k resistor
- PCB or perf board, cabinet, etc.

Drilled and etched PC boards are available from FAR Circuits, 18N640 Field Ct., Dundee IL 60118, for $6.50 plus $1.50 S&H.

See Table 1 for alternate construction parts.

Rules of Thumb for Charging NiCds

The recommended charge current is usually indicated on the pack or cell in question, along with the recommended charge time. If not, there are some reasonable rules of thumb for charging a NiCd. Charge a NiCd (pack or individual cell) at a rate in mA that is equal to 1/10 the value of the NiCd rating in mA/hr. For example, a 500 mA/hr. NiCd should be charged at 50 mA. NiCds require a total charge energy input equal about 1.5 times their mA/hr. rating. That means a NiCd should be charged at the "rule of thumb" rate for 15 hours. To recap, a NiCd should be charged at 1/10 its mA/hr. value for 15 hours.

Most AA size NiCds should be charged at 50 mA for 12 to 15 hours. Most C size NiCds, and many D size NiCds, should be charged for 18-20 hours at 100 mA. Or charge the C and D size NiCds for 12-15 hours at 150 mA. A 9 volt "transistor" size NiCd should typically be charged at 10-15 mA for 12-15 hours.

I trickle charge AA size NiCds at 1 mA and C and D size NiCds at 5 mA.

73 Review

by Joseph J. Carr K4IPV

EASY-PC Printed Circuit Layout Software

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For more than a quarter of a century (!) I've been writing about ham radio and hobby electronics. Over that time I've drawn about seventy kazillion schematics, laid out a couple score or two of printed circuits, and used up about 40 tons of those green "engineer's sketch paper pads" in the process. Now that I own a killer 486 computer, I decided to buy several software packages to make my technical writing easier and to help me do the schematics and PCB layouts (especially since one of my book publishers occasionally uses my original artwork . . . which isn't all that good).

I bought several software packages recently, but the one that I like a lot for laying out printed circuit boards is Easy-PC from Number One Systems, Ltd. (Harding Way, St. Ives, Huntington, Cambs., England, PE17 4WR. By the time this is published you will be able to contact the company via Ms. Sandy Bell, 1795 Granger Avenue, Los Altos, CA 94024; telephone 415-968-9306), at a cost of $195.

Features

EASY-PC is a very capable CAD program that rivals many professional packages in its built-in features. Indeed, although a professional version is available at extra cost, a large number of commercial or professional users will be able to use the EASY-PC version that I tested. It certainly meets my needs quite well.

EASY-PC will accommodate PCB sizes up to 17" x 17" (43 cm x 43 cm), and permits up to 1,500 ICs per board. It also allows up to 5,000 printed tracks with up to 12,000 track segments, and 4,000 connection pads per board. Those numbers add up to some pretty large boards, especially for amateur radio projects. The tracks can be laid down in widths from 0.002 to more than 0.5 inches (see Figure 1), while pads are available in the same sizes (up to 16 pad sizes are defined—see Figure 2A). There are also a number of PCB pad variants available, and these are shown in Figure 2B. There is a symbol set (Figure 3 shows a small sample) that can also be used on the PCB. The symbols are used to establish spacings between parts, and to create the top-of-board silk-screen pattern.

Most amateurs are familiar with single-layer PCBs (i.e. those with printed wiring on the bottom side) and double-sided PCBs (i.e. those with wiring on both sides of the card). It is frequently the case that the top layer is used for ground planes and/or DC distribution, along with the silk-screened component layouts. Advanced PCBs are multi-layered, and EASY-PC allows up to 10-layer designs. Eight of the layers are used for pad and track layouts, while the top layer (denoted "layer 0") is used for component overlay symbols and text information. The bottom layer ("layer 9") is typically used for text. One interesting feature of this layer is that it can be flipped to mirror image so that the text letters and numbers will appear correctly in the manufactured board.

When viewed on the screen of your computer's color monitor, the various layers can be rendered in different colors. Pads appear as white on a black background, while tracks are in red. When you go to a different layer, then a third color can be selected. That approach allows you to see the entire circuit, while keeping the various layers separated in your mind. When printing out the design on paper, either all tracks at once or just the layers of interest can be printed.

Getting Started

EASY-PC comes with 3.5" diskettes (5.25" on request), and installs easily. No one who has ever installed a modern program into a personal computer will have even the slightest difficulty in installing EASY-PC. If you do have a problem, the instructions are given in clear language in the manual, in any event.

The manual includes a tutorial that can take an hour or two to complete. Like many an impatient fellow, I attempted to skip over the tutorial and jump right into the program. Dumb. Take the time to work your way through the tutorial. It shows you in great detail how to work the program, and once you've gained that bit of empowerment a lot of other tasks can be figured out.

A mouse is highly recommended for EASY-PC, but the arrow keys will move the cursor for those who don't have a mouse. Operations within the program are selected from menus on the screen. When you first initialize the program at each session you will get a main menu that asks whether you want to design a PCB layout, design a schematic, or return to DOS. Once an option is selected the screen changes, and three small squares appear along the top of the monitor

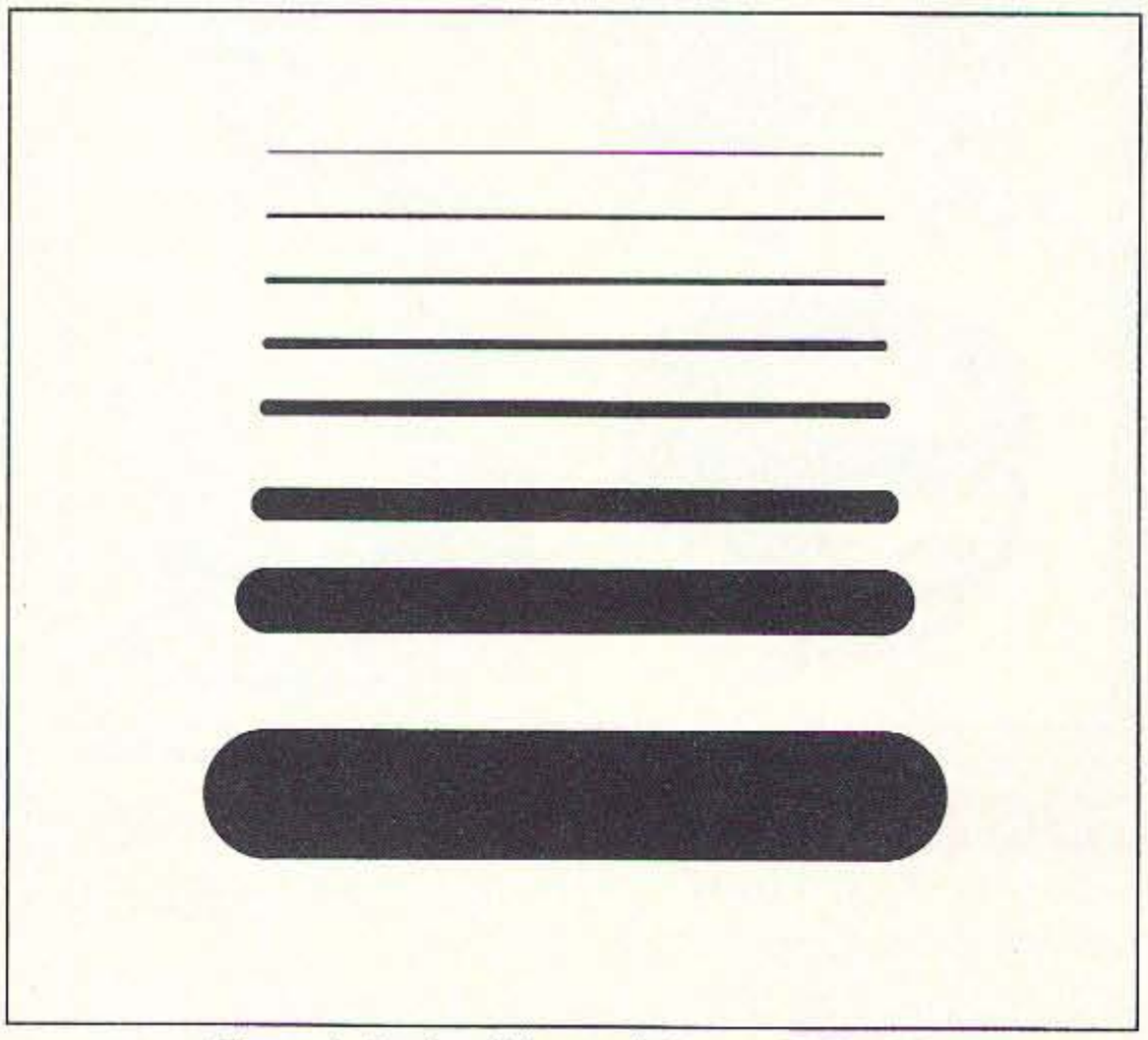


Figure 1. Track widths available on EASY-PC.

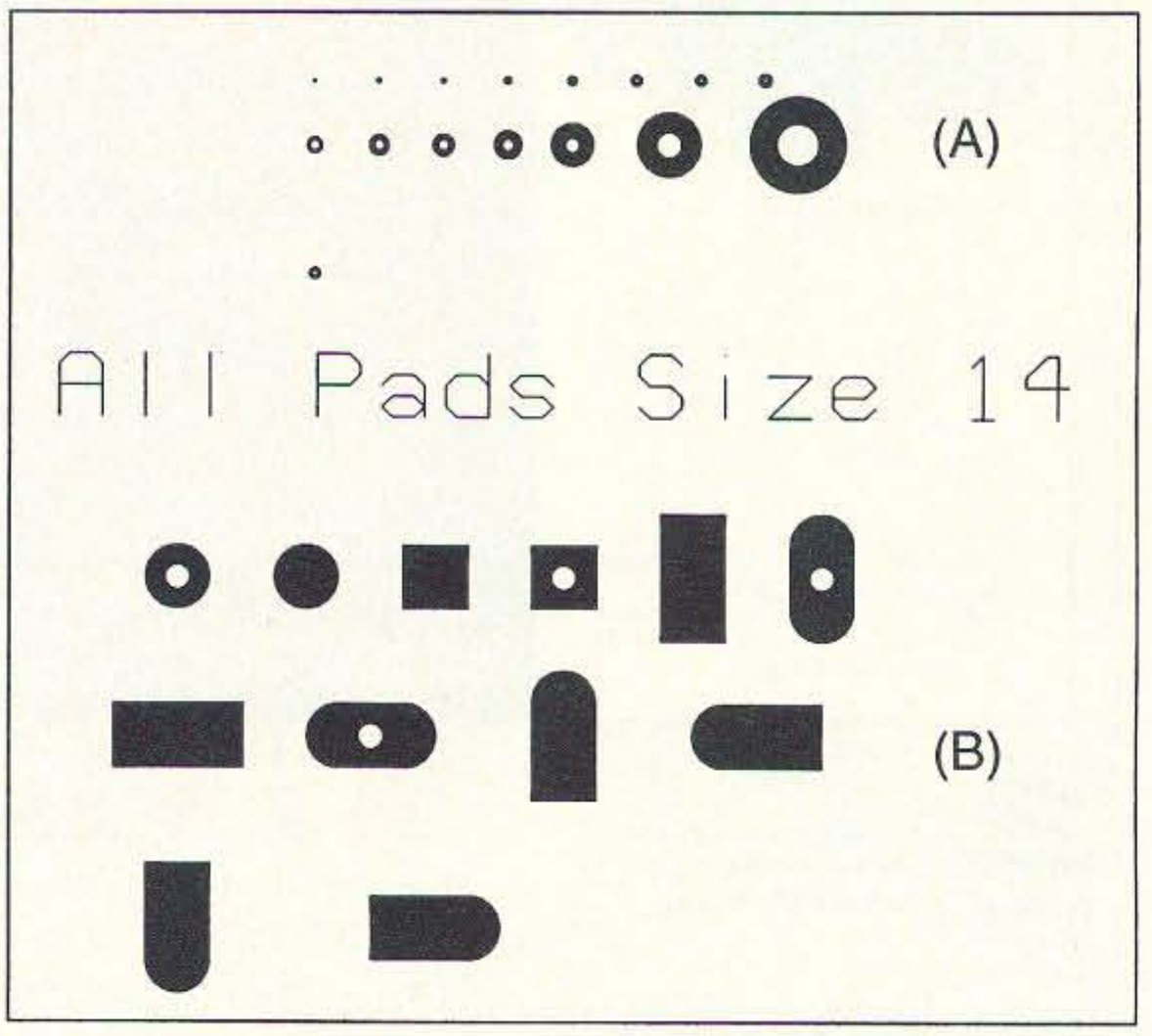


Figure 2. A) Pad widths available on EASY-PC; B) Pad variants available.

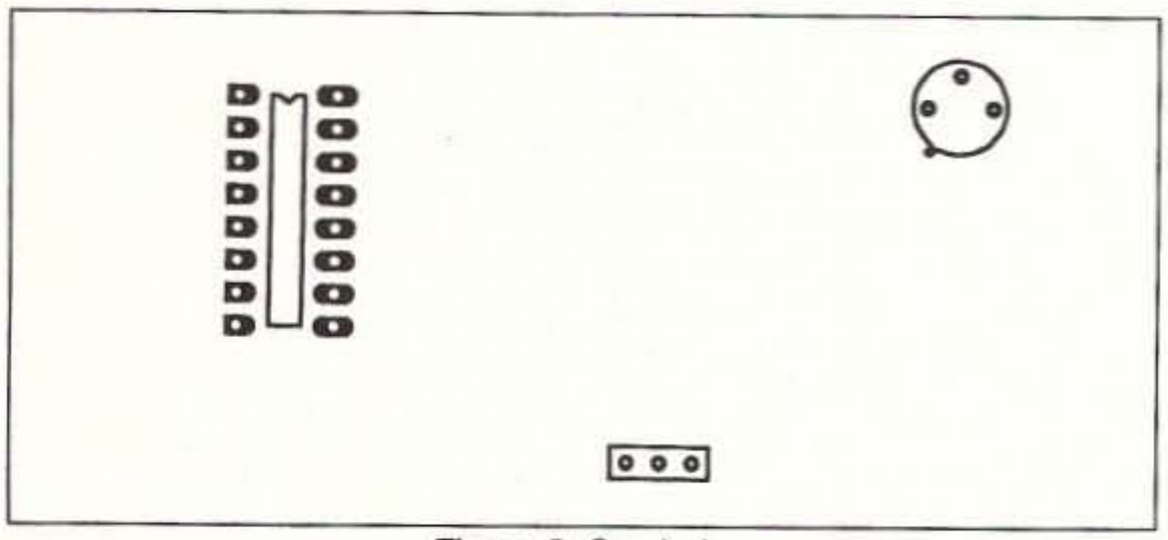


Figure 3. Symbols.

screen. Each of these squares is a trigger that turns on a pull-down menu (Left, Center and Right).

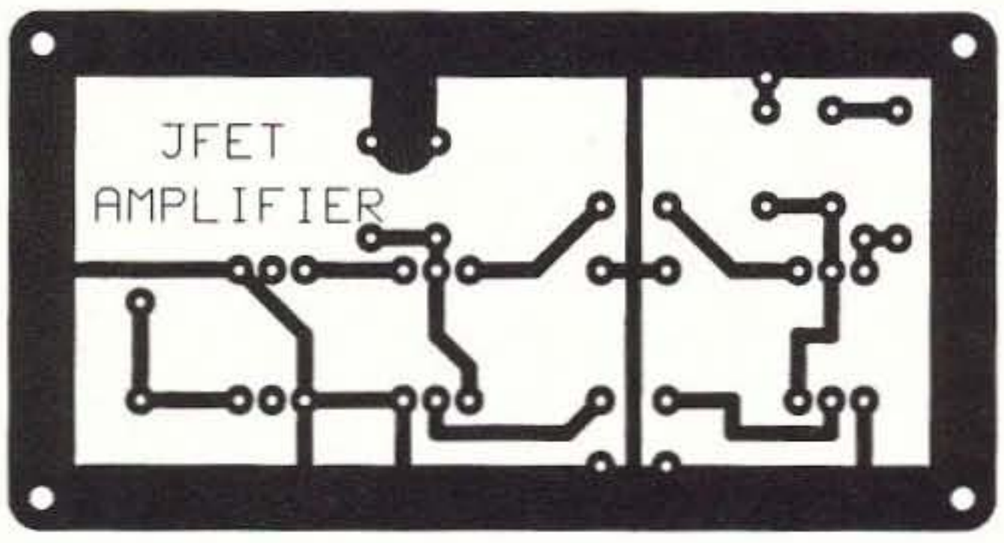
When you first enter the PCB layout screen, the background is black and there will be a white square in the center, taking up about a third of the screen area; the menu trigger boxes are along the top of the screen. This white square represents the 17" X 17" area of the largest size board that the program will accommodate. It is far too large an area to work in effectively, so you can use the Right Menu to find a "Zoom" function. If you click on the Zoom function, and then move the cursor to a point within the white square, the program magnifies the region so that the cursor-selected point is in the middle of the screen.

There are seven levels of magnification (ZM1 through ZM7), and these can be selected by pressing a number key immediately after clicking the mouse to position the cursor. For example, from the first level, ZM7, a single zoom operation takes you to level ZM6, but if immediately after arriving at ZM6 you press "3" the screen jumps to ZM3. The highest level, ZM7, is the initial opening screen and represents the 17" X 17" total area, with each lesser number (ZM1-ZM6) representing a magnified view of a smaller area. Level ZM4 is close to life-sized, but is not exact. I found that level ZM3 was the most congenial to work in for the kind of circuits that I do. If you design a very sparse board, then a lesser magnification can be accommodated (e.g. ZM4/ZM5), but if a really dense board is being designed, ZM1 or ZM2 might be appropriate. The adjacent levels appear to have a relationship of about 2:1 to each other.

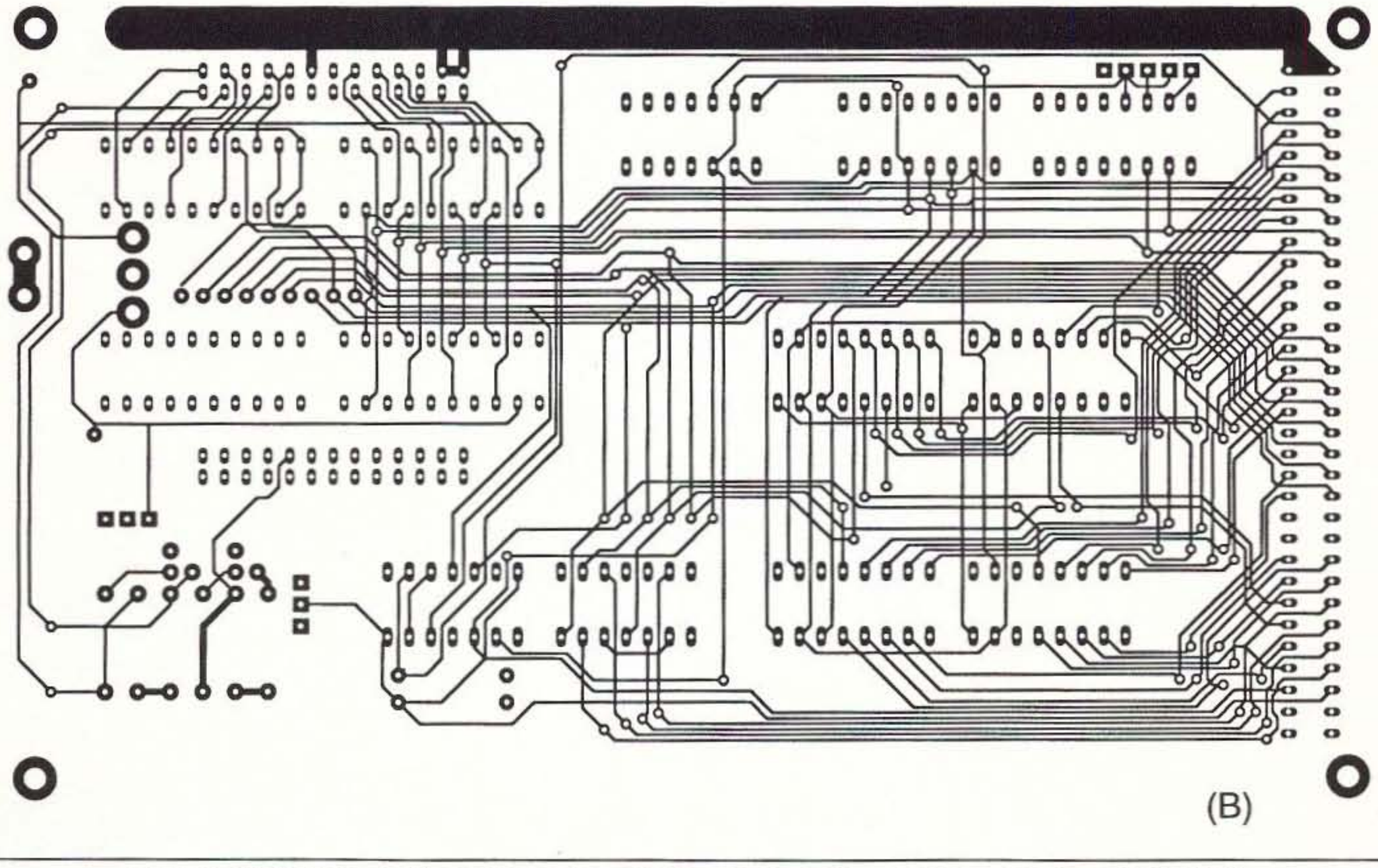
On all zoom levels other than ZM7 there is a "Grid" option that can be selected from the Right Menu. This option is highly recommended. It overlays a grid of dots to permit you to locate components properly and measure lengths. In the ZM6 level the dots represent distances of 1" each, while in my favorite ZM3 layer a 0.100" dot grid appears. Note that the 0.100 spacing is a standard, especially on digital components. The pins on a DIP IC package, for example, are 0.100" apart.

When working at a magnified level (below ZM7), even a moderate-sized board might not fit entirely onto the screen at one time. EASY-PC accommodates this difficulty quite nicely by having a "Pan" option selectable from the Right Menu. Select Pan, and then place the cursor at the spot on the PCB that you want to appear in the center of the screen. On larger boards, a move from one extreme edge to the other may take a couple of successive selections in the higher magnification levels of zoom. This problem can be rectified by using the "Unzoom" feature to temporarily go to a higher level. When you again Zoom into the working level, the selected area will be centered on the screen. There seems to be no difficulty in zooming and unzooming.

I found the ability to pan and zip between zoom levels very useful for initially laying out the board. In one application I knew I needed a board that



(A)



(B)

Figure 4. A) JFET preamplifier PCB I designed; B) Complex board from the tutorial package of EASY-PC.

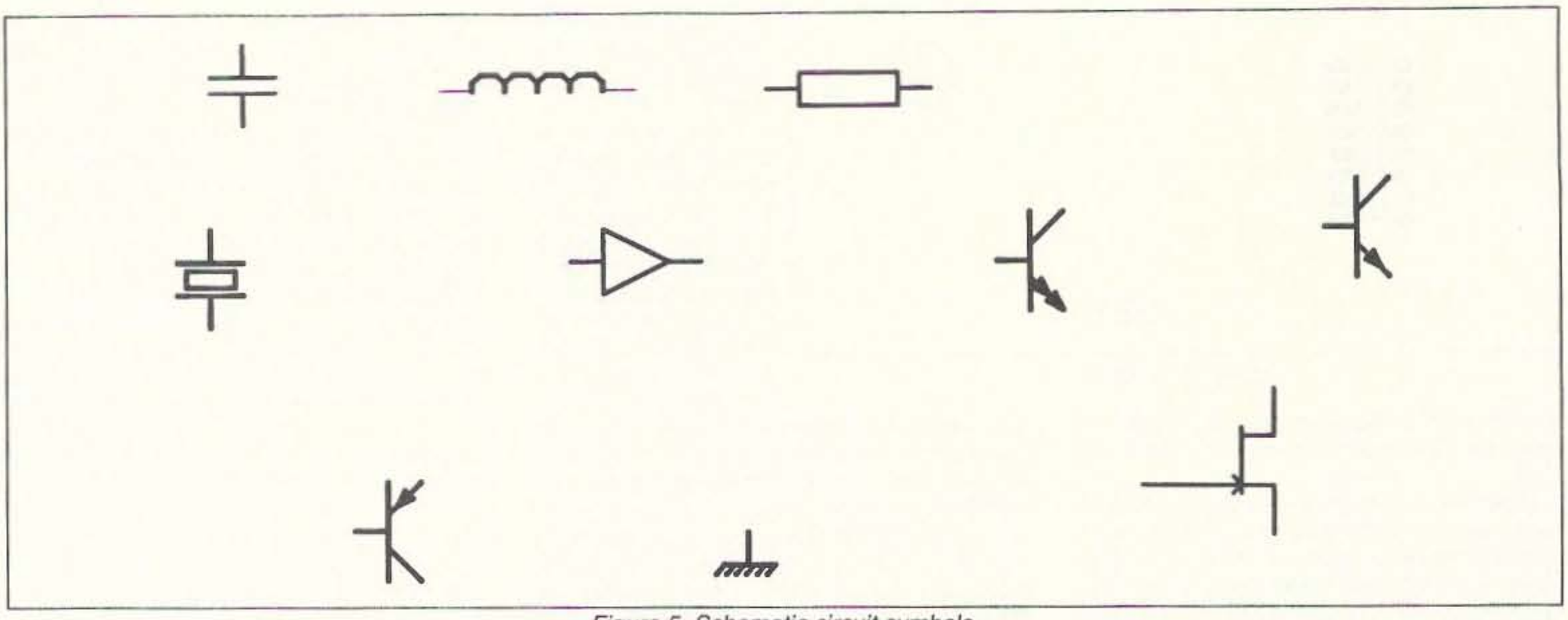


Figure 5. Schematic circuit symbols.

was 2" X 3" because it had to fit into an existing space. By selecting ZM6, turning on the 1" grid pattern, I was able to lay out the ground tracks around the edge of the board. That little job not only ensured that the tracks would be there when needed, but also defined the limits where I could work when the display was zoomed back to ZM3.

Figure 4A shows a printed circuit layout that I designed for a push-pull JFET RF amplifier. This design took me about an hour because it was the first time I tried anything other than the tutorial. I am quite pleased with the result, and a redesign (made to accommodate a different RF transformer component) took only 20 minutes. As I gain skill, I expect the layout times to be reduced considerably. Like any skill, PCB layout is sensitive to doing it for a while. Figure 4B shows a complex, multilayer PCB that is part of the tutorial package in EASY-PC. In this printout, all layers are shown at once. The printing menu will permit each layer to be printed separately.

Printout

Having a PCB layout on a computer screen is not terribly useful unless it can be transferred to a real board. EASY-PC allows the design to be printed out on either 9-pin or 24-pin "IBM graphics compatible" printers (which includes about all of them sold today), a plotter (which few amateurs have available), or laser or ink-jet printer. Specifically supported are laser (etc.) printers that will respond to the Hewlett-Packard Laserjet II and Laserjet III formats. My Laserjet III had no difficulty handling the graphics, even though it contains only about half the memory that the machine will hold.

Laser printer printouts are done through a utility

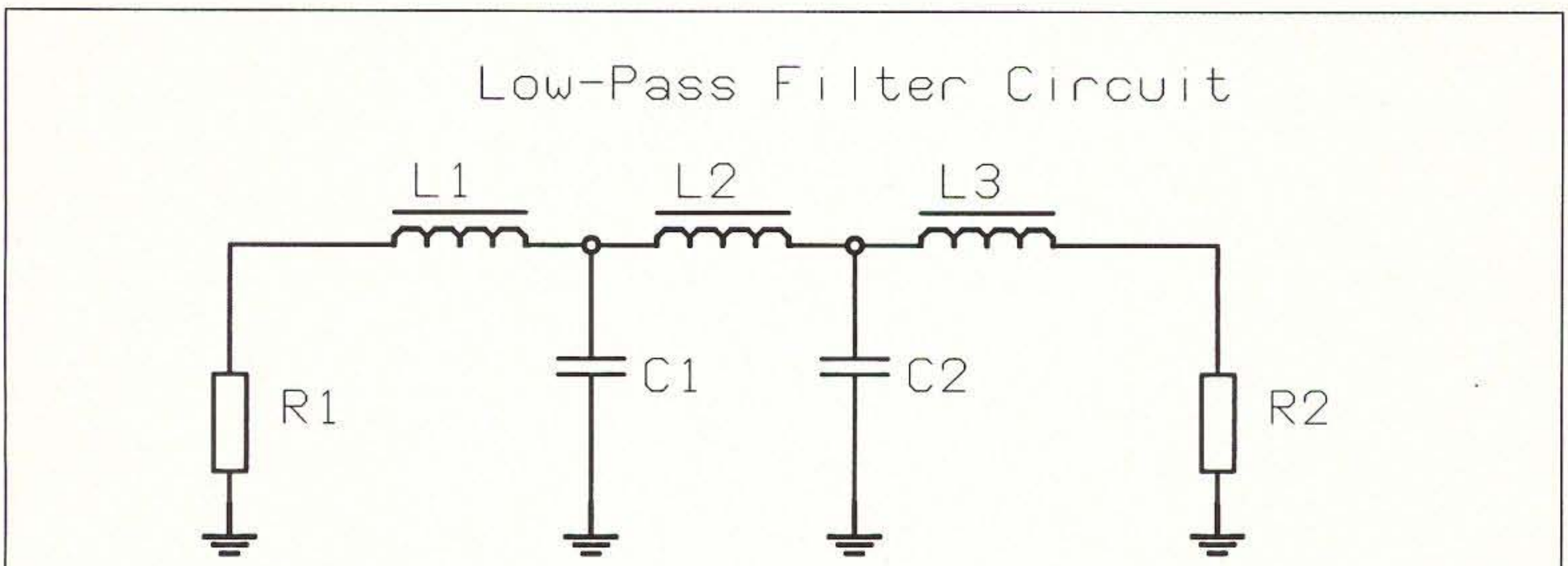


Figure 6. Sample schematic made using EASY-PC.

program that comes with EASY-PC: EASY-LASE. To print a layout, quit EASY-PC and return to the DOS prompt and type in "EASYLASE." The printing program screen will pop up with a number of selections. Something to note for USA purchasers is that British paper sizes are different from American paper sizes, so first off change the paper size to 8.5 x 11, or 8.5 x 14, depending on which you use. My version of EASY-PC came set to something called "A4" paper, which I assume is some British or European standard paper size.

Another trick I learned is to always press "K" to center the trace, although for your use this may not be needed. Otherwise, the trace will appear along the upper right-hand edge of the paper. This positioning would be OK if you are cutting it out and using it directly, but it doesn't easily accommodate the size needed for the printed circuit contact exposure frame that came with a PCB-making kit I bought.

Schematic Diagrams

One of the other design layout capabilities that EASY-PC offers is a schematic drawing option. You can draw some rather complex schematic drawings, and then print them out on a laser printer that makes them look "just like downtown." A symbols library is available, containing the most commonly used symbols. In addition, the program allows you to design your own symbols and add them to the library. Each symbol is given a file name that is used to call it into play. For example, "R" produces a resistor on the screen, while "L" and "C" invoke inductor and capacitor symbols, respectively; "XTAL" is the crystal symbol. Figure 5 shows some of the EASY-PC symbols that are available. American

readers will be mildly disconcerted by the European look of some of the symbols. For example, in Figure 5 the rectangle with axial leads is what you get when a resistor ("R") is selected. Figure 6 shows a low-pass filter schematic done on EASY-PC.

Suggestions

There are no serious criticisms to make regarding EASY-PC. I found it quite capable, and easy to learn. Even a computer dyslexic will find EASY-PC congenial, and for the Nintendo generation of users, hey!, it's duck soup. But there are a few nit noids to pick on, and since a reviewer is not doing his job if nothing naughty is reported . . . well, you get the picture. I have to grouse about something, or I'll lose my "Curmudgeon License."

Nit-Noid #1. The manual is a bit short in some of the instructions on how to do certain options. This appears to be the result of some well-qualified user forgetting us poor slobs who never saw the program before. One problem that I had was in the need to "fix" the location of pads and tracks. When you select "New Pad" from the Left Menu, and then move the cursor to where the pad is to be located, clicking the left mouse button places the pad at that point. However, moving the mouse to another location and then clicking again causes the pad to suddenly jump to the new location. This is a great feature for editing and correcting mistakes, but it's terribly disconcerting at first. What seemed to be poorly described is the need for a second operation to fix the location: Click the right mouse button. It is described in the manual, but I failed to pick it up first go around.

Nit-noid #2. The symbols libraries in both the PCB and schematic selections reflect a digital view of the world—lots of digital ICs, but only a few linear devices. While there are standard transistor symbols in both PCB and schematic portions, one does not see RF transistors or RF and other analog integrated circuits (e.g. the Signetics NE-602 device or the MC-1350P device). I would like to see both in future libraries.

Recommendations for Improvement

It appears the Number One Systems, Ltd. is committed to continuously improving their product (Dr. Deming and the Total Quality Management crowd will be delighted to hear), so I hope they will take into consideration some improvements.

First, figure out how Heathkit wrote kit-building manuals, and then use the knowledge as a model on how to rewrite the EASY-PC manual. This is not a slam on Number One Systems in particular, but reflects the fact that nearly the entire software industry seems to use qualified experts to test drive their "beta" versions prior to releasing to the public.

Second, now that they are moving into the USA/Canada market, create a set of libraries that reflect the symbols used in North America. Keep the European standard symbols, but add, even at a "priced-extra" option, the symbols we use over here.

Third, recognize RF and linear devices in the schematic package. I understand that they are working on these library options, and I want to be among the first to get my copy! After all, when I'm not working on RF projects I tend to be noodling about with op amps and other linear ICs.

Fourth, write a brief tutorial for the uninitiated on what a printed circuit board ought to look like. Really! I mean it. A very useful thing for the neophyte is some guidance on the sizes of tracks and pads, layouts, how close items can come to each other and other general knowledge that otherwise comes through experience. A little canned experience, learning from the wisdom of others, goes a long way for those smart enough to take advantage of it.

Other Products

Number One Systems offers other products in addition to the printed circuit layout software: an analog circuits analysis program, a digital logic analysis program, and a Smith Chart analysis program. I haven't reviewed these products so I can't comment on them, but if they are as good as EASY-PC, then they are probably a good bet. Contact the company at either the England or California addresses for details on these programs.

Conclusion

EASY-PC is a very capable, but low-cost, printed circuit design and schematic drawing package that will accommodate amateur users quite nicely. It prints out on ordinary dot matrix and laser printers, so it doesn't require an expensive collateral investment in plotters. Yet, for the professional user, it allows the use of plotters. It will also create the data file needed for automatic "numerical control" drilling machines, which are used in commercial production. EASY-PC is cost-competitive with other amateur grade layout programs, but is far more capable and easy to use than some of the others that I've seen. My opinion is that the next leap for greater capability in the commonly used products would be in the $1,800 price range. EASY-PC will do more than most amateurs will ever need, and for those who need more, give the "professional" version a try . . . it's cheaper than many other professional packages. 73

HAM HELP

Number 29 on your Feedback card

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 i, 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 recently acquired a satellite dish, and I'm trying to get set up so I can receive the NASA Select Video feeds. I have a receiver that needs work, but I have no documentation on it. Any help obtaining documentation for the following items would be appreciated: LUXOR Model 9540 Satellite receiver; LUXOR Model 9534 Antenna Actuator (Positioner control). Any other tips, advice, equipment for sale (CHEAP!!), would be appreciated. Thanks. *Don Byrer KJ5KB, 216 23rd Ave. N.E., Norman OK 73071.*

WANTED: Manual for a KENWOOD AT-200 Antenna Tuner. I'll appreciate if someone can send me a copy of this manual. *Ruben Sanchez XE2NI, P.O. Box 3-4137, Monterrey NL 64460, Mexico.*

I need info on enabling full Xmit coverage on an ALINCO DJ-180T HT, for volunteer fire use. Thanks. *Bob Grater K6SUB, 631 E. Taylor Ave., Sunnyvale CA 94086.*

NEEDED: Instruction manual and schematic for the MX 2930H/USM Vertical Channel Dual Trace Preampl.; or the Model 162A Dual Trace Amplifier. I will pay reasonable copy costs. *M. Crosby, 1301 Touhy Ave., Apt. 212, Park Ridge IL 60068.*

I am looking for a shop manual or an owner's manual for a HALLICRAFTERS Model HT-40 (MARK-I) transmitter. I am willing to pay for it. Even copies would be helpful. Thanks. *Andre' Pelletier, 500 - Dineen APT #300, Labrador City Nfld., A2V 1E6 Canada. Tel./Fax: (709) 944-2540.*

NEEDED: Alignment instructions for the TEN-TEC Century 22 transceiver. Also, I would like to contact anyone with a Heath HWS-2 handheld with the optional PL encode/decode installed, who has found a way to disable the decode mode. *Glenn Torres KB5AYO, 584 Central Ave., Reserve LA 70084.* 73

73 Review

by Gordon West WB6NOA

"The Radio Doctor"

"Fix it and run it" videos.

Ham Repair
c/o Milton Lord N4DA
710 Teague Drive
Kennesaw GA 30144
Telephone: (404) 422-1415; (800) 788-1416
Price Class: $19.95–$39.95

Until now, we haven't seen much interest in video training cassettes for amateur radio. Our hobby seems to be too technical for complex matters to be digested in 78 minutes of mylar. While there have been attempts to offer videos to go from Novice through Extra in just 55 minutes of instruction, or to fully understand how to assemble a KT-34-XA step-by-step in just 68 minutes of tape, it's just not going to happen *in detail.* Hams know that, and that's why you don't see video titles for every subject of ham radio popping up in full-page ads.

That was until "The Radio Doctor" radio maintenance videos caught my attention. I regularly work on amateur radio equipment, and I would love to see a video that could give some inside hints on working on these specific radio transceivers:

Kenwood TS-850S
Yaesu FT-757
Kenwood TS-430S
Kenwood TS-440S
Kenwood TS-830S
Kenwood TS-930S

Several "Understanding and Assembling" Videos

I ordered a good selection of these videos, having no idea what I was going to get or what quality had gone into their production. I didn't have to wait long—the order was processed within 12 hours of when they received my check, and the videos arrived packed in a secure carton with not-so-fancy graphics on the outside.

I popped in the Yaesu FT-757 77-minute repair and tune-up video and endured the first minute of FBI copyright warnings, canned music, and the introduction by "The Radio Doctor," Milton Lord N4DA, a licensed ham for over a quarter century with 20 years of experience in designing and servicing RF communications equipment. I became more intrigued by his low-key, friendly style of talking, about how "we" were going to open up the Yaesu and go into deep surgery.

Milton's son shoots the video over his dad's shoulder, using excellent lighting and professional video techniques. We systematically back out the screws to the equipment, catch some unique hints on how to pull the covers and get into the insides of the set, and then proceed to completely tear down the front panel to gain access to the heart of any problem that he is going to show us how to repair. The close-ups put you right there on the end of your tiny screwdriver—you can almost smell the solder cooking as "The Radio Doctor" pulls wires off the printed circuit board with the skill of an operating room surgeon.

His same unhurried, sincere technique in talking us through the repair and alignment of Kenwood radios was found on each of the other video tapes. The 72-minute Kenwood TS-940S finally gave me the definitive repair to cure PLL unlock, or a failure of the power supply, or a failure of the internal antenna coupler.

"Seventy-five percent of the problems occurring on the Kenwood TS-940S can be repaired using this video on your own test bench," comments Milton Lord. "I also show you alignment procedures, frequency calibration techniques much easier than what is described in the service manual, and power output modifications, as well as out-of-band transmit mods for the MARS operator."

And Lord knows what he's doing—you see every step in disassembling and reassembling printed circuit boards, and he gives you valuable hints on how to keep from accidentally ripping out solder traces, or inadvertently shorting something out when you accidentally lay the fold-out board down incorrectly.

After screening all of his videos, including a powerful set of tapes that describe how to tune up a kilowatt amplifier, how to pull packet RX out of most mobile 2 meter transceivers, and why the proper ALC settings are important to good linearity, I was convinced we really have someone sincere about producing good videos for getting things done, as opposed to simply a lot of videos to turn a quick buck. He works on these rigs on a daily basis and you can tell it by watching his techniques.

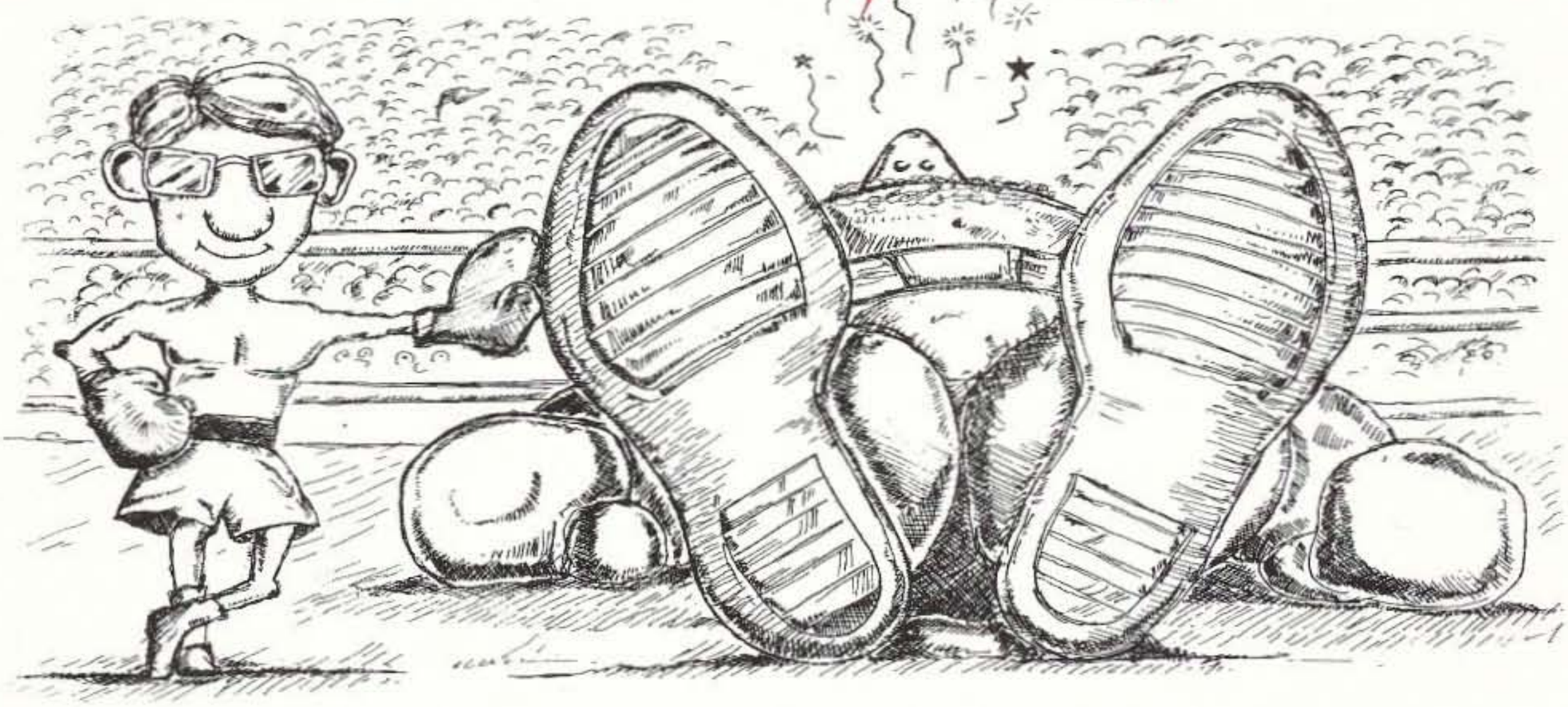
About the only mistake I could find in his dialogue was once when he referred to calibrating a piece of equipment that would zero beat WWV only when the frequency read 10.000.030 on the display. He described this as being 30 Hz high, when actually the radio is 30 Hz low in calibration, requiring the 30 Hz high offset for proper zero beat. Other than that, his dialogue is on the nose.

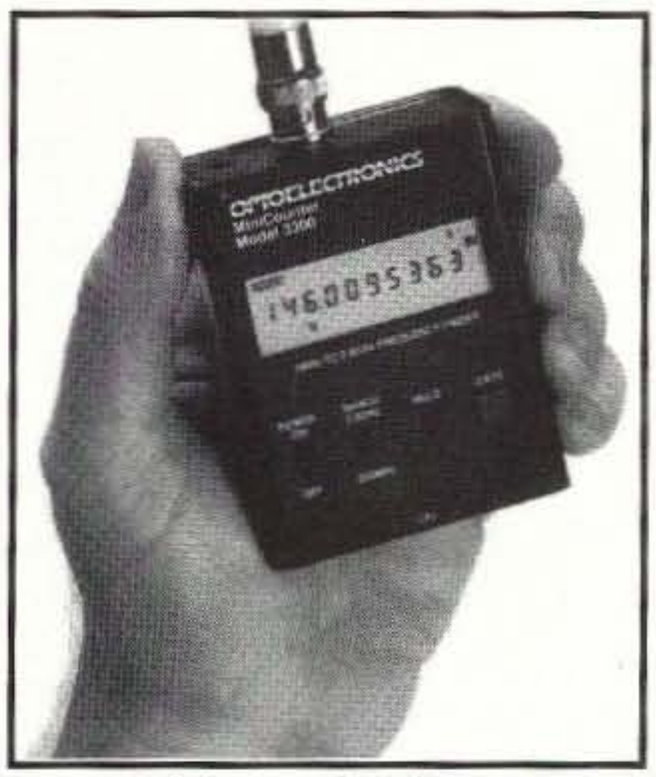
I phoned the technical types at Kenwood, Yaesu, and ICOM, and all three manufacturers agreed that Milton Lord has provided knowledgeable amateur radio operators a teaching tool that they have not had before. But all three companies urged the amateur operator to go no further in their radio surgery than their individual skill level in truly understanding what the problem and solution might be. But for actual "hands-on" technique, "Dr. Radio" shows you some tricks not found in the big technical service manuals.

"More videos on the newer sets are coming out as we speak," says Lord. For an up-to-date list on his ham radio repair videos, phone (404) 422-1415. I think you will be as impressed as I was with his sincerity and non-frantic detailed approach to learning how ham radios play and what happens when you need to fix them yourself. 73

Photo A. There are plenty of close-up shots on the Radio Doctor Videos.

It's kinda s m a l l, but it sure packs a WALLOP!





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The AMSAT Annual Meeting

The 1993 AMSAT Annual Meeting and Space Symposium was held October 8-10, 1993, in Arlington, Texas. Over 170 satellite enthusiasts listened to dozens of presentations, examined satellite models and antennas on display, and made hamsat and moonbounce contacts using antenna arrays set up outside the convention hotel. For all participants it was a fantastic weekend. With the launch of more new hamsats on an Ariane rocket only two weeks earlier, spirits were high.

Friday

Although activities at the symposium began on Thursday with a tour of electronic surplus stores in the Dallas/Fort Worth area, the paper presentations started Friday afternoon following a morning of antenna-test-range activity hosted by Kent Britain WA5VJB. Kent also gave a Friday talk on the use of metal booms to support amateur satellite antennas.

Rosalie White WA1STO of the American Radio Relay League got things started Friday afternoon with an ARRL/AMSAT educational workshop. Concurrent presentations included a status report on the SEDSAT-1 program by Dennis Wingo KD4ETA. SEDSAT is a microsat-class satellite that will be flying as a secondary payload as part of NASA's Small Expendable Deployer System (SEDS). It will be placed in a circular orbit at 730 km altitude with a 39-degree inclination. SEDSAT will carry several scientific and amateur-radio experiments. The main purpose of the satellite is to test the dynamics of tethered satellites and remote sensing.

AMSAT President Emeritus Dr. Tom Clark W3IWI discussed the status of UNAMSAT from the Autonomous University of Mexico. David Liberman XE1TU could not attend to present the paper since the launch of UNAMSAT will be very soon. It is scheduled to ride to orbit on a converted Russian ICBM early in 1994.

Lyle Johnson WA7GXD talked to the group about ITAMSAT-A, now known as ITAMSAT-OSCAR-26. AMSAT-Italy Vice President of Engineering Alberto Zagni I2KBD could not attend the symposium due to ground control activities relating to the new Italian satellite. I-O-26 is in orbit and fully operational. It is based on the standard microsat structure but has advanced features and modifications. Last month's column gives more details.

Other Friday papers included those by Jeff Wallach N5ITU concerning high-resolution weather satellites, Dan Schultz on the Hubble Space Telescope service mission and a Shuttle Amateur Radio Experiment talk by Lou McFadin W5DID. Lou explained SAREX from a payload point of view. Friday evening included a trip to the Fort Worth stockyards cultural district and local cuisine.

Saturday

Activities began in earnest at 8 a.m.. AMSAT President Bill Tynan W3XO gave an official welcome to the symposium participants and introduced the first speaker, AMSAT Vice President of Engineering Dick Jansson WD4FAB. Dick gave a detailed description of the structural design of the new Phase-3-D spacecraft. Dick has produced countless engineering drawings for the construction of this new hamsat. His presentation was enhanced by many slides showing the design endeavors and sights in Germany where simultaneous engineering efforts are underway. Symposium participants were given the opportunity to ask Dick questions relating to the many challenges encountered in the project.

Peter Gulzow DB2OS of AMSAT-Germany followed with a narrative on the many electronic packages to be flown on Phase-3-D. This ambitious multi-million-dollar satellite will carry an array of receivers from 145 MHz to 5.6 GHz and transmitters from 29 MHz through 10.4 GHz. Several non-radio payloads are also under construction, including an atomic clock, a Global Positioning System (GPS) navigation experiment, radiation sensors, and a group of three Charged Coupled Device (CCD) cameras to provide pictures from the earth and planets in true color via the German digital communications unit. The proposed orbit is to be highly elliptical, similar to that of AMSAT-OSCAR-13.

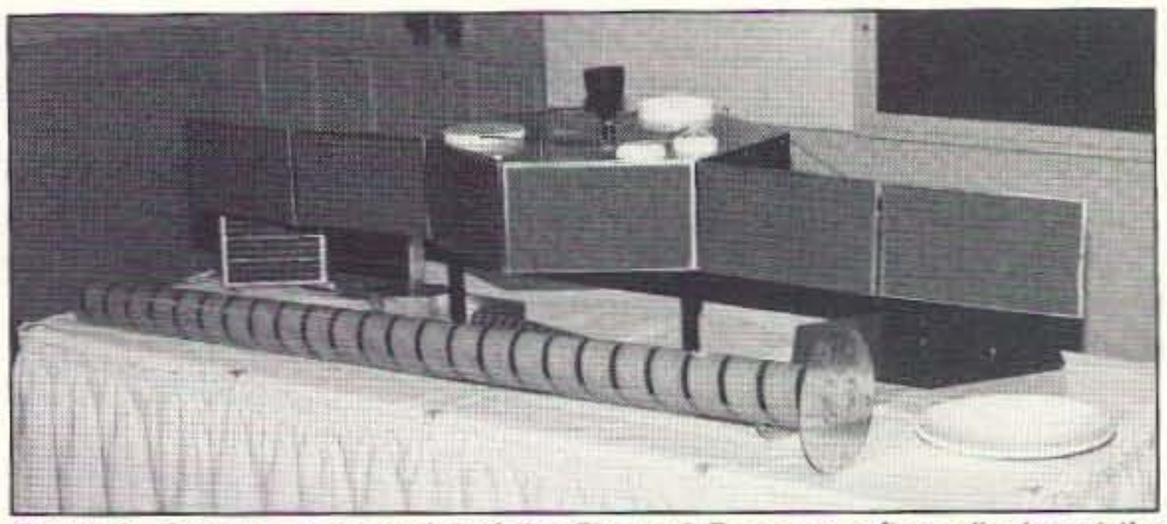

Photo A. Quarter-scale model of the Phase-3-D spacecraft on display at the AMSAT-NA Eleventh Space Symposium and General Meeting; October 8-10, 1993, in Arlington, Texas.

After a short break, Stan Wood WA4NFY presented a design review of the antenna systems to support the many radio modules carried on Phase-3-D. Ranging from a two-element "ZL-special" beam for 29 MHz to exotic patch antennas and dishes for the microwave bands, P-3-D will be covered with antennas.

Tom Clark W3IWI came to the podium again, this time to describe the inner workings of GPS and how it will be used on P-3-D. Several carefully-positioned GPS antennas will be needed on the satellite's surface to provide location and satellite orientation data. Tom also discussed terrestrial uses and equipment enhancements to allow better locating accuracy now available to experimenters and prospective users of GPS technology.

AMSAT Vice President of Manned Spacecraft Operations Frank Bauer KA3HDO provided insight on the status of SAREX and future missions. True to his predictions at the conference, the STS-58 flight of the Shuttle *Columbia* was extremely successful both for school contacts with the astronaut-hams and for the general amateur radio community via general voice QSOs and packet connects with the SAREX Robot. Frank also explained the purpose of the SAREX working group that manages the day-to-day activities and provides guidance and direction for the program. In addition, he explained AMSAT's participation and how school groups are coordinated.

James Miller G3RUH made his first trip to North America to present his paper on "Managing OSCAR-13." James spends at least two hours each day collecting A-O-13 telemetry and determining the best operating schedule and satellite orientation. He and the other ground control stations are responsible for positioning the satellite to keep the batteries in good condition. James has been responsible for many hamsat advances over the years, including the first PSK kit for use with Fuji-OSCAR-12, a 400-baud PSK demodulator for A-O-13 telemetry and a 9600 baud modem for use with the newer, high-speed digital satellites.

Ed Krome KA9LNV gave a report on his efforts to develop a truly portable Mode "S" (2.4 GHz receive) ground station. Ed's small dish, made of screen mesh, wooden dowels and cord was quite a hit at the symposium. Ed also described his ventures with single-conversion receivers for

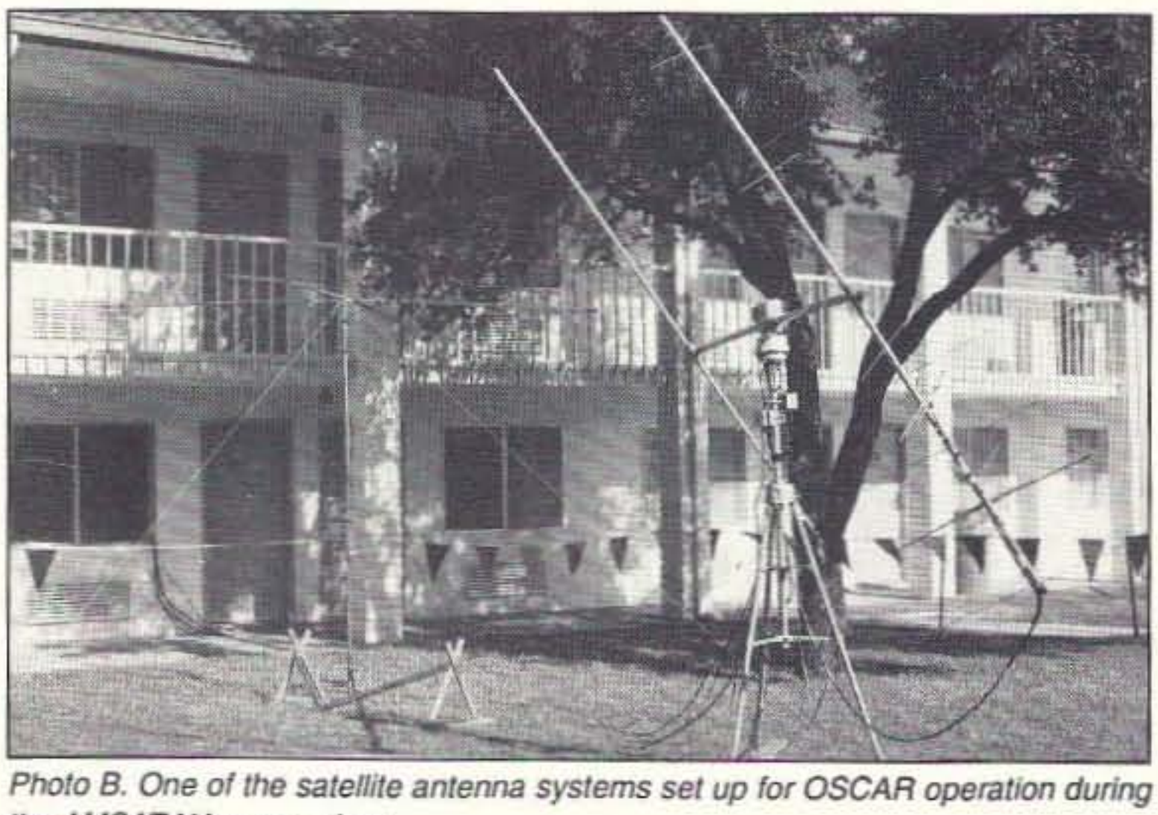

Photo B. One of the satellite antenna systems set up for OSCAR operation during the AMSAT-NA symposium.

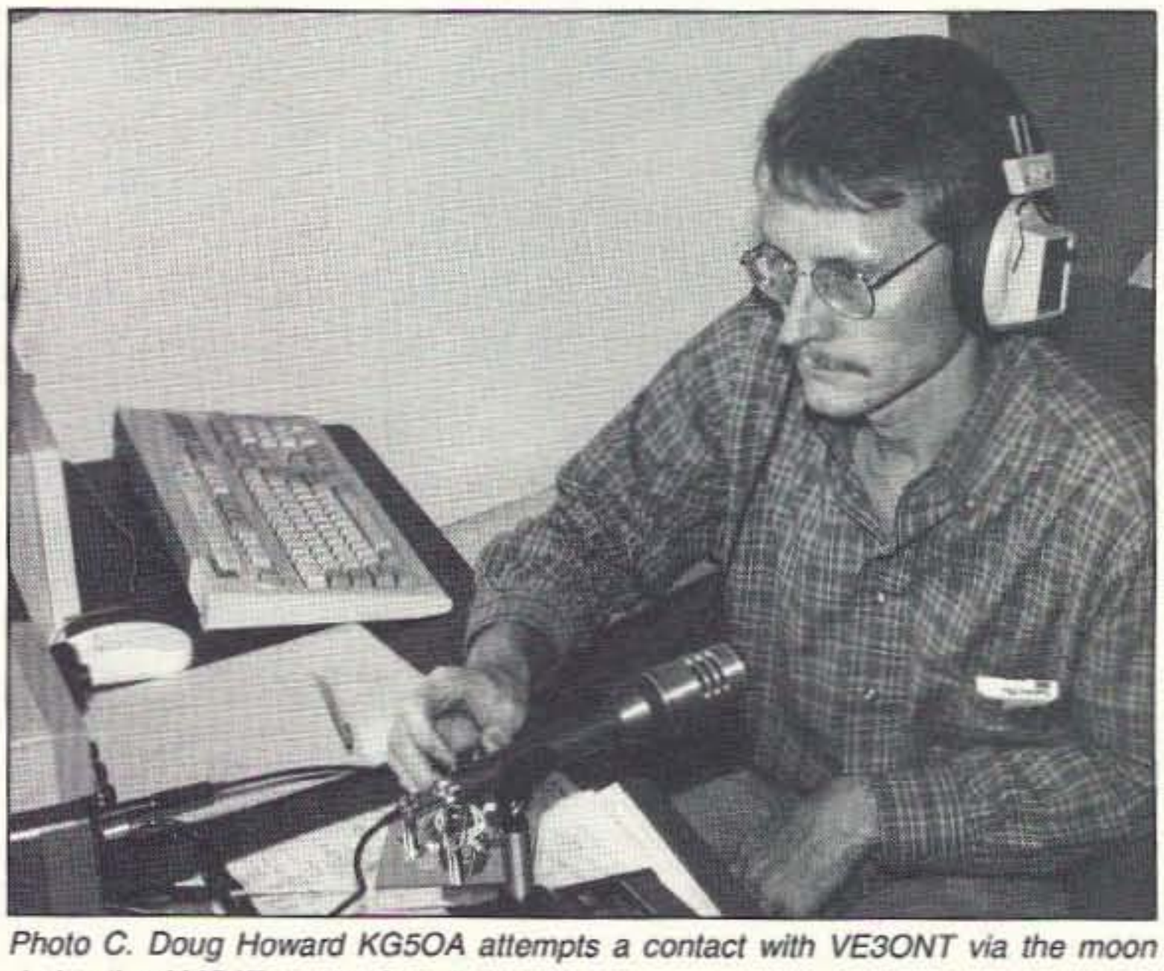

Photo C. Doug Howard KG5OA attempts a contact with VE3ONT via the moon during the AMSAT symposium weekend.

Photo D. Ed Krome KA9LNV demonstrated his portable 2.4 GHz receive system for Mode "S" via OSCAR-13.

Photo E. Ed Krome KA9LNV at home with the three-foot dish for SSB reception using OSCAR-13 and his 15-inch "WOK" reflector for successful CW reception via 2.4 GHz, Mode "S." (KA9LNV photo.)

microwave reception.

Jim White WDØE discussed efforts to bring the *DOVE* satellite back on-line. He has been working with Bill McCaa KØRZ and Bob Diersing N5AHD to uplink new software to the satellite. Significant progress has been achieved by the team since the symposium weekend. Packet telemetry output has been enabled and digital voice transmissions are expected to follow.

Darrel Emerson AA7FV presented his findings on digital processing of weak signals buried in the noise. Using only a modest antenna system, Darrel has copied signals sent via A-O-13 30 dB below the signal level of the satellite's telemetry beacon. Using receiver filtering and tape-recordings that sound more like noise, he has analyzed the data using a sound-blaster-type board in a PC to literally extract information from the random background. The process was quite involved but yielded results and his description delighted the symposium attendees. Darrel has gone on to try his hand at other weak-signal detection experiments.

Other Saturday talks included those by Greg Jones WD5IVD concerning the joint TAPR/AMSAT DSP program, Bob Argyle KB7KCL on the status of the WEBERSAT project, and Brad Reed on commercial solar arrays for satellites. The long day concluded with a question and answer session with the AMSAT Board of Directors, a dinner banquet followed by a fine speech from AMSAT-UK Secretary Ron Broadbent G3AAJ, then the recognition awards and prize drawings.

Sunday

Following the Field Operations Breakfast at 7 a.m., the talks began again with AMSAT-LU (Argentina) Vice President Gustavo Carpignano LW2DTZ and his summary of the Voice Experiment Satellite (VOXSAT) program. With one very functional satellite already in orbit, the Argentina group is working to get another ready for orbit.

More papers were presented throughout the morning on topics ranging from microsat ground stations to the efforts in Sweden to develop a satellite education program. At the same time, the AMSAT Board of Directors meeting began.

Bill Tynan coordinated the board meeting which lasted through mid-Monday with a few breaks for food and sleep. The agenda covered many items including publications, SAREX, the DSP project status, long-range planning, commercial relationships, new satellites, and the budget. AMSAT has a significant challenge ahead to pay its part of P-3-D and still maintain its many other activities. Work on fund raising will continue to dominate AMSAT's operations 'til launch in late 1996.

The North Texas AMSAT group did a great job coordinating the AMSAT Space Symposium and General Meeting in 1993. Orlando, Florida, is the site for the 1994 meeting. It is sure to be a fascinating event since many of the key mechanical parts for Phase-3-D will be there for participants to see.

Copies of the *Proceedings* of the symposium are available from AMSAT or the ARRL. The book is 8-1/2" by 11", nearly 300 pages, and softbound. It's well worth the cover price of $12. AMSAT can be contacted at 1-213-589-6062 for details on shipping charges.

Straight Key Night

For many years the ARRL has sponsored Straight Key Night (SKN) on New Year's Eve and New Year's Day. In 1972 a group of satellite chasers decided to try their hand at some straight key CW via OSCAR-6 during SKN. The idea caught on and the tradition has been maintained whenever there has been a satellite available for the event.

AMSAT Executive Vice President Ray Soifer W2RS invites interested satellite operators to participate in the 22nd annual SKN via OSCAR. He reports that there are no rules, no scoring and no need to send in a log. Just call CQ SKN in the CW passband segment of an OSCAR between 0000 and 2359 UTC on January 1, 1994, or answer a CQ SKN call from another station. Contacts via the moon also count. Nominations for best "fist" can be sent to W2RS @ WA2SNA.NJ.USA.NA via packet, or toW2RS@AMSAT.ORG via the Internet. You can also use his *Callbook* address. 73

Number 11 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

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

Happy New Year! As we begin 1994, let's cuddle up by the fire with some letters and see what you all have to say.

The OS-9

Daniel P. Lindsley N5AGG of Bath, Maine, writes regarding a reference to OS-9 in the September 1993 column. He has worked with Motorola 6800s for some time and has never heard of it, and wonders just what it is.

Well, Daniel, as you are aware, a microprocessor is just a chip until some program tells it to do something. In most general purpose computers, a supervisory program, called an Operating System, handles the tasks of input/output (I/O), communicating with storage devices, memory, and the like. In the case of the currently popular Intel-based systems, the supervisory program is the MicroSoft Disk Operating System, or MS-DOS. In the dim Dark Ages of eight-bit (or, shudder, four-bit) computing, we often called it a "monitor" program, and each chip had its own. A common program to run the Motorola 6800 was the MIKBUG program, distributed by Motorola. A bit later came SWTBUG, from Southwest Technical Products, and other simple monitors.

With the introduction of the 6809 CPU, Motorola and Microware Systems Corporation got together and modeled an operating system based on UNIX, which had been pioneered at Bell Laboratories. Much of what OS-9 encompassed, while familiar to us now, was at the cutting edge of innovation in the early 1980s. A system composed of a kernel, unified input/output system, and device drivers characterized OS-9, and allowed it to implement a multi-user, multitasking operating system while Intel chips were just starting to access hard drives.

One of the primary marketing strongholds at the time was the Tandy Corporation which, through its Radio Shack stores, had introduced the Tandy Color Computer, based on the 6809 chip. By porting OS-9 to the Color Computer, Tandy spawned a cottage industry of add-on products, including displays, storage devices, and other accessories, that vastly expanded the capacity of what would otherwise be a simple little computer. Unfortunately, OS-9 suffered from one central flaw: lack of software support. While basic programs, such as word processors, spreadsheets, and games, were available for OS-9 systems, the rapid growth of the MS-DOS system at the same time usurped the impetus for software innovation, and the system slowly withered and died. Tandy ceased supporting it, and no major manufacturer stepped in.

You can still find some independent sources for OS-9 if you look around, and every once in a while a local Radio Shack will have a clearance sale on software or hardware. Keep your eyes open and you might luck out.

Needed and Offered Items

Last month, I presented some information about the Flesher TU-470 terminal unit. Well, "Mitch" Mitchell WA4OSR of Mobile, Alabama, is looking for some help with the IRL FSK-1000. He would like to use the unit on RTTY, but does not have a manual for it. Does anyone out there have a manual we could forward to Mitch? Let me know, and I'll try to put you in touch. He is also looking for a HAL CRI-200 modem. He says he had one of these a while back, but he let a friend talk him out of it. If you have one that you would be willing to part with, send that information along as well.

California hams, listen up. Joseph J. Brugman WB6ALI in Whittier, California tells us that he will be moving in a few months, and will need to dispose of some equipment. He asks if someone wants a museum piece, or if he will have to haul it to the dump. The items in question are an old Model 15, a Model 19, and an ASR-33 teleprinter. He is anxious to hear from anyone who wants any or all of these, presuming they are still available when this column is printed. Let me know, and I will send the information to him forthwith!

Thanks to Rich Carter KN4WJ who came through with a solution for Michael Mihailovic VK2OZ in Sydney, Australia. Michael was looking for some older Kantronics information on AMTOR, and Rich had a copy of the book he was looking for. A copy of same is now winging its way Down Under, and I thank Rich for lending a hand.

Norman Beasley P29NB/KO4CB in Papua, New Guinea, writes wondering if any of the RTTY programs around will work with modems built into laptop computers. I really don't think so, Norm. You see, the tone pairs used for RTTY are just straightforward frequency shift keying, whereas, depending on baud rate, telephone modem tones can be straight tones all the way up to modulated sets of tones. So, sorry to say, I don't think it is practical.

At least one of the programs around, BayCom, which is part of the "RTTY Loop" collection described below, comes with a circuit for a simple interface. If you want to keep things simple that may well be one way to go.

Where to Find RTTY

Several of you have recently asked that perennial question, "Where can I find RTTY?" Well, let me give you two frequencies and a suggestion. On HF, the most active RTTY frequency centers around 3620 kHz and 14080 kHz. These are both FSK, of course, and 60 wpm, 45.45 baud, Baudot still predominates. On VHF, my suggestion is to ask around. In some areas, you will find a simplex frequency active; in others there may be an RTTY repeater. Listen and ask, and you may turn something up. Packet or AMTOR are different subjects, and we may touch on them another time.

Regards as well to Bud Boulton WA8CFP of Spring Hill, Florida. Yes, the four "RTTY Loop" collections remain available. Collections #1, #2, and #4 are compendiums of ham radio, RTTY, and packet programs culled from various sources. Collection #3 is an assortment of archiving and dearchiving utilities essential to efficient operation. Each may be had by sending me sufficient blank disks, return stamped mailers, and $2 per disk to be filled, specifying the collection or collections desired. Remember that each collection just about fills a 3.5" 1.44 Mb high density disk, so if you are sending disks of lesser capacity, adjust the quantity accordingly.

As always, please contact me at the above address, or electronically via CompuServe (ppn 75036,2501), America Online (MarcWA3AJR), or Delphi (MarcWA3AJR). Inventive users have even sent Email through electronic portals from other services to me on CompuServe and AOL—isn't the global community wonderful?

One of the items in the works includes a look back to an interesting circuit published in *73* over 10 years ago. That's from a reader's question. Feel free to ask yours! I look forward to it. 73

UPDATES

Number 12 on your Feedback card

The FARA Project

Drilled and etched PC boards are now available for the above-mentioned 2 meter amplifier project (November 1993, p. 10). You can order one from FAR Circuits, 18N640 Field Ct., Dundee IL 60118. The price is $9 plus $1.50 S&H.

You may also be interested in knowing the relay K1 is available from Mouser Electronics, (800) 346-6873, Part Number 431-OVR-SH-212L. The Bud Box is available from Gerber Electronics, (800) 225-1800. Q1 is available from RF Parts, (800) 737-2787. Happy home-brewing! 73

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CARR'S CORNER

Joseph J. Carr K4IPV
P.O. Box 1099
Falls Church VA 22041

Building Small DC Power Supplies, Part 2: The Voltage Regulated Supply

Last month we took a brief look at the basic low-voltage, low-current (LVLC) DC power supply. These supplies are used to power solid-state circuits. They have output voltage ratings of 1.5 VDC to 28 VDC, with +5 VDC, +9 VDC and +12 VDC being most common. Some circuits also need negative output voltages in the same values. The current ratings range from 100 mA to 5 amperes, with 1 ampere (1,000 mA) being most common. In this installment, we will take a look at small voltage-regulated power supplies.

Why Voltage Regulation?

Most electronic circuits work better when the applied DC voltage is stable. Oscillators, for example, will "pull" slightly in frequency when the DC power supply voltage changes. When you hear it on CW, this phenomenon is called "chirp," and is undesirable (not to mention illegal).

The principal reasons that DC power supply outputs vary are: 1) variation in the AC input voltage and 2) variation in the load current drawn from the power supply. The input voltage variation is from the AC power mains, and there is little practical that one can do about it on the AC side. Normally, the "110 volt" AC line will vary from 105 to 125 VAC RMS. At my house, the meter tends to sit between 120 and 124 volts most of the time. During "brown-out" conditions, seen mostly in the summer months when huge amounts of current from air conditioners strain the system, the voltage might drop to 95 volts or so.

The mechanism of voltage variation from changes in DC load current is shown in Figure 1. Here we have a representative "equivalent circuit" containing a load resistance (R_L), a load current (I), an ideal (lossless) voltage source (V), and an internal resistance (R_S). It is this internal resistance that is the problem. When switch S1 is open, the load is disconnected from the power supply. Voltmeter M1 will read the full value of V. At this time, Vo does not appear. But when S1 is closed, the load is connected to the voltage source, and current I flows. The output voltage V_O will be $V - V_S$, or $V - IR_S$. As I varies, so do V_S and V_O.

Although one can reduce the effects of the load current variation, it cannot be eliminated altogether. The "cure" is to make the current capacity of the power supply much larger than the required load current. But this method is expensive, wasteful and heavy (components weigh a lot). A better way is to use voltage regulation . . . it will take care of both forms of variation.

Another value for voltage regulation was shown to me by a salesman named Walter who used to call on a shop where I was employed in the early 1960s. We serviced car radios and two-way radios, and as a result required bench power supplies. Walter came in and told me he could sell me a DC bench power supply " . . . with the equivalent of 1,000,000 µF (1 farad) of ripple filtering. Although I was initially skeptical, Walter was right. The power supply was voltage-regulated (a rarity in those days) with a solid-state voltage regulator circuit, and the voltage regulation reduces dramatically the amount of ripple.

Photo A shows the ripple before (top trace) and after (bottom trace) the voltage regulator circuit. The circuit used for this measurement was a moderately loaded 12 VDC, 1 ampere, DC power supply. Note that the "before" ripple is about the same as we saw last month for the 1,000 µF case. The ripple factor was about 400 mV. The bottom trace shows 5 mV of ripple which, because the top and bottom scales were taken using the same vertical deflection factor, barely makes a difference from a purely straight line. That's where Walter got his "1,000,000 µF" of ripple reduction.

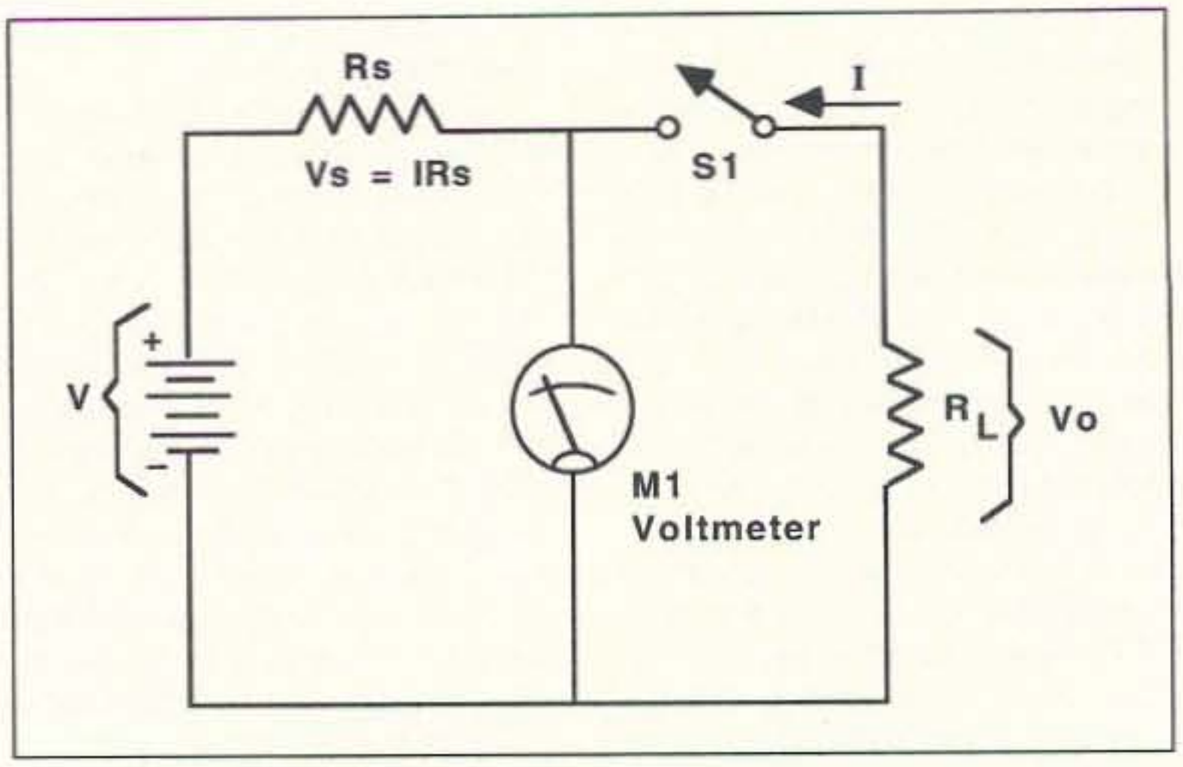

Figure 1. Equivalent circuit showing how voltage variation occurs.

Figure 2 shows the basic circuit for a voltage-regulated DC power supply that is based on the circuit we discussed last month, married to a three-terminal integrated circuit voltage regulator device (IC1). The rectifier is selected according to the criteria we used last month, i.e. a peak inverse voltage (PIV) of not less than 2.83 times the RMS voltage of the transformer (T1) secondary, and a forward current rating equal to not less than the maximum load current (plus a little reserve if you are conservative). As a practical matter, a 1,000 volt PIV, 1 ampere bridge rectifier will suffice for all 5 to 28 volt DC, 1 ampere, power supplies.

The regulator shown here is a positive voltage regulator; i.e. the input and output voltages are positive with respect to common (which in this case is a chassis ground). Several different forms of regulator are available in various combinations of current and regulated output voltage. For positive regulators, the two main lines are the LM-340n-xx and the 78xx (which for practical purposes are interchangeable). In both cases, the "xx" is replaced with the required output voltage, and the "n" with a letter denoting the package style. For example, the LM-340-05 (or LM-340-5) and 7805 are +5 VDC output regulators, while the LM-340-12 and 7812 are +12 volt regulators.

The current rating of the voltage regulator is given by a letter designation in the LM-340n-xx series, and sometimes in the 78xx series as well. The "T" package is a TO-220 three-lead plastic package similar to certain plastic audio power transistors. It is often rated at 1,000 mA (1A), although without a good heat sink 750 mA is more like it. The "K" package is the same as a TO-3 diamond-shaped power transistor package. It is good for 1 ampere, and in certain configurations (with a heat sink) up to 5 amperes. For example, the LM-323 is a +5 VDC, 3 amp regulator, while LM-338 is a 5 amp variable voltage regulator. In labeling the LM-340n-xx, therefore, an LM-340T-xx is capable of 750/1000 mA depending on heat sinking or your courage, and LM-340K-xx is a 1 ampere regulator.

The filter capacitor in Figure 2 is C3. The general rule for setting the value of this ripple filter for voltage-regulated circuits is to use 2,000 µF per ampere of maximum load current (some people accept 1,000 µF/ampere). For this reason, in the 1 ampere supply of Figure 2, the capacitor is set to 2,000 µF (more can be used, if desired—it's not that critical).

Capacitors C4 and C5 are intended to guard the regulator (IC1) from noise transients propagated on the input power, and from RF that gets into the circuit. These capacitors should be 0.1 µF to 1.0 µF, and are mounted as close as possible to the body of the voltage regulator. Capacitor C6 is set according to the rule: 100 µF/ampere. Its purpose is to guard against sudden, rapid rise time, changes in load current demand. It holds a small charge that dumps into the circuit when the load changes, while giving the regulator its necessary milliseconds to catch up. Capacitor C7 is optional, but is required in power supplies used in ham stations. It guards against the RF that might arrive through the DC output terminals. Place C7 as close as possible to the output terminals.

Diode D1 is used to prevent charge in capacitor C6 from causing damage to the voltage regulator during shutdown. It has a current rating of 1 ampere, and a voltage rating of 1,000 volts PIV.

Note that a heat sink is shown on IC1, the voltage regulator IC device. If the regulator is used in a circuit that can output more than about half the full rated output of the regulator, then it's a good idea to use a heat sink.

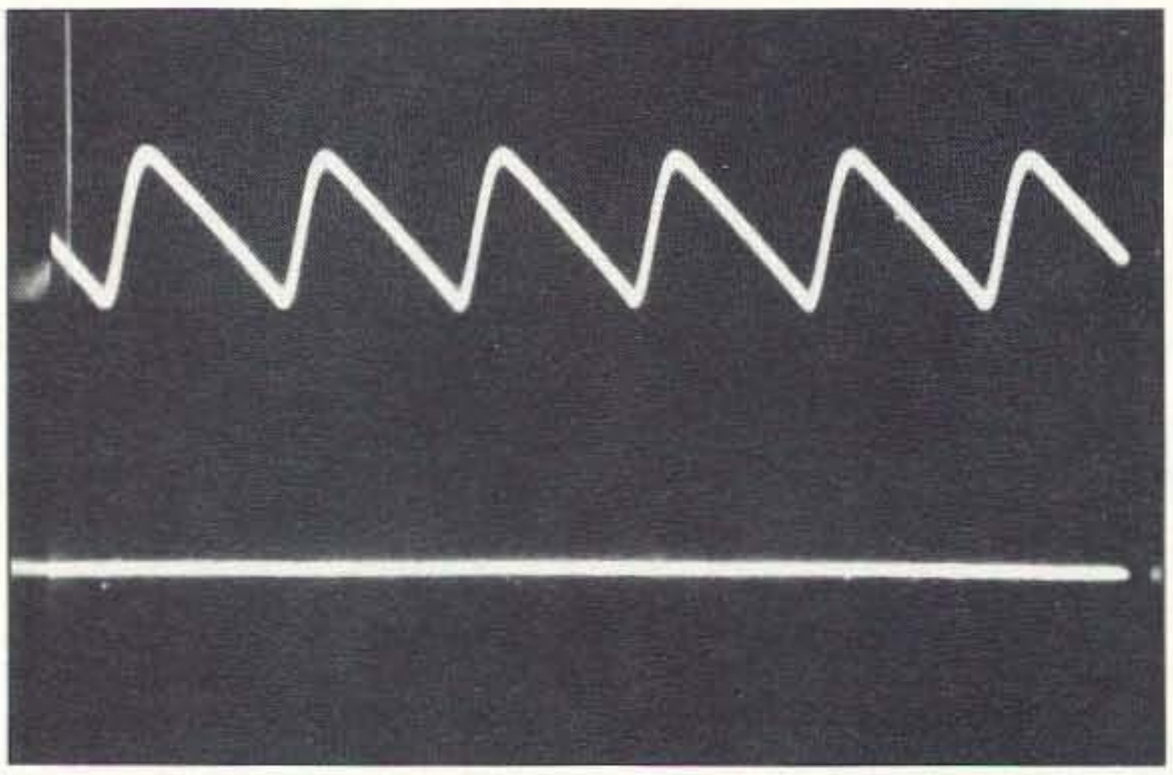

Photo A. Top trace is ripple at the input of the regulator, and the bottom trace is the ripple at the output (to same scale).

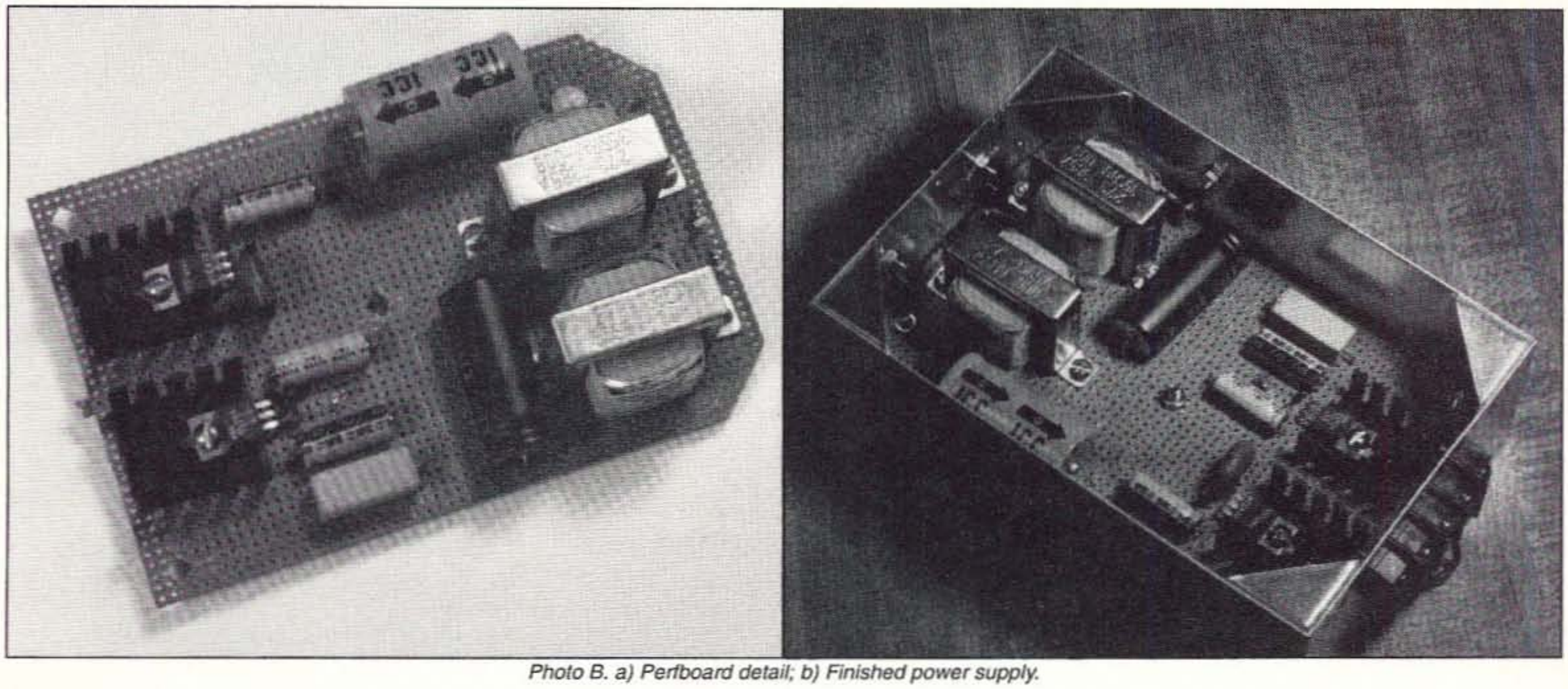

Photo B. a) Perfboard detail; b) Finished power supply.

The mounting tab of "T" package devices, and the case on "K" package devices, is also ground, so be aware that the heat sink will also be ground (keep hot leads away from it).

Photo B(a) shows the construction of a simple 1 ampere, low voltage DC power supply wiring board, while Photo B(b) shows a typical finished product. The wiring is done "point-to-point" on the back of a piece of perforated wiring board. This board is available from most parts distributors (for perfboard and other DC power supply components, see the catalog of Ocean State Electronics, POB 1458, Westerly RI 02891; 1-800-866-6626). Note in Photo B(a) the use of heat sinks on the "T" package regulators. Also note the wide spacing between the heat sinks. Also note that the transformers are mounted on the board. This type of construction should only be used for small, low-current applications. Heavier transformers will best be mounted on the chassis.

The chassis shown here is a shielded box . . . which is a good idea for a regulated power supply used around (or inside) radio transmitting equipment. For a bench power supply, use an appropriate cabinet.

Packet Radio Buffs

Dave Wolf WO5H sent me a copy of his new *Packet Power Newsletter.* It's an eight-page monthly intended to keep packet buffs up to date. He tells me that readers of this column can get a free complimentary copy if they mention this column and send a self-addressed stamped envelope (SASE). Sample copies are normally $1. Looks pretty good for packet buffs. 73

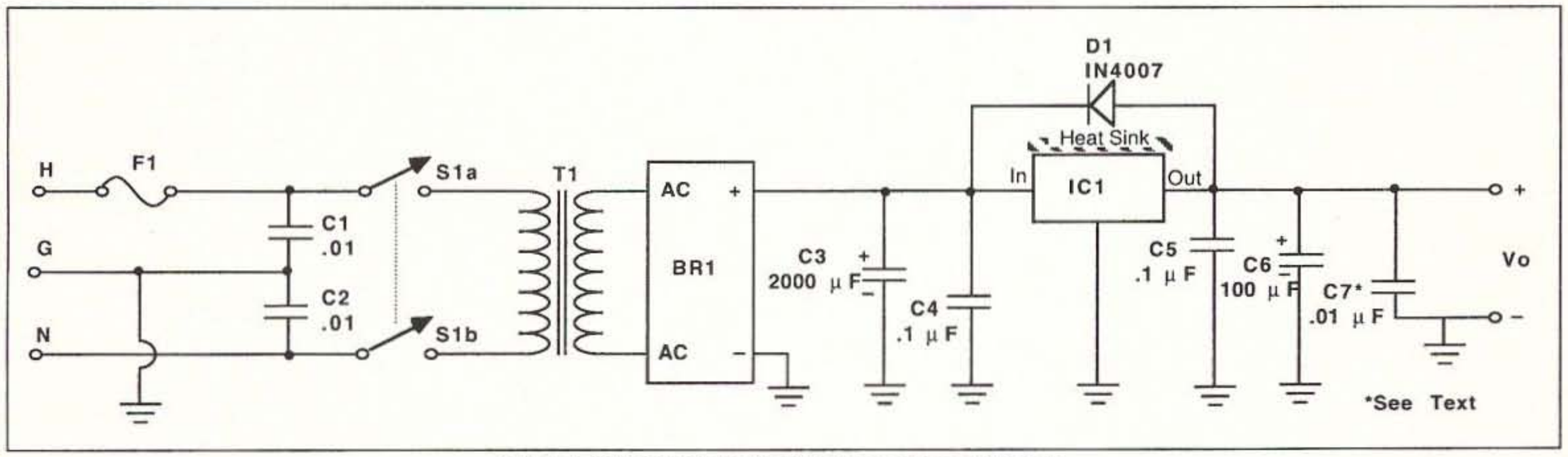

Figure 2. Circuit for the basic voltage regulator power supply.

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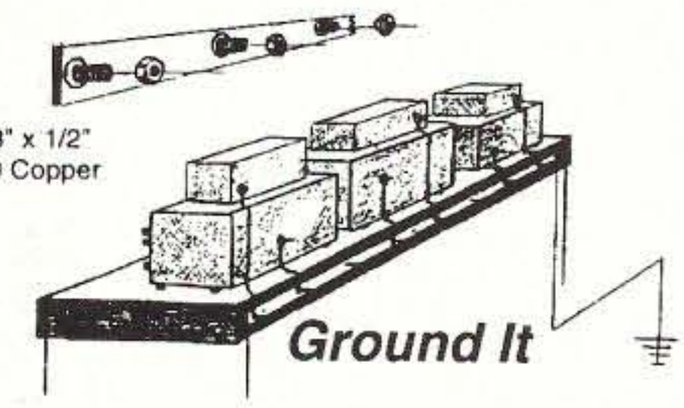

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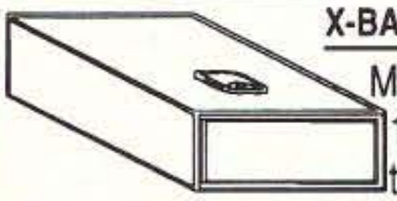

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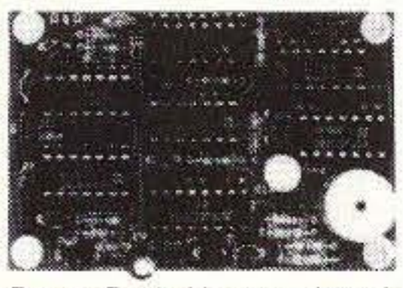

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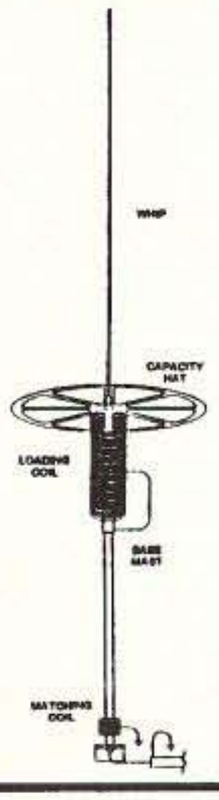

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Model	Pin (W)	Pout (W)	Ic (A)	Gain/NF (dB)	(13.8 V) Type
50 MHz					
0503G	1-5	10-50	6	15/0.6	LPA
0508G	1	170	28	15/0.6	Standard
0508R	1	170	28	–/–	Repeater
0510G	10	170	25	15/0.6	Standard
0510R	10	170	25	–/–	Repeater
0550G	5-10	375'	60	15/0.6	HPA
0550RH	5-10	375	60	–/–	Repeater HPA
0552G	25-40	375	55	15/0.6	HPA
0552RH	25-40	375	55	–/–	Repeater HPA
144 MHz					
1403G	1-5	10-50	6	15/0.6	LPA
1406G	25	100	12	15/0.6	Standard
1409G	2	150	25	15/0.6	Standard
1409R	2	150	24	–/–	Repeater
1410G	10	160	25	15/0.6	Standard
1410R	10	160	24	–/–	Repeater
1412G	25-45	160	20	15/0.6	Standard
1412R	25-45	160	19	–/–	Repeater
1450G	5	350	56	15/0.6	HPA
1450RH	5	350	56	–/–	Repeater HPA
1452G	25	350	50	15/0.6	HPA
1452RH	25	350	50	–/–	Repeater HPA
1454G	50-100	350	40	15/0.6	HPA
1454RH	50-100	350	40	–/–	Repeater HPA
220 MHz					
2203G	1-5	10-40	6	14/0.7	LPA
2210G	10	130	20	14/0.7	Standard
2210R	10	130	19	–/–	Repeater
2212G	30	130	16	14/0.7	Standard
2212R	30	130	15	–/–	Repeater
2250G	5	220	40	14/0.7	HPA
2250RH	5	250	40	–/–	Repeater HPA
2252G	25	220	36	14/0.7	HPA
2252RH	25	250	36	–/–	Repeater HPA
2254G	75	220	32	14/07	HPA
2254RH	75	250	32	–/–	Repeater HPA
440 MHz					
4403G	1-5	7-25	4	12/1.1	LPA
4410G	10	100	19	12/1.1	Standard
4410R	10	100	18	–/–	Repeater
4412G	20-30	100	19	12/1.1	Standard
4412R	20-30	100	18	–/–	Repeater
4448G	5	100	22	12/1.1	HPA
4448R	5	100	22	–/–	Repeater HPA
4450G	5-10	175	34	12/1.1	HPA
4450RE	5-10	175	34	–/–	Repeater HPA
4452G	25	175	29	12/1.1	HPA
4452RE	25	175	29	–/–	Repeater HPA
4454G	75	175	25	12/1.1	HPA
4454RE	75	175	25	–/–	Repeater HPA

MODEL 1410G
STANDARD

MODEL 1450G
HPA

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RX Preamplifiers

Band	Model	NF (dB)	Gain (dB)	Connector
50 MHz	0520B	.5	25	BNC
50 MHz	0520N	.5	25	N
144 MHz	1420B	.5	24	BNC
144 MHz	1420N	.5	24	N
220 MHz	2220B	.5	22	BNC
220 MHz	2220N	.5	22	N
440 MHz	4420B	.5	18	GNC
440 MHz	4420N	.5	18	N
1.2 GHz	1020B	.9	14	BNC
1.2 GHz	1020N	.9	14	N

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HOMING IN

Number 15 on your Feedback card

Radio Direction Finding

Joe Moell P.E. KØOV
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Fullerton CA 92633

Ploys and Pranks

"If I had to choose just one part of ham radio to do all the time, it would be transmitter hunting. I love it!" Those aren't my words, though they could be. They came from Tom Lewis AB5CK of Grapevine, Texas. Hams from all over have expressed similar sentiments to me in letters and e-mail about radio direction finding (RDF) activities. T-hunts and foxhunts (as competitive RDF events are called) continue to attract new participants across the country and around the world.

Be prepared for adventure when you set out on a mobile hidden transmitter hunt. You never know where you'll end up and you can never be sure what you'll find. A good "fox" will have some surprises planned to challenge your RDF and deductive abilities. Your fellow hunters will be doing their best to see that you don't find the T first or have lowest elapsed mileage, depending on the rules of the hunt.

In previous "Homing In" columns, I categorized the sneaky, yet legal, techniques for confounding hunters, namely:

1. Deceptive signal parameters
2. Apparent inaccessibility
3. Indirect signal paths
4. Concealment and camouflage

I have explained that a hunt can be made easy or hard depending on the hider's choice of power level, antenna aiming, signal polarization, and transmitter timing. Darryl Widman KF6DI must have read this because his transmitter timing gave fits to participants in the advanced mobile hunt at the 1993 ARRL Southwestern Division convention in Ventura, California. Each signal burst was only a fifth of a second in duration. Transmissions were six seconds apart.

As a hunter in this event, I can attest to the difficulty of trying to read signal strength of a 200-millisecond signal pulse on a heavily-damped S-meter. A fast bar graph or audio tone strength indicator worked much better. A Doppler set is usually the best choice of RDF gear for a hunt like this, but I didn't have mine along. Only one team used a Doppler that day. That pair did not find the transmitter, probably due to copious signal reflections. The others did, eventually.

KF6DI's T was 40 miles up the coast in Santa Barbara, nestled in heavy brush at the base of a tree. The J antenna up in the branches was well camouflaged with green garden hose around the elements (Photo A). Not far away was a box at the base of another tree that flashed and clicked at the same rate as the real T. Anyone finding and reporting this decoy to the huntmaster wasted valuable time on this first-finder-wins event.

Hamfest High Jinks

Most regularly scheduled T-hunts have a set of firm rules that bound the hunt area and establish the expected hidden T on/off timing. These rules usually prohibit moving or multiple transmitters except on advanced level hunts. At conventions and hamfests, however, there need be no hunt rules. Hiders have much more latitude. A valuable prize warrants a special challenge. Some hiders say, "If the hunters don't complain, the hunt wasn't hard enough."

The two-hour on-foot foxhunt at the 1993 ARRL Texas State convention was not too hard and not too easy. According to hunter Tom Lewis AB5CK, "The only information provided was that there were multiple T's transmitting at different times on the same frequency. Ticket stubs were given out sequentially at each T, and the lowest numbered stubs would determine the winner in the event of a tie. After the hunt, we learned that there were seven foxes. Five of them were hams using handie-talkies, positioned at various locations around the convention property.

"The last two foxes were more difficult," Tom wrote. "One was remotely operated in the middle of a large open field of tall grass. It was impossible to see unless you were standing directly over it. The last one was even tougher. A ham had it hidden in his briefcase while he milled around the flea market as if he were shopping. There had never been a moving T at this convention before.

"By the way," AB5CK continues, "the ham carrying the briefcase was the same guy who pulled off a trick T at the convention the year before. He positioned himself in the middle of the flea market with his rig hidden inside a gutted video camera mounted on a tripod. Most of the hunters ran right past him, seeking other T's on the same frequency."

It's great to see the number of hamfest hunts growing. 1993 was the first year for T-hunting at the ARRL state convention at Virginia Beach, Virginia. Jeff Goldstein N4AVJ knew that most competitors would be beginners, so he made his hunt fairly short and simple. But he put out a few decoy pseudo-transmitters in the field at the end point to make things interesting (Photo B).

Canadian Capers

My last visit to Quebec was memorable because of a great Montreal

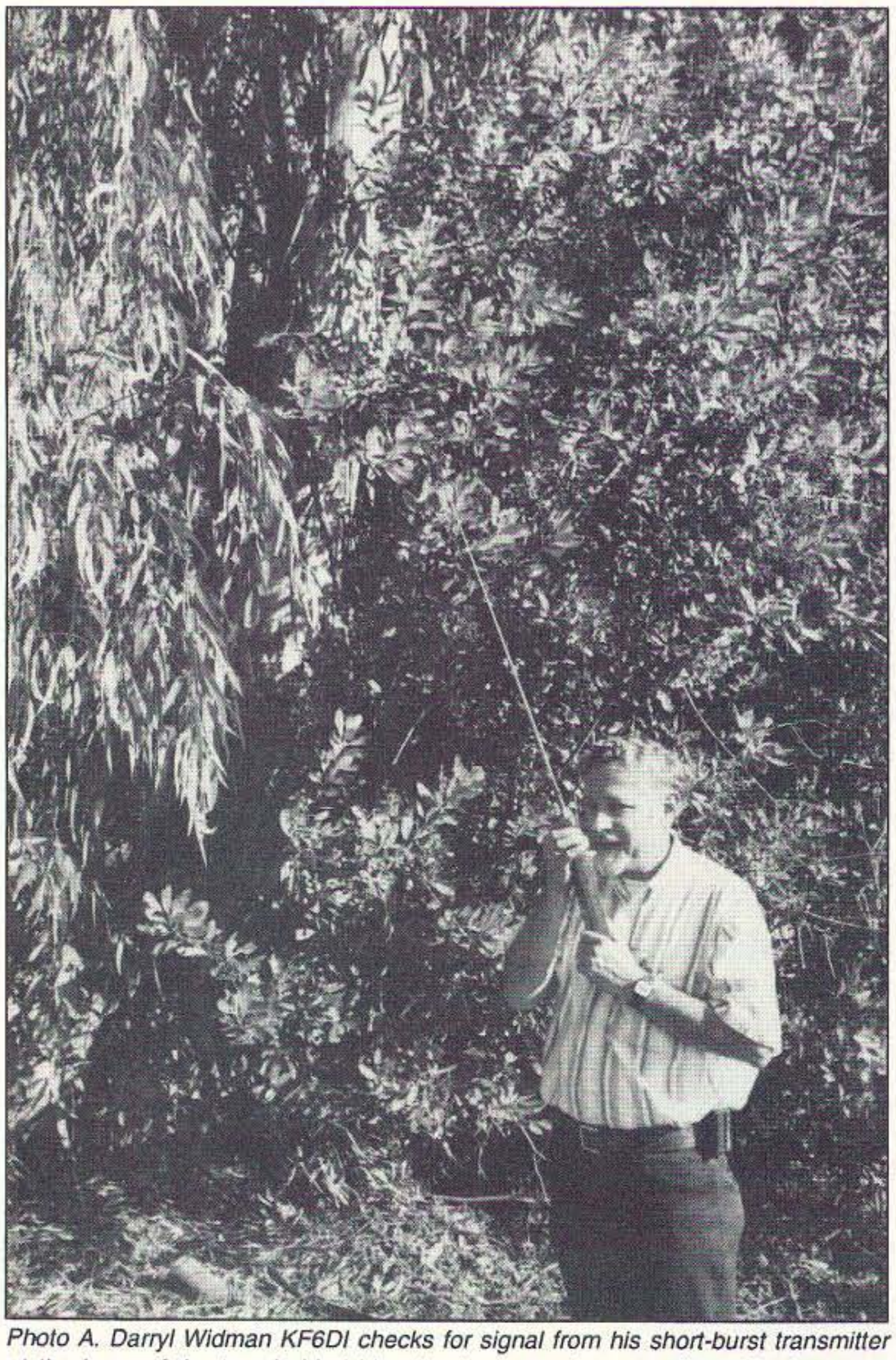

Photo A. Darryl Widman KF6DI checks for signal from his short-burst transmitter at the base of the tree behind him. Its J antenna is camouflaged in the upper branches. Can you see it?

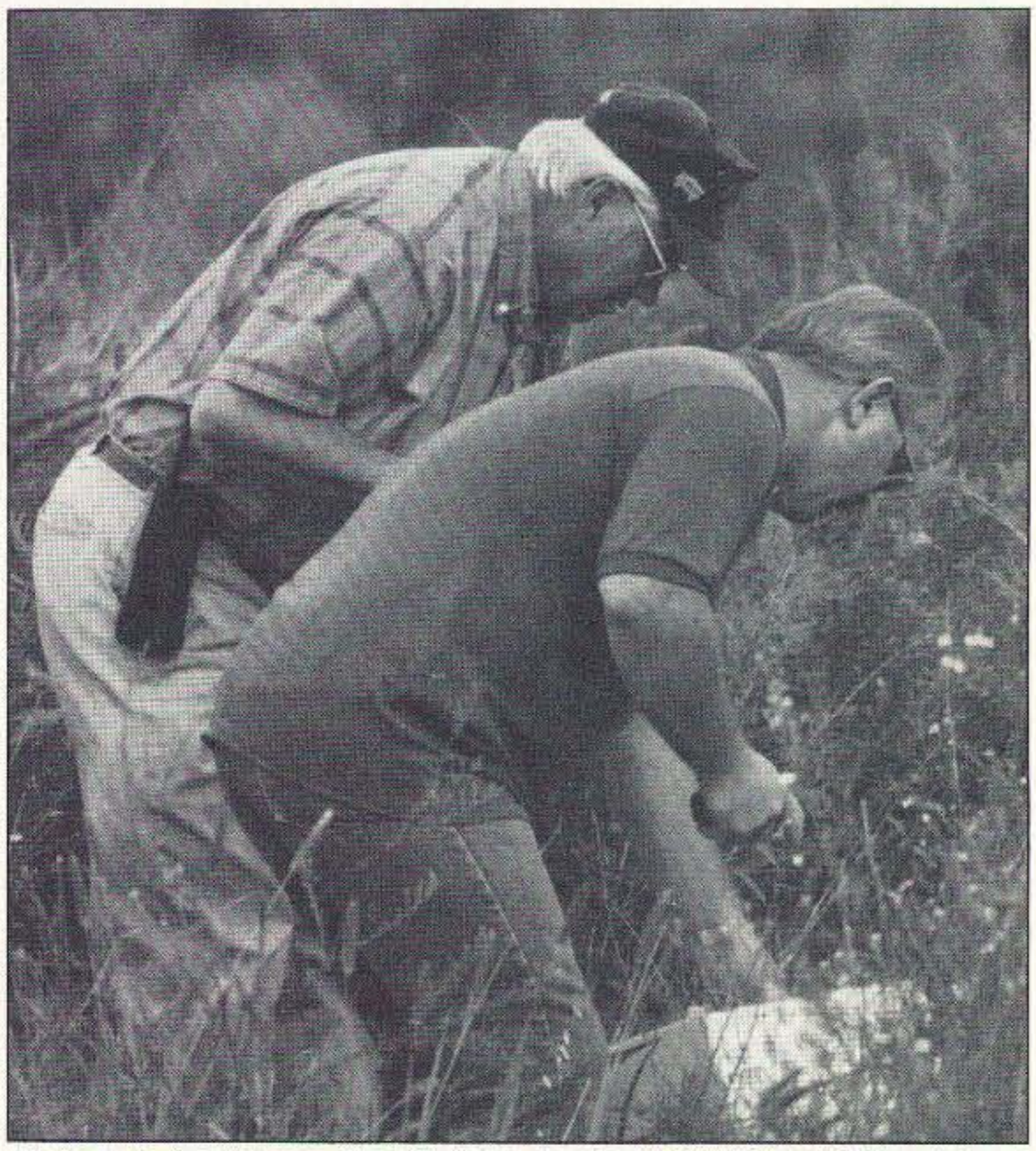

Photo B. Is it a fox or a decoy? James Lambert KC4YIW and Clifton Ireland KN4DV check out a mysterious box during the 1993 Virginia Beach Hamfest T-hunt.

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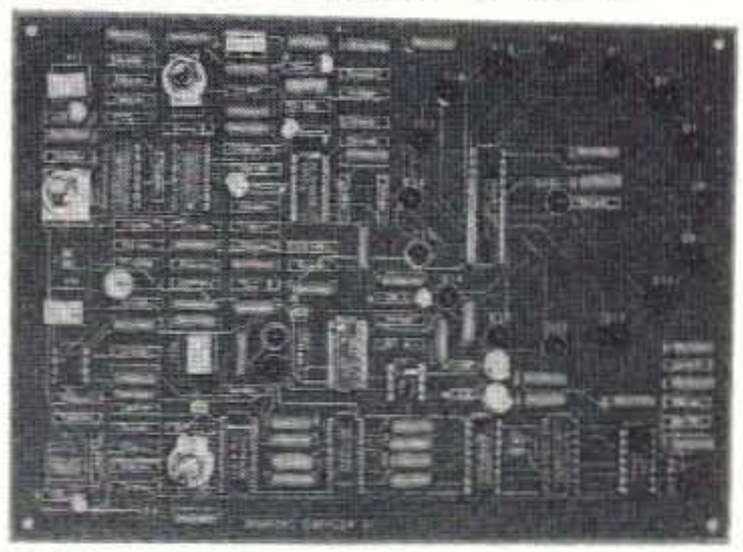

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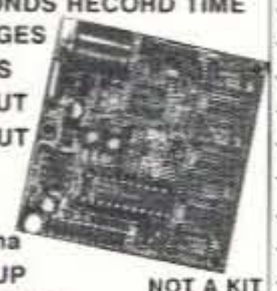

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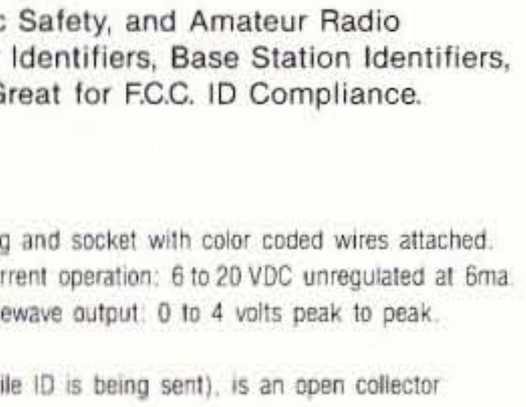

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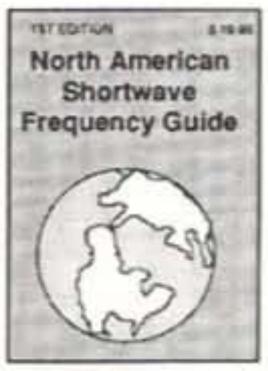

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CIRCLE 276 ON READER SERVICE CARD

Symphony concert. On my next trip there, I want to go T-hunting. It has really caught on in recent months. "Intrepid" is the word for Montreal T-hunters, as they hold hunts all year long. I guess I need to add snowshoes to the suggested hunting gear list!

Eldor Gemst VE3HUG reports Montreal T-hunt activities in the *marcOgram*, his club's newsletter, and also on CompuServe. He says that most hunts are interclub events among the two English and four French ham organizations in the area. His description of the September outing shows the extreme lengths to which Quebec foxes go to foil hunters.

"The organizers of this hunt work for Hydro Quebec, so they had the full resources of that organization behind them," Eldor wrote. "All the bearings led to some railroad tracks with quite heavy brush on both sides. The tracks were fenced in, although the fence had some barely human-sized holes in it. The trick was figuring out which side of the tracks the fox was hidden on. Crossing the tracks could be easily done only in places about three miles on either side of the hottest signal zone, so you had to be pretty sure what side to approach from."

"We guessed wrong," says VE3HUG, "and we had to crawl through the broken fence. At this point we were certain that the T was somewhere inside the fence either in the bush or near the tracks. We searched high and low and eventually found it on the other side of the tracks. Outside the fence was a little dirt path with a "No Trespassing" sign. Barring entrance to the area were two cement posts with heavy pipes in them. At the top of the pipes were caps with a length of chain attached."

Eldor continues, "It turned out that those posts were fakes! The hiders had poured the cement forms around metal-colored plastic pipes and put plastic caps on top. They looked absolutely real. Everyone was certain that the fox lay behind the posts, either in the brush or by the tracks. But the transmitter was actually inside one of the pipes. The numbered tags for hunters to take, showing what position they came in, were only a quarter-inch square and the numbers were in Roman numerals. The material was some kind of metalized stuff laminated with plastic, the same color as the pipe. You'd look at the numbers and think it was some kind of identification of the pipe. Incredible!"

That hunt will be hard to top, but you can be sure the next hiders will try. Note that the T was not actually inside the "No Trespassing" area, which would be against the rules on most hunts. Usually T's can be hidden on private property only if the area is freely accessible to the public at no charge and is not posted as a "No Trespassing" zone.

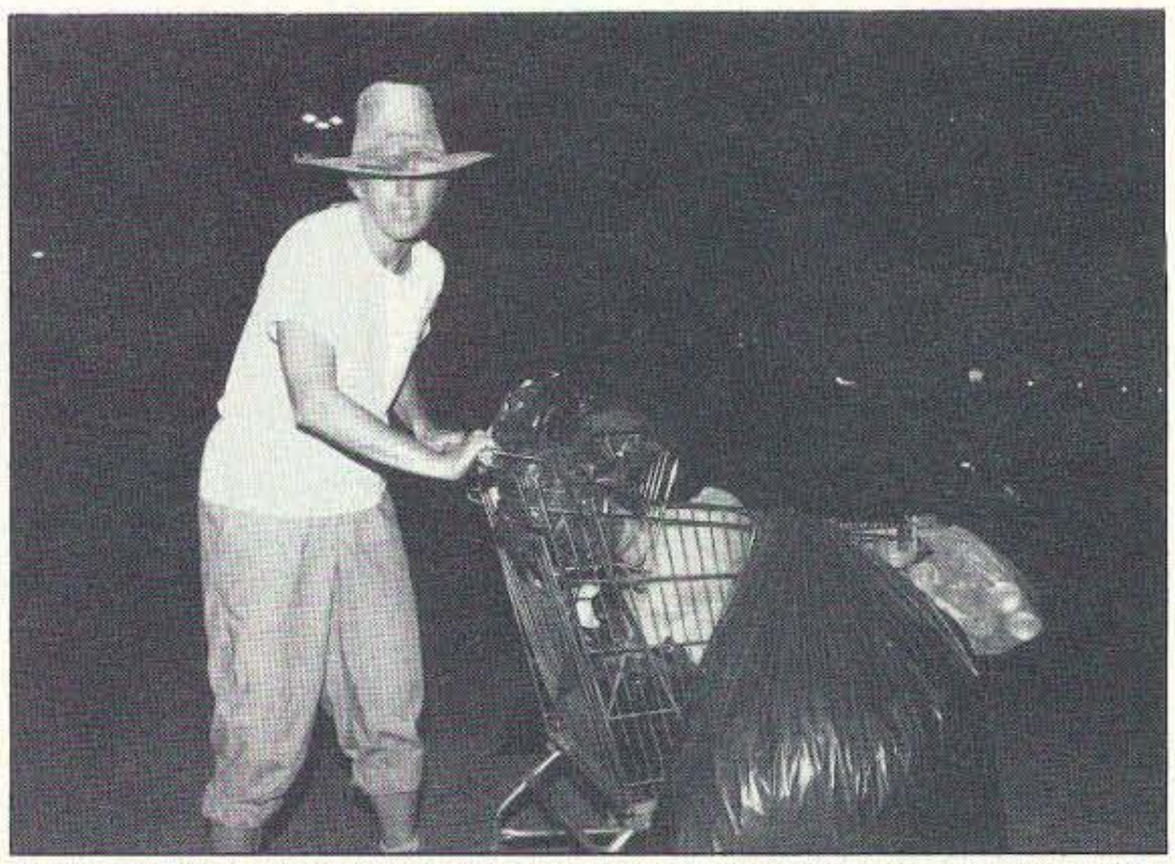

Photo C. Christie Holoubek KØIU is under the tattered straw hat, playing a "bag lady" as fox for the Fullerton Radio Club's monthly nighttime mobile hunt. Look closely to see the battery in the cart.

Shopping Cart Shenanigans

When asked to name a memorable T-hunt, most RDFers will bring up one in which the T was concealed in a particularly clever way. It doesn't have to be a grueling event like the Montreal hunt described above. Christie Holoubek KØIU showed her acting skills by portraying a bag lady in a mall parking lot on a Fullerton (California) Radio Club night hunt. She pushed a junk-laden shopping cart around the lot for three hours with the transmitter concealed among the refuse (Photo C). After 15 miles of mobiling and a drive around the parking lot, would you have suspected her?

Shopping carts are "liberated" from supermarkets every day, but Gary Holoubek WB6GCT asked permission to borrow this one. "Don Frizielle W6HRC and I went to a store and explained to the manager what we wanted to do," he says. "In case security guards thought we had stolen the cart, we had the manager give us his business card with a note on the

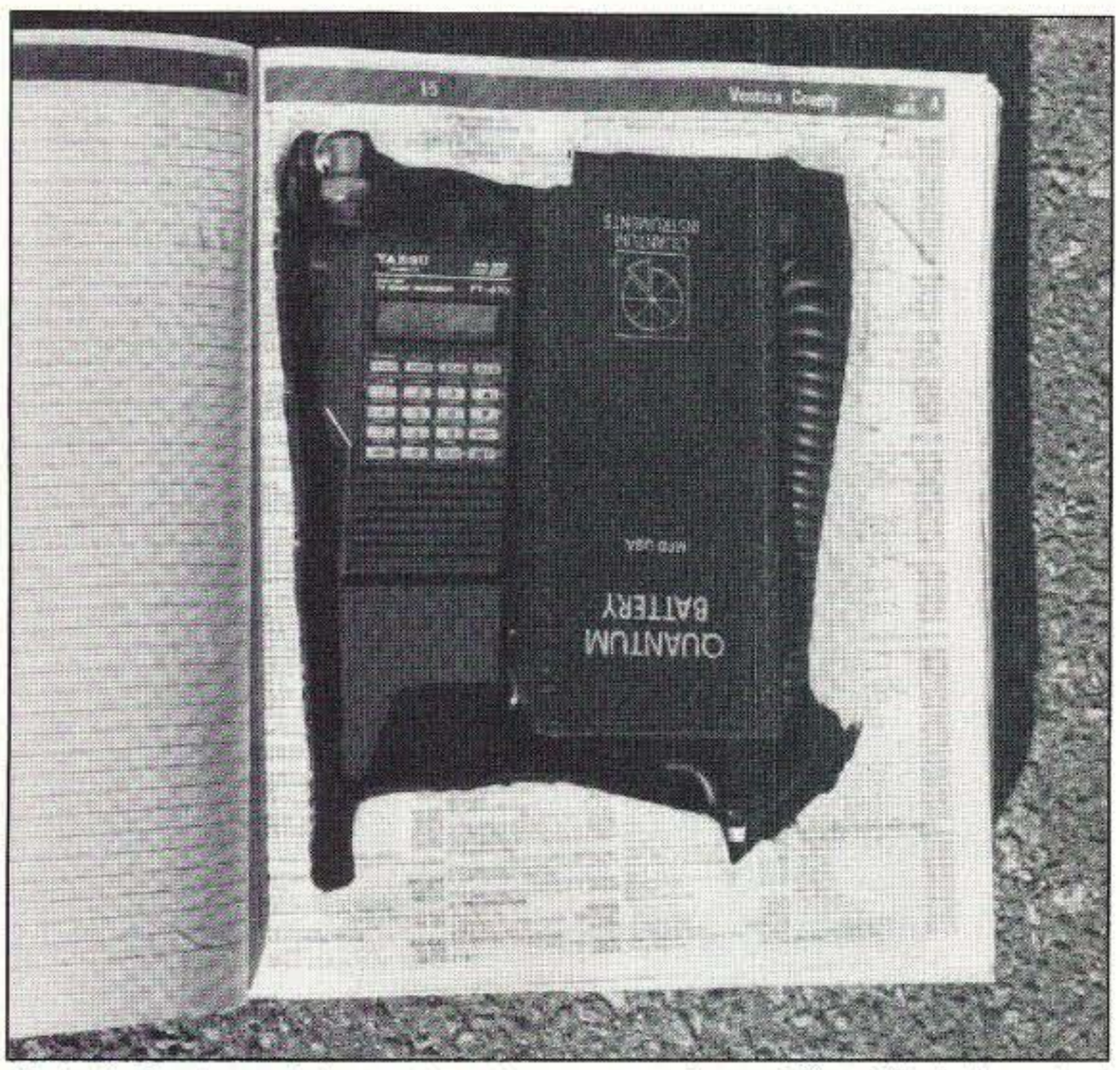

Photo D. Trust your instruments, not your eyes, when sniffing. This hollowed-out phone book in a hotel lobby contained the T at a hamfest beginners' hunt.

back. He was willing to loan us a brand-new cart, but we picked out a ratty looking one with good wheels. After the hunt, we took it right back."

Even a so-called "beginners'" hunt can include a clever concealment surprise. At the aforementioned convention in Ventura, California, KF6DI put on another event especially for brand-new RDFers. It was an on-foot hunt on the hotel grounds. Darryl encouraged everyone to give it a try, even those with no special RDF gear. (The "body shielding" maneuver with a handie-talkie or scanner was adequate for getting bearings.)

As usual, most of these new hunters assumed that the hidden T would be in plain sight, so they hunted mostly with their eyes, not their radios. That was the wrong thing to do! The rig was concealed inside a hollowed-out telephone book (Photo D) underneath a pay phone in the hotel lobby. Most hunters ignored the innocent-looking white pages and kept poking around for something in plain sight that looked like a radio.

Many memorable T-hunts involve lakes and rivers. Baffling bearings can result when the signal source is at the surface of a body of water, due to signal reflections from nearby and distant shores. For one Fullerton Radio Club hunt, Erik Schoedl N6NWW and Michael Foster KC6NHJ transmitted from a rubber duck. No, not a flexible helical 2 meter whip, I mean a real rubber duck, floating on a small lake in Tri-County Park. The real ducks ignored it, mostly.

Marty Mitchell N6ZAV and Byon Garrabrant KD6BCH went a step further, trying for invisibility on an Orange County night hunt in October. They attached a thin 2 meter whip to a piece of black-painted styrofoam and attempted to float it onto a lake with miniature coax back to the transmitter on the muddy shore.

"We put ballast under the styrofoam to hold the antenna erect," Marty says. "Apparently something tangled underwater and the thing kept sinking. My RaCon foxbox got soaked. Next time maybe we'll try putting the T in a radio-controlled submarine. We could eliminate the coax and be able to raise and lower the antenna!"

Keep It Fun

As you can see, being the hidden fox is an opportunity to unleash all your creativity. But don't forget to be fair and to match your subterfuge to the skill level of the hunters. If the majority of them are beginners, go easy by giving plenty of signal, frequent (if not continuous) transmissions, and lots of encouragement. Give them a challenge, but not an impossible task.

As your group's average skill level and equipment inventory increases toward the "expert" category, you can make hunts tougher by shortening transmissions, lowering or varying the signal level, increasing distance, and including stunts like those described above. Of course you won't do anything illegal or make the hunt unsafe for yourself or any hunter, will you? Remember that if participants don't have fun (however they define it), they won't come out to hunt you again next time. Your goal should be to increase the level of camaraderie of the hunt group.

Let's hear about the clever pranks taking place on your local foxhunts. Mail photos and stories to me at the address above. You can send e-mail to JoeMoell@cup.portal.com via Internet or to 75236,2165 on CompuServe. 73

Number 16 on your Feedback card

HAMS WITH CLASS

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Instructors' Workshop

This past summer, I had the pleasure of moderating the workshop for teachers and instructors at the Texas HamCom in Arlington. All those who attended for the full five hours received continuing education credit for 0.5 units. We had 80 folks who came to get ideas and share experiences of using amateur radio in the classroom. It was great!

Due to the length of the workshop, I wanted to be sure to have some lively, interesting speakers. I think that everyone in attendance will agree that every speaker presented valuable information in an "entertaining" manner. Matt McCullar KJ5BA spoke about his and his club's efforts with weather balloons and ham radio. He not only brought us the actual box the rig was packed in, he had a wonderful slide presentation of actual balloon-in-flight pictures to show. The visual aids that each speaker used added a great deal to the presentations.

Vicki Gigante KA3PBS not only joined me as cospeaker at the banquet that weekend, she also made a terrific presentation at the workshop. Vicki is in charge of shuttle retransmissions at the Goddard Space Center. She spoke about SAREX (Shuttle Amateur Radio Experiment) and its use in the classroom with youngsters. I agree with Vicki, based on first hand experience, that one of the best and most exciting things you can do with kids in the classroom with a radio is to give them an opportunity to speak with astronauts.

Cynthia Wall KA7ITT is the talented author of children's books that incorporate amateur radio in the story. It was a delightful experience to meet with her and hear her suggestions on using the books to help provide high motivational classroom reading lessons. I can really recommend these exciting adventure books as an enrichment activity in a ham radio class.

My good friend Jim Wilmerding N4MDC came from New Orleans just to participate in the workshop. I'm so glad that he did! Jim is one of the net controls on my CQ All Schools Net on Tuesdays and Thursdays at 17:30 UTC on 28.303 MHz (after 10 minutes 21.324, and then on to 14.325 MHz if you hear nothing). When folks can't hear either my school or Gordon West from California, they can probably pick up Jim in the middle of the country. Jim is the principal at St. Martin's Episcopal Middle School. Our two schools have corresponded and shared numerous school-wide projects as a direct result of our radio contacts each week. Jim spoke to the group about how to approach an administrator when trying to get a radio program into a school. His input was excellent.

Photo A. Jim Wilmerding N4MDC.

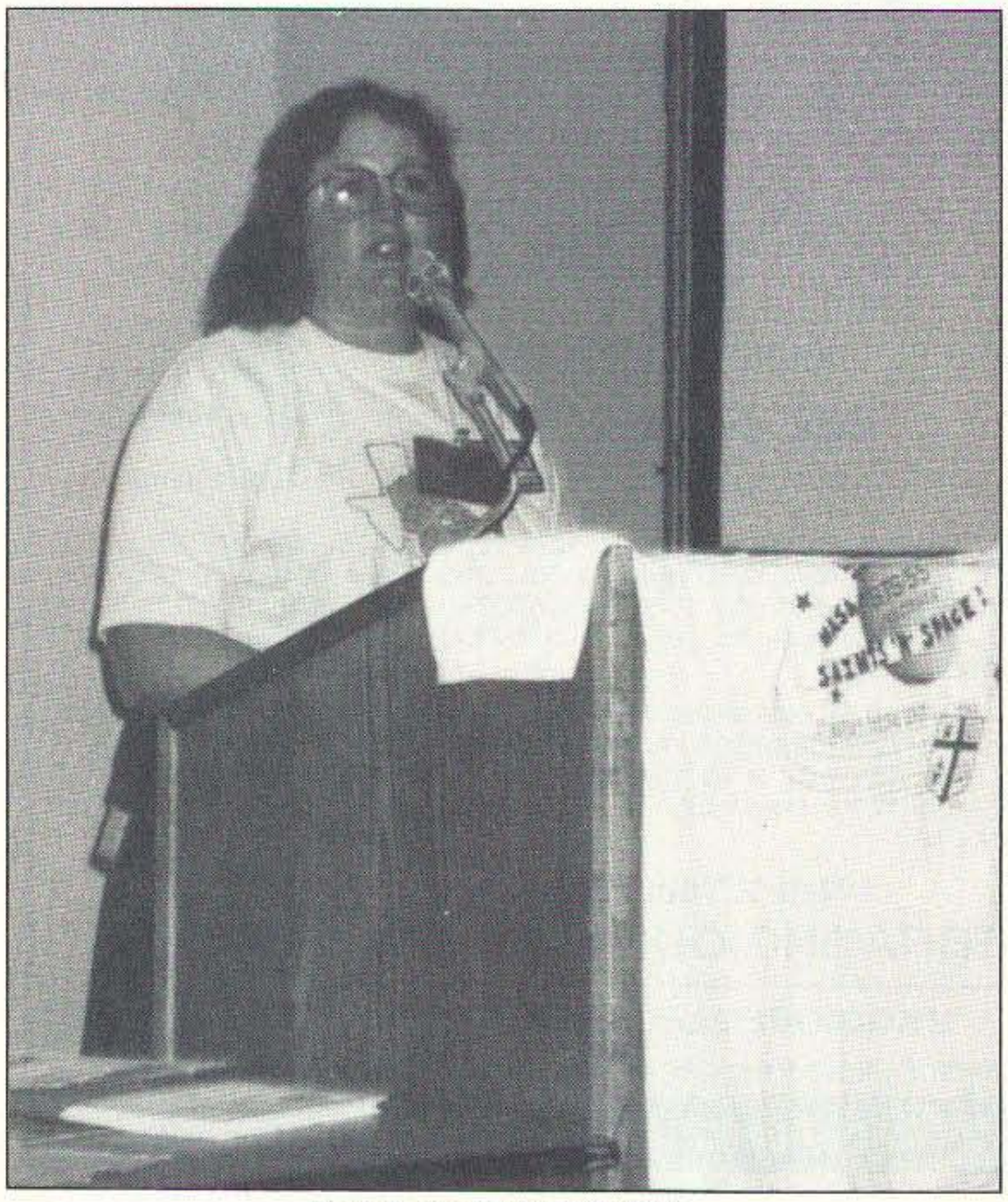

Photo B. Connie Dunn KB5LES.

Connie Dunn KB5LES was my liason with the convention most of the year. We became instant friends. Connie is very active with the YLs and does a super job editing their publication. She spoke about using packet radio in the classroom, and had very good slides to demonstrate what she was explaining. Connie introduced Kathy Hootman N5VKY, a teacher at Sanger Middle School, who talked about creative lessons with packet radio in her class.

My friend Bob Scupp WB5YYX is Vice Director of the Rocky Mountain Division of the ARRL. He informed the audience about the League's ability to support educational efforts. The new telephone number available to non-hams only is 800-32-NEW HAM to have questions answered. He provided the group with literature that the ARRL makes available to teachers.

It was also my pleasure to introduce the Geisen family who drove up from Houston to appear at my Youth Forum the next day. Marie KB5QPB, Shalon KB5QMY and Linda KB5PQW are home-schooled teenagers who have integrated ham radio into their studies.

In between these speakers, I managed to do some of my own little presentations. I showed a video that demonstrates children in my class having fun on the radio and with radio-related activities. I stressed the importance of using child-oriented materials. The group really enjoyed the other video I showed, astronauts fooling around for the camera to demonstrate weightlessness and how life on board the shuttle can be fun at times.

I am indebted to the talented people who did presentations at the Instructors' Workshop so that others could benefit from their experience. Readers of the "Hams With Class" column know that I am a firm believer in the value of youth forums for the recruiting of young people into the hobby. It is also very obvious to me, after having moderated several teacher continuing education courses, that they can inspire and motivate teachers to incorporate amateur radio in their classrooms. The sharing of ideas with a good group of presenters is a dynamic, exciting and educational experience.

Don't be afraid to organize one at your group's next large gathering, and let me know how it works out. 73

Number 17 on your Feedback card

QRP

Low Power Operation

Mike Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

A very popular setup for the active QRPer is the Ten-Tec 509 Argonaut with its matching 405 amplifier. With DC power consumption of 100 watts, the 405 amplifier produces 50 watts RF output with only 2 watts input from 80 through 10 meters. This amplifier was one of the first all-solid-state high-power amplifiers to hit the ham market.

When Ten-Tec stopped producing the popular Argonaut 509, they introduced the 515. The 515 contains an enhanced version of the 509, with a few more features added. However, the FCC ban on 10 meter amplifiers made it illegal to build an amplifier capable of working with the 2 watts input from the Argonaut series. Therefore, they never offered a matching 406 amplifier for the 515 Argo.

The 10 meter amplifier bill, as it is known, made it illegal to sell any device that will amplify an RF signal between 24 MHz and 30 MHz. The bill was introduced in the mid 1970s—a reaction to the growing number of sellers and users of illegal power amps on the nearby 11 meter CB band. Under the law, the amplifier must not be able to amplify a signal under 50 watts input power, and the amplifier must not use RF sensed switching. As you can see, this put the 405 right in the middle of a very deep can of worms.

The whole idea behind the bill was to keep those amplifiers capable of operating on the CB band (27 MHz) out of the hands of CBers. There were some who likened this bill to a sort of gun control for ham radio. The rule's usefullness is still being debated to this very day: Is it effective in keeping those amplifiers away from 27 MHz? The CB craze of the '70s is long-gone. Unfortunately, the interest in illegal CB amplifiers is still with us.

The Ten-Tec Argosy

Ten-Tec got around this amplifier problem with a simple solution: the Argosy transceiver. The Argosy is capable of running up to 50 watts output on 80 through 10 meters in either CW or SSB modes. Or, it is just as happy with an output of 5 watts, again in either mode you choose. The Argosy also featured the 30 meter band, a first in a commercial QRP transceiver. Also included with the Argosy was a completely broadbanded receiver. No longer did you need to resonate the front end of the receiver like you had to do with the Argonauts. Of course, the transmitter was broadbanded too, just like the 509 and the 515 Argonauts.

The Argosy also featured a noise blanker that really worked (also a first from Ten-Tec) and a two-stage audio CW filter. Of course, you had the Ten-Tec full QSK CW system in the Argosy and PTT SSB. The Argosy did not have a VOX circuit for phone use. Both the audio filter and the noise blanker were optional to the base Argosy.

The Argosy continued the tradition of the slide-rule frequency readout Ten-Tec used since the days of the PM series. The Argosy updated the readout with a sliding LED to mark frequency while the dial skirt read out the nearest kHz. A pulsed calibrator provided a marker signal every 25 kHz. The calibrator was also an optional accessory on the Argosy.

You could also install several optional crystal filters on this transceiver. The stock filter is a rather so-so four-pole 2.7 kHz filter. The eight-pole 2.1 kHz filter proved the most popular among Argosy users, providing the ability to switch-select between two other crystal filters as well. Most people went for the 1.8 kHz filter for improved sideband performance and either a 500 Hz or 250 Hz CW filter. With all those filters in place and with the ability to operate from a battery, the Argosy became a QRPer's delight. When band conditions went into the dumpster, you could flip a switch and run 50 watts out.

The Argosy contained no microprocessors or PLL. It was completely analog, including the VFO. Of course, just like the Argonauts, touching the dial skirt of the VFO would change the frequency of the rig because of hand capacitance. Without microprocessor control, the Argosy required about 200 mA on receive. The lack of a PLL made for an extremely quiet receiver. The Argosy did lack one important feature though: an RF gain control for the front end of the receiver.

The Good Gets Better

As great as the Argosy was, it got better. Ten-Tec followed the original model with the updated Argosy II. This model incorporated features and upgrades in the receiver from the first model. Also, the Argosy II did away with the slide-rule readout. In its place is an LED display showing you the most important digits. You don't see the MHz on this display. The digital display really is nothing more than a frequency counter counting the VFO's

output. If the rig drifts, you'll see it on the display. (Today's rigs monitor the CPU and not necessarily the actual frequency of the transmitter.) The Argosy II is not an Argosy with a digital readout! It is different in many ways.

The front panel layout as well as the selection of the optional crystal filters remained the same. Gone is the calibrator switch and in its place is a switch for turning off the LED display. (The light behind the meter remains on though.) The display increased the receive current to 750 mA.

Ten-Tec also improved on the noise blanker and receiver. The transmitter now has full ALC control at the 5 watt QRP setting. You can now adjust the power level (inside control) for the ALC at different settings of the power control. In my case, I have my Argosy II set for 50 watts output, but at a supply voltage of 12.5 volts. The original Argosy did not have this feature on the low power setting.

Ten-Tec also chose not to use a microprocessor in the Argosy II. Again, this makes for a very quiet receiver and low receive current. And, for reasons known only at the top, the Argosy II still lacked an RF gain control or even an ATTN switch.

Both the original and the Argosy II are still sought-after. Scan through the *Yellow Sheets* and you'll see ads every week seeking an Argosy. On the used market, be prepared to shell out about $300 to $400 for a Argosy.

The Ten-Tec Argosy.

An Argosy II will make you dig a bit deeper, around $400 to $500, depending on filters and other options. If the Argosy series is this popular even after being discontinued, what happened?

Sticker Shock

The basic Argosy was cheap. But, when you started to add up all the crystal filters, noise blanker, power supply, microphone, and audio filter, it really got a bit pricey. In fact, just before Ten-Tec dropped the line, an Argosy II, fully loaded, approached $1,000. But there was to be one more nail in the coffin—the microprocessor.

At the time, hams just started to see what the microprocessor could do when custom-installed inside their rigs. Why, all of a sudden you could get PLL frequency control, TWO VFOs, memories, band scanning, memory scanning, and the list continues to this day of the bells and whistles we have all gotten used to. Ten-Tec followed soon afterward with their own microprocessor rig, the Paragon. The Omini V and Omini VI followed, with even more chores being controlled by a computer chip.

I've used my Argosy II as a test bed, contest machine, on AMTOR, CW and SSB. Yup! You'd have one helluva time getting my Argosy from me. In fact, you'll probably have to pry it out of my cold, dead fingers when I go.

Here's wishing you the best of the holiday season. Stay tuned for more project, reviews and other QRP goodies, here in the "QRP" column. 73

Number 18 on your Feedback card

PACKET & COMPUTERS

Digital Amateur Radio

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

Getting Started with TCP/IP, Part 4

[This is Part 4 of a series on getting started with TCP/IP over amateur radio. The series uses JNOS, a KA9Q NOS implementation as the focus, though much of the information is applicable to any variation of NOS. Non-IBM-PC users will still find the information useful, though details may vary for NOS running on your platform. If you see something that varies, and would like to share tips with other users of the machine you own, please send mail and I will pass along interesting material . . . N1EWO.]

OK, I think that most of the confusion concerning versions has been cleared up; just to be sure, here is the rundown:

We will be concentrating on two versions of JNOS: 1.07b and 1.08c. These two versions are widely distributed, though some configuration details vary. Both versions are now on the *73* BBS, though the "official" version for our purposes is 1.07b. Because of differences in details, it is quite possible that "errors" will creep into the articles in this series—that is, I may miss some differences and not spell them out. If something doesn't work with the version you are using, please try to work with it a little before assuming what you read here is wrong. If you find one of these "mistakes" please send me e-mail [jsloman@bix.com] (NOT packet mail) and let me know.

If you are using a version of JNOS other than these two I can guarantee that you will find discrepancies. This does not mean that you cannot follow along with the version that you have. I may even point out some of these if I know about them. There will be changes in syntax and feature support. If you are using a version that is 1.10x(n), where n is any number, you are using an experimental version and should expect some trouble.

The Components of JNOS

Knowing the purpose of the several files that comprise JNOS is a great way to get started. Some of these files are optional, but others must be precisely correct for the program to work at all. Let's take a look at the components and how they are used.

NOS.EXE

This is JNOS itself, the executable file that does all the work. It is, of course, not optional. The exact functionality of the executable file you have can vary quite a bit. JNOS is generally distributed as source code and compiled by the end user using a C++ compiler. If you did not compile the version you are using, you cannot be sure which pieces of code were included at compile time. The generally available .EXE files are often compiled with the 8088 switch rather than 80386. This means that it will run on 8088 (PC-XT, etc.) machines as well as 386/486 machines—though perhaps a bit slower.

AUTOEXEC.NOS

This file is the heart of JNOS configuration—the entries in this file configure JNOS at startup. This file is very much like DOS's AUTOEXEC.BAT. Entries in it are treated as command line entries when the program starts. In other words, what you put in this file is—in effect—typed at the command line. The default location is in the root directory of the drive where NOS.EXE resides. This can be changed with the proper command line switch when you start JNOS, or with an entry in NOS.CFG (we'll look at this stuff later).

There are a few essential entries in the AUTOEXEC.NOS file. These are basic configuration commands. Though it is theoretically possible for you to type these commands manually each time you start the program, it doesn't make much sense to do this—it is what AUTOEXEC.NOS is for. Let's take a first pass look at the this file to help you get started. We'll take a look in more detail later in the series.

ax25

The ax25 command sets various ax25 parameters, the same as if you were programming a TNC. Among the very first things that you must have in your AUTOEXEC.NOS file is a command like:

```
ax25 mycall  N1EWO
```

where N1EWO is, of course, your call. This sets the call for your station as far as the FCC and the rest of the packet world is concerned. The ax25 command does many other things which we will discuss later.

ATTACH

The ATTACH command attaches an *interface* to the NOS program. The most basic interface for ham radio use is a TNC connected to a serial port. The interface can be looked at from several levels. It is a serial port at the physical layer, and follows RS-232 standards. It is also a TNC in KISS (Keep It Simple, Stupid) mode. At the *network* layer, this interface is an ax25

connection, and an IP connection. At the *transport* layer the interface uses TCP and UDP—this also holds for the *session* layer. These layers are taken from the OSI network reference model. This is a generic description of networking that divides the functions required for a data network into seven "layers":

Application
Presentation
Session
Transport
Network
Datalink
Physical

This model is a tool to help think about networking. As you can see, some components may fit into more than one layer. Some networks omit some layers unnecessary for the application. If you don't follow this discussion, don't worry—it is presented for background and you don't need to understand it to make JNOS go. If you are interested in it, you will find this information discussed in depth in any good text on data networks.

Attaching any interface requires issuing an attach command with the proper command line parameters. Below is an example of attaching a KISS mode TNC to COM1: at 4800 bps:

```
attach asy   0x3f8 4 ax25 TNC0
  2048 256 4800
```

attach is the command
asy is short for asynchronous—the serial port interface
0x3f8 is the base port address for COM1:
4 is the IRQ for COM1:
ax25 specifies the interface protocol
TNC0 is the (arbitrary) name of the interface
2048 is the size—in bytes—of the buffer to allocate for this interface
256 is the MTU (Maximum Transmission Unit)—biggest packet size—in bytes
4800 is the data rate in bps

This is the structure of any attach command. JNOS supports other parameters on this command line. The first parameter, called "hardware type," supports things like Ethernet adapters and internal TNC boards. The specifics for versions and supported hardware should be found in the latest documentation for JNOS.

The second parameter, called "IO address," can be set to any valid port address, usually though it will be one of the four standard com ports:

COM1: 0x3f8
COM2: 0x2f8
COM3: 0x3e8
COM4: 0x2e8

Note that the address is specified in *hex* (hexadecimal or base 16), and is preceeded by "0x." This prefix is a convention indicating that what follows is a hex number.

The next parameter is called "vector," and is the same thing as IRQ (Interrupt ReQuest line). This is the hardware connection that is used by the port hardware to get the computer's attention when data is available. These IRQs are generally set at standard values, unless you have unusual or reconfigured hardware:

COM1: 4
COM2: 3
COM3: 4
COM4: 3

Note that ports 1 and 3 share IRQ 4, while 2 and 4 use 3—this means that ports 1 and 3 (or 2 and 4) cannot be used in pairs unless reconfigured because IRQs CANNOT BE SHARED. This is not true on MCA or EISA machines if you happen to have one, but it is the general rule. So, if you want to connect more than one TNC to your JNOS station—the software allows this easily—you will have to juggle your hardware resources to prevent conflicts.

The next parameter is called "mode" and specifies how JNOS should interact with whatever is on the other side of the serial port. In this case ax25 tells JNOS to include information to control the KISS mode TNC along with the data. Another option is SLIP (Serial Line Internet Protocol), which is designed for direct connections and so omits the TNC stuff.

Following mode is "label," an arbitrary name for the interface. This name should be representative of the interface's function on your system; it is for you—call it something that is meaningful to you.

The next parameter is "bufsize." This is the size, in bytes of the *ring buffer*, allocated for the serial port. If this number is too small, data may be lost. We'll discuss choosing the right size for this parameter later during optimization. The default of 2048 (2K) should suffice for most cases.

After bufsize is MTU. The Maximum Transmission Unit is the size of the largest data packet that your station will send on this interface. 256 is a good default value; changing this number will be discussed in the optimization section later on the series.

Finally, there is "speed" in bps (bits per second). The first consideration in setting this number is that it must match what the TNC expects on the other end of the connection. Second is the speed of your processor. The higher this number, the more interrupts to which the CPU must respond. Slower machines may lose data if the number is too high. A symptom of too high a setting is strange callsigns in the stations heard list.

Next month we'll look at other commands that you need in the AUTOEXEC.NOS file to get your station on the air. Until then, keep working to get on the air. A basic JNOS station is something you should be able to put on the air yourself. There will be three or four more parts to this series, and I'd hate to think that you would wait that long to get on the air. 73 de N1EWO. 73

ATV

Number 19 on your Feedback card

Ham Television

Bill Brown WB8ELK
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

ATV in Utah

While visiting the Salt Lake City area, I had the opportunity to see two ATV repeaters in operation.

The WB7FID In-Band Machine

Built by Dale Jarvis WB7FID, this machine has been in operation since the late '70s. It has an input on 426.25 MHz and outputs on 439.25 MHz. The repeater is located on a ridge called the Point of the Mountain and is about 1,000 feet above both the Salt Lake Valley and the Utah Valley. The equipment is housed in a military surplus communications hut near a hang glider launching site (see Photo A).

Most ATV stations in the area live either in the Salt Lake area (Salt Lake Valley) to the north of the repeater or in the Provo area (Utah Valley) to the south. To cover both groups, the repeater has a pair of wide-beamwidth corner reflector antennas (horizontally polarized) on both transmit and receive that point north and south, providing a figure-eight type of pattern.

About 80 watts of output power is fed into the antenna system, and after filtering and coax loss about 20 watts makes it to each antenna, providing excellent coverage into the two valleys.

From the repeater, at its vantage point on this strategic site, I was able to receive nearly P-5 signals while mobile from south of Provo, throughout the Salt Lake City area and clear up to the western edge of Ogden. The city of Odgen itself is blocked by a mountain ridge, however. Although having an output on 439.25 MHz with the input on 426.25 MHz is a reverse split from most ATV repeaters in the country, it does tend to eliminate interference to the repeater from nearby FM repeaters, remote links and packet.

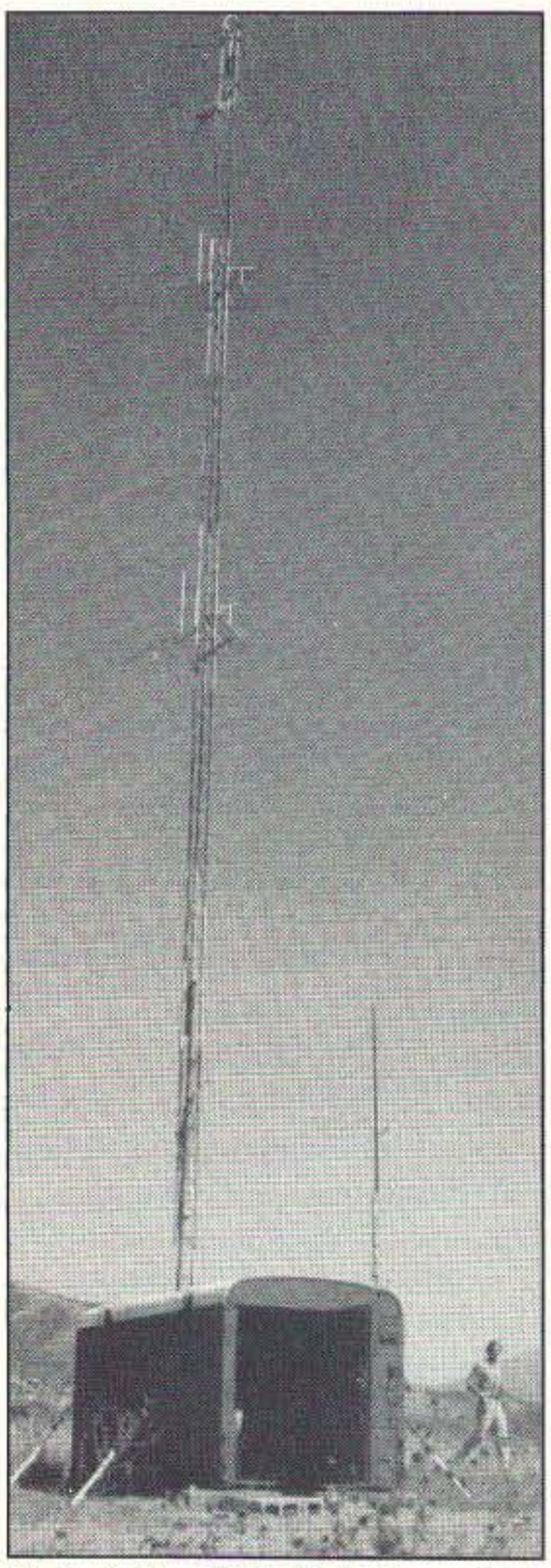

Photo A. The WB7FID ATV repeater is located in a military surplus communications hut located at the Point of the Mountain between the Salt Lake City and Utah Valleys.

The KA7OEI Crossband Repeater

Located in the radio club of the University of Utah, this system was built and designed by Clint Turner KA7OEI (see Photo C). The repeater covers most of the Salt Lake region from its vantage point 500 feet above the northeast corner of the city.

This repeater has an input on 439.25 MHz and outputs on 1248 MHz (FM ATV, audio subcarrier on 5.8 MHz). It has a horizontally-polarized corner reflector transmit antenna with about 11 dB of gain and a very broad pattern (about 100 degrees) to cover the valley. With 22 watts of output power, he gets about 150 watts ERP from the antenna after coax loss is considered.

All of the circuitry in the repeater was home-brewed by Clint, including the receive downconverter, IF system and the FM ATV transmitter and amplifier system. He even developed a circuit to take low-res VGA graphics and overlay them as an ID over the live video (see Photo B—the overlay is near the bottom of this computer screen).

The repeater frequency can be changed by remote command to 426.25 MHz and the receive antenna can also be switched from a corner reflector to a yagi. When the yagi is switched in, Clint's repeater can receive the output of the WB7FID repeater and link it out on 1248 MHz FM to help fill in some parts of the Salt Lake City area that are shielded from the WB7FID machine.

A number of local ATVers are successfully viewing the KA7OEI repeater on surplus satellite TV receivers (TVRO) using an inexpensive downverter for 1248 MHz that Clint designed.

Photo B. The computer ID screen of the KA7OEI crossband ATV repeater.

SLC Activity

There are a number of active stations who work through the repeaters. A few of the more active ATVers I watched during my visit were Dale Jarvis WB7FID, Paul Larson WA7PXD, Clint Turner KA7OEI, Dave AA7IZ and Glen WA7X.

If you're passing through the area, give a call on 145.74 MHz (the local ATV calling frequency). Also check out the repeater outputs during any shuttle mission as they rebroadcast the NASA select video during most flights. 73

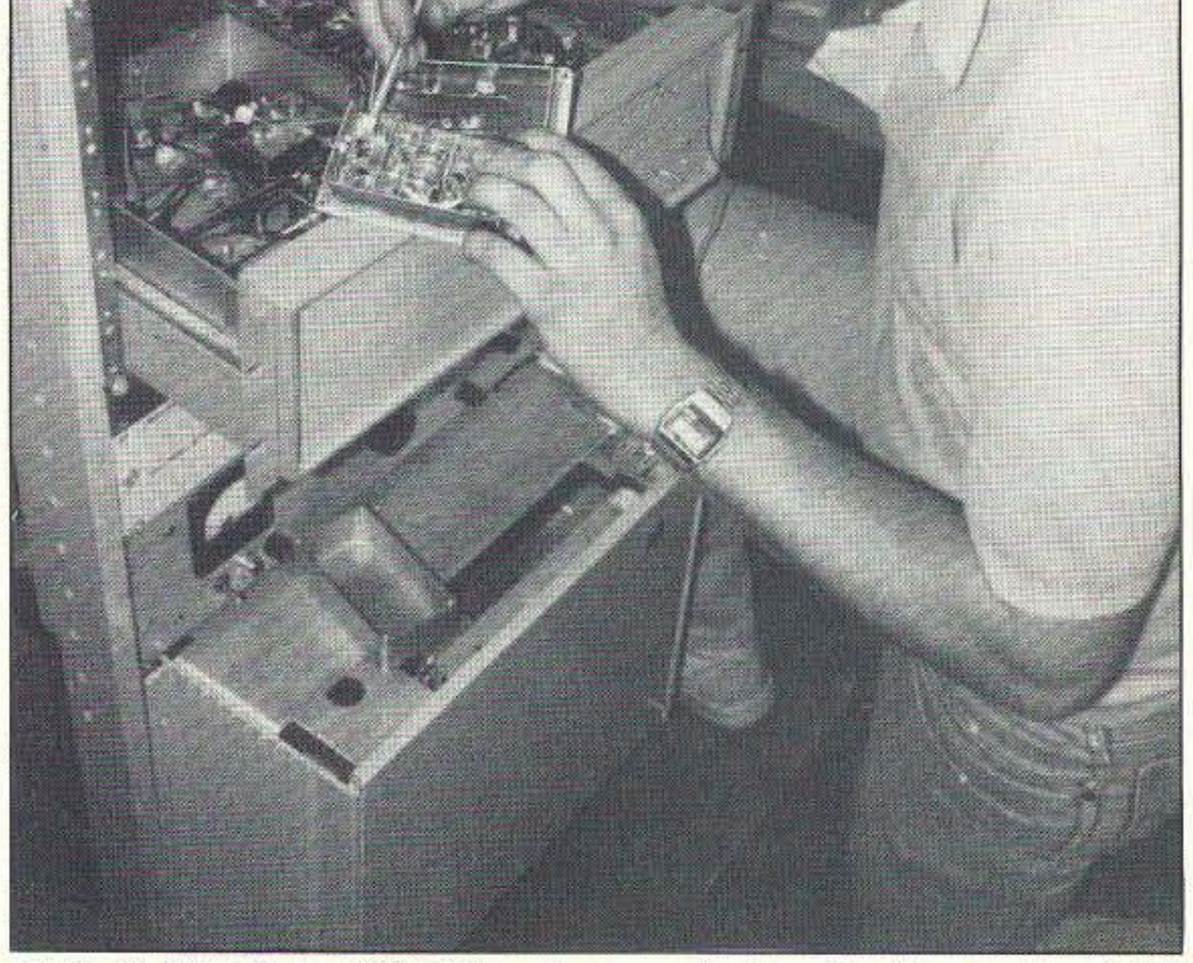

Photo C. Clint Turner KA7OEI makes an adjustment to his crossband ATV repeater located in the radio club of the University of Utah.

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Construction and Workbench Practices

The ARRL 10 GHz contest first weekend is over and time is running out for getting our equipment ready for the next weekend contest operation period. This brings to mind the many gremlins that crept in while operating on 10 GHz during this contest. I know what my problems are, and I thought I would describe some of them to aid you in your Field-Day-type operations. Also, this is a time to dust off some of those projects that have been collecting dust in the "pick-up-and-hold" bin. I have so many projects in this category that they could absorb all my "winter" time.

Projects that I have on hold include a DSP system for IBM computer operation using Qualcomm system components, my 6 GHz SSB system, a new bias power supply for GaAs FET amplifiers (described this month), and a switch mode power supply system for portable operations. There's no rest for those afflicted with that swap-meet disease called pickup'itus!

A Builder's Confession

First, I would like to offer a little confession: I am not a perfectionist but rather a constructor who never really finishes anything. Most of my projects are in a constant state of flux. My basic premise is "Microwave Building Blocks," so most projects can be or are constructed with a building-block modular concept. Almost all of these have a coaxial patch cord interconnection between modules. This construction method describes most of the microwave systems and converters used today. Those modules that are not located through surplus or commercial sources are home-brewed. My main concern trying to stretch a buck as far as it will go.

Using this reasoning, a converter is the only viable way I have of placing equipment on microwave frequencies above 1296 MHz. That way I can stay on budget. This modular equipment, a mix and match of commercial equipment, can be interfaced with my home-brewed modules which cannot be picked up in surplus. In this way I can construct a system package inexpensively, reaping the financial rewards and having few drawbacks compared to a full commercial system, especially for the non-perfectionist. True, the results might not look as good as a full commercial system, but I have been very satisfied with many such converters in the past.

Solving Field Day Problems

One drawback on my part in home-brew construction is not being thorough in the construction and testing of the system. Little things can have devastating effects. This is a little like rat-ting on oneself, but the trouble is a common one and I think it bears some mentioning. Let me start out by describing my troubles during Field Day operations and their resolutions.

One problem I had was a simple one for the workbench, but in the field proved to be nearly fatal as far as system operation was concerned, since I was 200 miles from the home workbench. What happened was that I broke a solder connection between my RF-operated switching circuit and the rec/transmit coaxial connection to the IF radio (circuitry from my October '93 column). Without this connection I could not transmit during the first weekend portion of the ARRL 10 GHz contest. Despite a shakedown test for the equipment on Saturday, I didn't discover the problem until I was 200 miles from home. The shakedown was to be a precursor to the trip north to operate from the northern Los Angeles sector, above Santa Barbara. We discovered the station trouble when we arrived at our northern-most location for Sunday's operation. What can be done on a sandy beach 200 miles from the home workbench, without proper repair repair facilities?

At first evaluation, the situation seemed hopeless. What had broken was a simple coupling capacitor picking off RF for the RF detect rec/trans switch circuitry. It was locked in receive; transmit was dead. The TX switching circuit was all automatic and the relays that operate on detected RF were not functioning. Further complicating the situation was the fact that the equipment was located in the bed of a pickup truck, and I was in the cab for normal remote operation.

This calamity certainly upset my operating prospects. Taking inventory of the situation, I discovered that the capacitor that had broken off was subject to strain on the device; that was my mistake during installation. (I was still using the proto-wired circuit constructed dead-bug style and without a PC board). A long trip for mobile operations could have been averted if I had taken a little longer to install the capacitor without strain between its leads. Repair would have been very simple with a soldering iron, but with none at hand what could I do? I tried to form the very small leads together with part of the circuit to insert the broken capacitor onto the two points of connection and let gravity assist the operation. This would be flimsy at best, and it didn't work. Just then I remembered the pack of Radio Shack clip leads that I had just purchased and pulled them out. Now the clip leads were about 16" long and definitely not suitable for RF work. However, by cutting the wire away from the alligator clip I was able to use two clips to clip the capacitor in place.

This was sort of like using a clothespin to hold things together. I left the insulation on the clip lead and it worked well. What a blessing to have the clip leads on hand! They were pur-

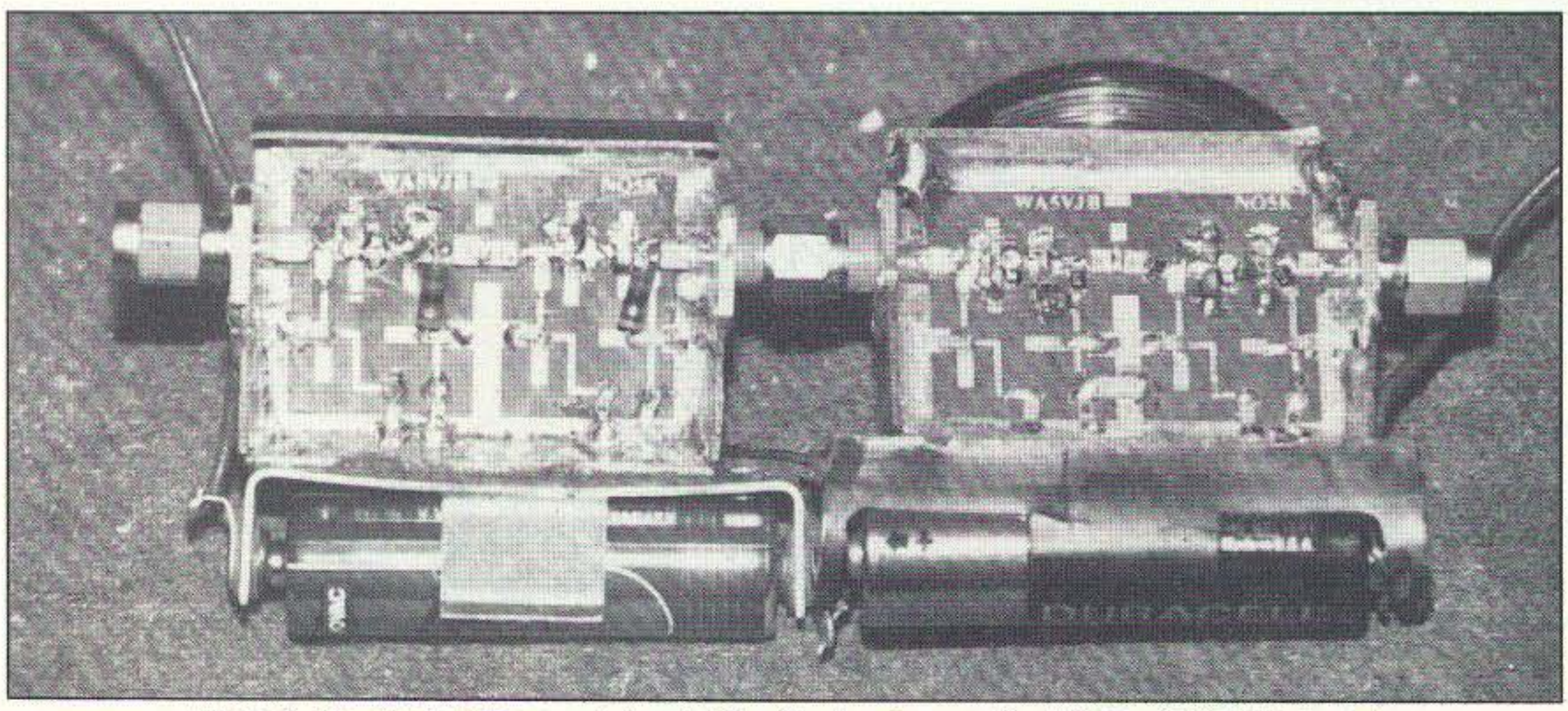

Photo A. The simplest bias supply is a 1-1/2 volt battery for negative DC bias. (WA5VJB photo.)

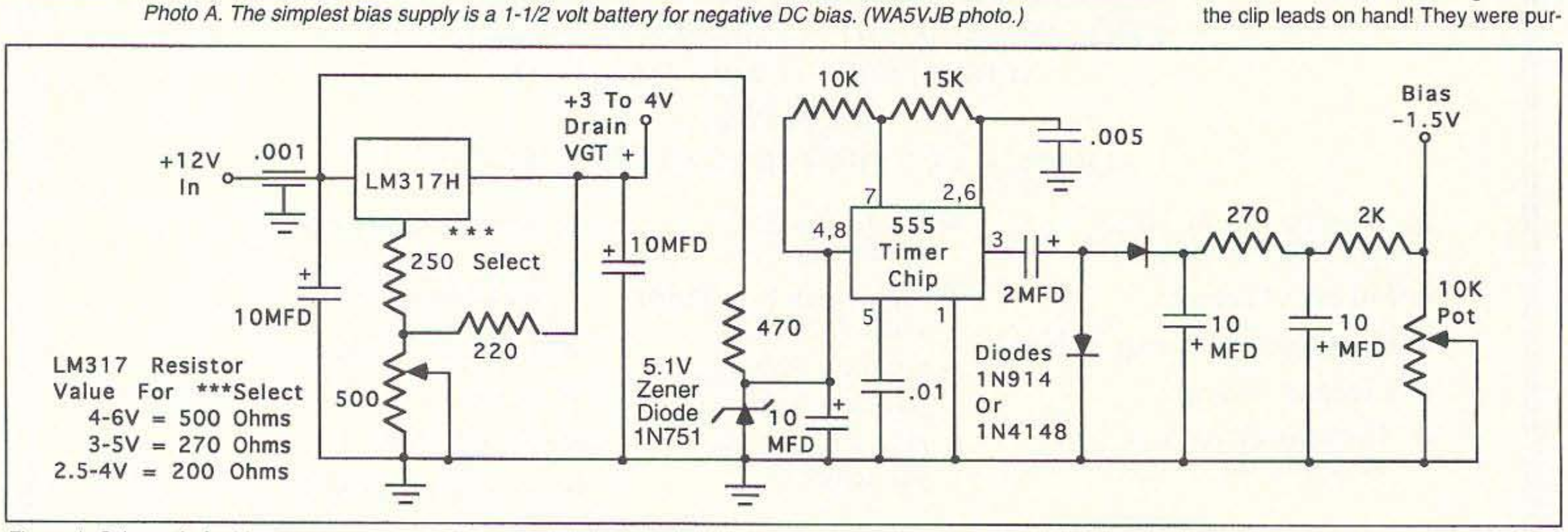

*Figure 1. Schematic for bias power supply. Adjust positive voltage with selection of LM317 resistor as indicated by ***. Note: 470 ohm resistor at the imput of the 555 chip (pins 4 & 8) is mounted on the PC board to +12 volts. This maintains a stiff -1.5 volts bias output at minimum pot output from the negative bias supply.*

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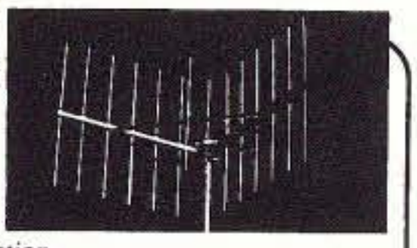

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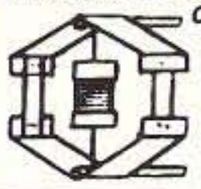

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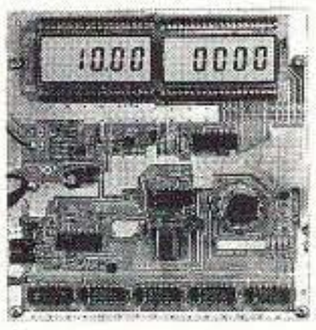

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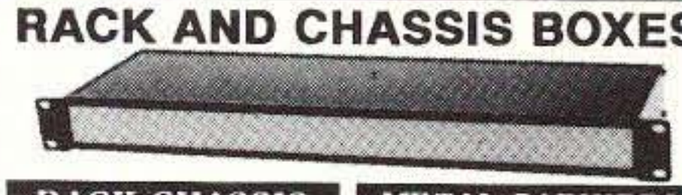

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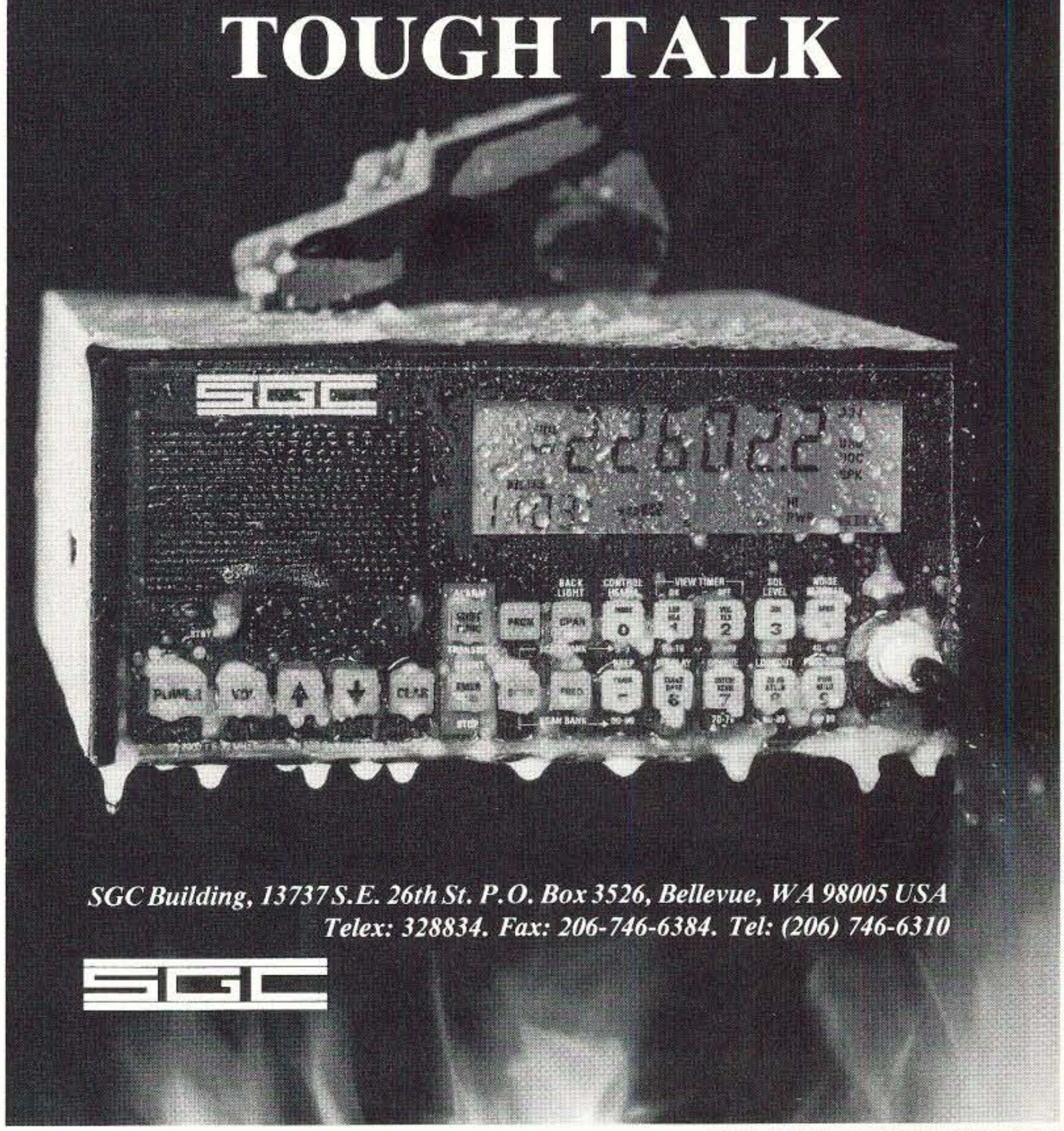

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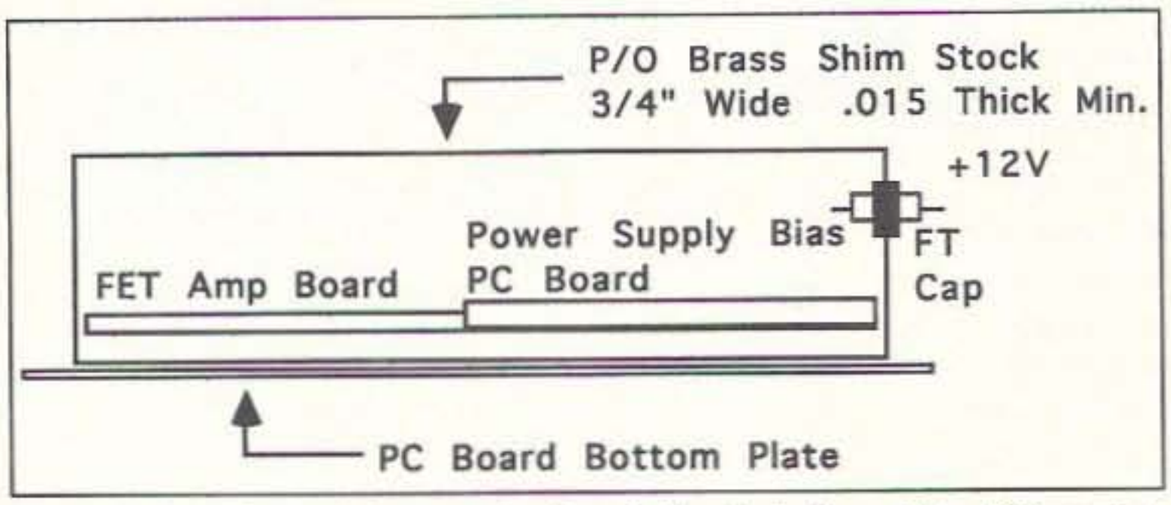

Figure 2. Amplifier container construction. Solder the bottom of the PC boards to brass shim stock sides. Solder amp PC board and bias PC power supply board together. Locate the holes for coaxial connectors for the amp and feedthrough cap for the power supply before soldering the boards together. Use aluminum foil or copper foil for the top of the container.

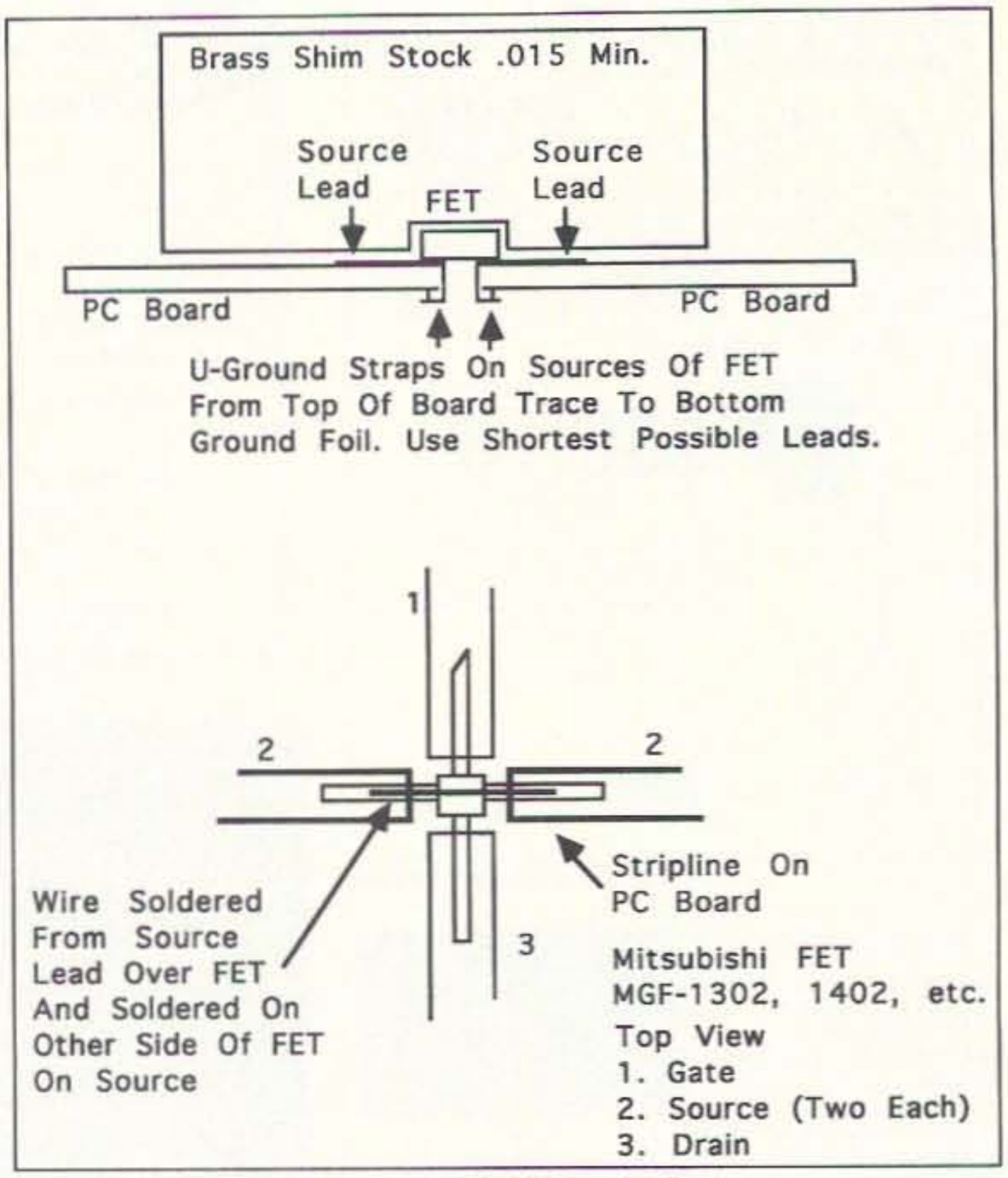

Figure 3. FET shielding details.

chased on the spur of the moment at Radio Shack when I picked up a new catalog. Radio Shack now charges for catalogs but with each catalog comes a coupon good for the catalog price on your next purchase. The coupon is what purchased the clip leads. Lucky for me, to say the least. Am I ratting on myself? Yes, but the point is that when we operate in the field unexpected things can and will happen. The thing to do is to attempt to be prepared. In this case a quick connection broke under stress. Unfortunately it took me about 30 minutes of fiddling with the capacitor and clip leads to make field repairs.

Clearly, some portable repair equipment might be in order. However, a better approach would be to be more careful in test and assembly. This is where my original problem took root, especially using the prototype PC board which was constructed dead-bug fashion. I should have potted the midair connections in silicon to give some rigidity. To prevent similar problems in your equipment, use careful construction techniques and test each connection carefully. A little preparation at this level of test and construction can save much grief later when it can pop up and be difficult to spot.

I don't know just how the original soldering job looked because I destroyed much of the connection by positioning the clips. Each solder joint should be made by heating the connection prior to applying solder to the junction. Many of us apply a glob of solder to wet the contact and let the metal flow before removing the iron. With this type of conection between solder and contact, the chance of a rosin connection or poor electrical connection is great. Soldering each connection by letting the parts reach temperature and allowing solder to flow, still applying a little heat, would further ensure good adhesion and solderability. So much for a parts junkie. At least I plan to take a portable soldering iron along as part of the field equipment in the future. I obtained a temperature-controlled handle and heating element Weller WTCP type unit and the heating element was good. I married the cord to a pair of clip leads as the element is made to operate from 24 volts AC. My portable station runs on 24 volts DC so the iron won't know the difference if it gets the call for action.

Repair of the circuitry couldn't have come at a better time as our best 10 GHz distance contact was just about to happen: Jack XE2/N6XQ operating in Mexico, just short of 1,000 km south of our position—an all over-the-water shot. My partner Kerry N6IZW worked him first just as I was getting everything back in order. I made the contact with Jack and the quality was so good we carried on a conversation for a few minutes. I never thought that my day would be saved by Radio Shack, but it was. This is the longest contact I have ever made on 10 GHz SSB, and without the lowly clip cords it would not have been. Our contact was a formidable distance but there were West Coast record shots from others to come.

Conditions that day were excellent. Kerry and I worked Jack N6XQ/XE2 for a distance of 586 miles—not bad considering we were tired of driving from San Diego to north of Santa Barbara. We've got to thank Jack for his dedication in making the trip to Mexico for the contest; his was quite a long trip. (I'll get some of his experiences for a later column.) It would have been nice to be included in the record shot but we were tired after several hours of driving and wanted to set up operations before 9 a.m. I am very satisfied that Kerry and I were both able to make any contact at all with Jack, considering the equipment difficulties I experienced. Kerry and I run very similar rigs, both 10W TWT transmitters and receivers in the 3 dB system noise figure range with 30"-off-center feed dishes.

This record shot was preceeded on Saturday, August 22, by a contact that qualified for the record books, if only for a day. Chip N6CA, Dave WA6CGR, and Gordon WB6YLI worked Jack from Refugio Pass near Santa Barbara, California, to Jack XE2/N6XQ at the same location. The distance for this contact was 613 miles.

A new North American record on 10 GHz was made on Sunday, August 23, 1993, by Dave Glawson WA6CGR, operating out of Point Sur, California, and Jack N6XQ/XE2, located at Vizcaino Peninsula in Baja California. The distance covered on this single-hop microwave contact was 632.86 miles, for a new North American 10 GHz record. Jack was running his 3 watt home-brew transceiver and 30" dish. Dave was using his converted MA/COM transceiver with 1.25 watts and a 27" dish. Receiver performance was similar, with about a 3 dB noise figure on either end. Quite a microwave shot (single hop), to say the least. Congratulations to all!

Construction Projects

I thought I would include the data on one of the projects that I wrapped up recently. It's a neat little bias power supply for GaAs FET amplifiers. I constructed this one due the expense ($2) of the ICL-7660 chip that I have used in the past. In its place I substituted a more common 555 timer chip ($0.45). It requires more component parts, but at least they are common and easier to obtain. See Figure 1 for the schematic details and Figure 4 for the PC board layout and parts placement. I made the power supply small so it would coexist in the same enclosure with the RF preamp for packaging simplicity. A simple modification would be to add a second bias pot should you wish to use this board in a dual-stage application. I presented such an amplifier last month, shown as a dual-stage MGF-1402 preamplifier with a dual-bias supply.

The bias supply was used this way to overcome the use of several connection leads. The use of several amplifiers or component parts of the "building block approach" was to make each unit a module with minimum leads for interconnection to the associated circuitry. Coupled with a diode for reverse voltage protection, we have a measure of self-assurance that the circuitry is protected from abuse by not hooking up leads incorrectly.

The two boards (amplifier and power supply) are connected by soldering

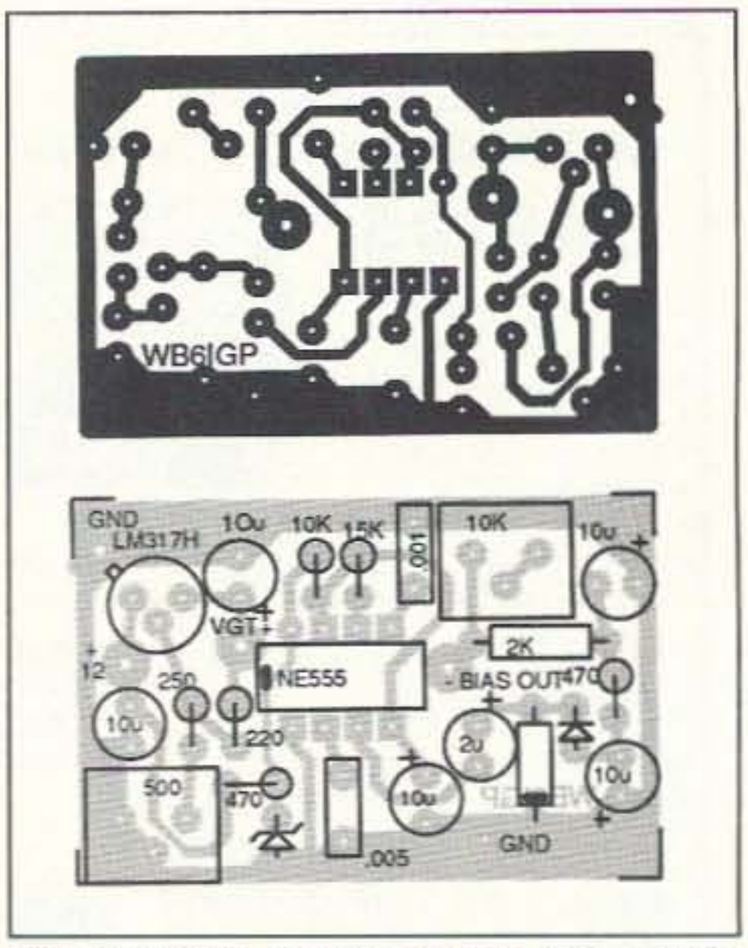

Figure 4. PC board layout and parts placement diagram. Drilled and etched PC boards are available for $3.50 plus $1.50 S&H from FAR Circuits, 18N640 Field Ct., Dundee IL 60118.

the bottom ground foil of the preamp board and the bottom ground foil of the power supply together. When the boards are assembled together, bench-test the unit and complete it prior to placing it in a container. See Figure 2 for details on the brass shim stock container. The basic PC board arrangement is not strong by itself so it is beefed up by the brass stock to form a container. To add the box and strength to the PC boards, we shape brass around the PC boards to form our container sides for the amp and power supply. I use 3/4"-wide shim stock that is about 0.015" thick. This brass stock is available in most hobby shops.

Before soldering the brass sides to the boards, locate the RF connector holes and drill them to fit the board and solder together. I use SMA connectors for almost all RF work as they match the size of the amplifier closely. When the brass stock is soldered to the PC boards the amplifier and power supply as a unit is quite rigid. In the units that I have constructed I connect the coaxial connectors to the PC board prior to assembly in the brass enclosure. I drill the holes to clear the connectors and wrap the brass stock around the PC board with the power supply attached. After I have fashioned the entire piece of brass, formed to clear the connectors and having a hole for the feed-through capacitor to be mounted last, I solder the unit together using a small bench vise to hold the bent sections together for soldering.

True, this type of container does not hold a candle to a commercially fabricated unit, but it will do the same trick: provide shielding. I position the PC board sides up about 3/16" from the bottom of the brass to clear the power supply and amplifier leads. The bottom can be soldered to another brass sheet or PC board stock to close off and shield the bottom of the amp. The top can be shielded by formed tin foil for testing. A stiffer copper or other metal foil can be used in the final version.

A few tricks might be in order concerning the stability of microwave amplifiers, particularly when located inside of boxes. The boxes can act like waveguide and make a good amp unstable when placed in the box. The box looks like a section of resonant waveguide. There are several methods to stabilize amplifiers built this way. One is to add a small brass shim plate over the FET, effectively shielding the input of the FET from the output (this also breaks up the waveguide effect). See Figure 3, FET shielding. This shield is soldered to the common source leads and common ground like a brick wall over a freeway. A small slot to clear the FET connections is cut into the wall for FET clearance. Additionally, a short piece of insulated wire is placed over the FET and soldered on each side of the FET to each source lead (source leads are grounded).

Another trick is to place static foam over the power supply amplifier on top of the component parts. It can touch the components as its resistance is quite high; in the 100k or megohm range. If this works, but not really effectively, you need to take a drastic last step that is just short of black magic. What you do here is find some broken ferrite cores or broken ferrite material and glue an irregular pattern of them onto a lid or top plate on the enclosure. This will break up the waveguide syndrome inside the box. You might get by with only one of these methods or you might have to use all of them together. It's a little "cut and try." Nothing is guaranteed. Remember: As microwave FETs are used at lower frequencies their gain becomes quite large and stability is an increasing problem. Good luck with your amps, may they all be stable.

That's it for this month. As always, I will be glad to answer questions concerning VHF-to-microwave topics. Please include an SASE for prompt reply. 73 Chuck WB6IGP. 73

Number 21 on your Feedback card

ASK KABOOM

Your Tech Answer Man

Michael J. Geier KB1UM
c/o 73 Magazine
Route 202 North
Peterborough NH 03458

The Essential Element

Over the nearly five years I've been writing this column, I've tried to cover just about every facet of our radios' innards, in the hope that I might help you fix and understand your ham gear a little better. We've looked at RF, IF and AF stages, microprocessors, the art of reading schematics, and more basic stuff like Ohm's Law and scientific notation of parts values.

In order to follow a schematic and make sense of the circuit's stages, though, it is vital that you understand the operation of the essential element that is at the heart of virtually everything electronic: the transistor. Now, I'm not saying that you need to understand it at the "holes and carriers" physics level. In fact, you don't need to know that at all. What you do need to know, though, is how a transistor operates in the real world. If you can see how changes in the signal to the transistor's base affect the flow of current across the collector and emitter, you can go a long way toward understanding why circuits are wired the way they are. Also, you're much more apt to recognize performance problems when you see them. So, let's take a look at the most basic, common active element in any circuit: the bipolar transistor, so called because of its two polarity-enhanced types of semiconductor material.

It Takes All Kinds

There are two basic kinds of bipolar transistors: NPN and PNP. These designations refer to the voltage polarities in the chemical "doping" of the semiconductor material, and are related to the polarities you must place on the three terminals in order to make the device work. Those terminals are named Emitter, Base and Collector. Take a look at Figure 1 to see how they're shown schematically. If the arrow on the emitter faces outward, the transistor is NPN. If it goes in, toward the center line, the part is PNP.

The important letter is the middle one, because it specifies what polarity must be placed on the base, relative to the emitter, to turn the transistor on. Notice that this polarity is strictly relative to the voltage on the emitter; the transistor has no idea where true ground in the circuit is. It only responds to what is connected to it. That has important implications, as we'll see later on.

Keeping Current

Bipolar transistors are called "current-operated" devices, while FETs (field-effect transistors) are known as "voltage-operated" components. It's a confusing terminology with a fairly straightforward explanation. Look at Figure 2 and you'll see that the internal construction of the transistor is very similar to that of two diodes. Current can flow between the base and emitter, and between the collector and the emitter, but never between the base and collector. So why not just use two diodes? Well, the magic of the transistor that makes it useful is that the diode between the collector and emitter only conducts when current is flowing between the *base* and the emitter! And, it takes only a small current between B and E to create a path for a much larger current from C to E. And that's why transistors have gain.

Regarding the current vs. voltage operation issue, take another look at that B-to-E junction. It's just a diode, right? There are two things about diodes that are important here. First, they are low-impedance devices. Second, they have a fixed voltage drop—they are not simply resistors. The voltage drop across a silicon diode is about 0.6 volts. So, if you apply more than that, the diode conducts until there's just 0.6 volts across it. The result is that signals applied to the base of a transistor look like they're getting chopped off to a 0.6 volt level (assuming the emitter is connected to ground—remember, the 0.6 volts is only relative to the emitter). So, what good is that? Well, the *current* flowing through the diode will vary as the incoming signal's voltage fluctuates, and it's that current which adjusts the conductance of the C-to-E diode. And that's why bipolar transistors are known as current-operated devices.

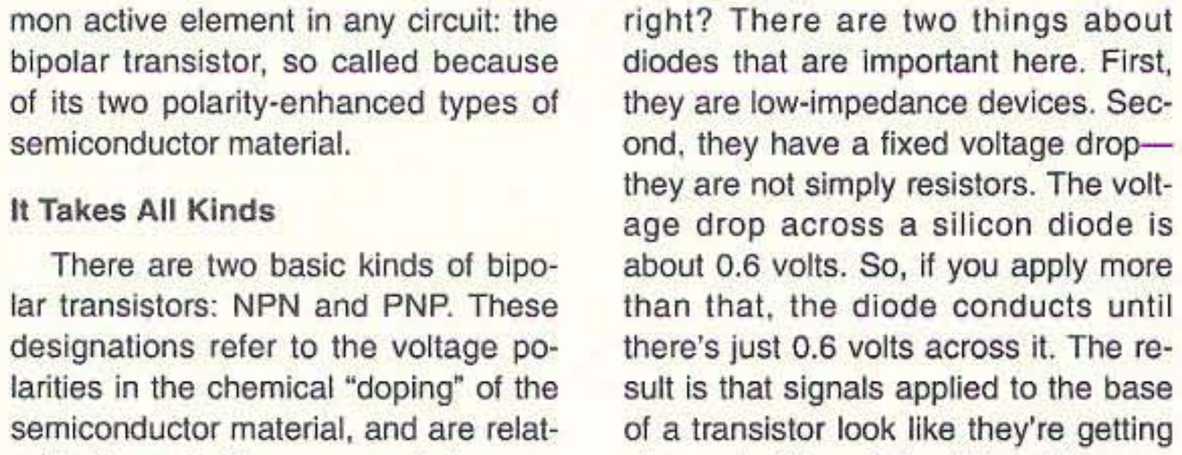

Figure 1. Schematic symbols for NPN and PNP transistors. Note the arrow's direction for each.

FETs operate on very different principles, because there's no diode between a FET's gate (its equivalent of a base) and the rest of the transistor. The "junction" is more like a capacitor. FETs have extremely high input impedances, so the input current is negligible. The voltage of the incoming signal is what affects the FET's conductance, so they are "voltage-operated" devices.

NPN

By far, the most common polarity of transistors is the NPN. It has become so for two reasons. First, most circuitry made today uses negative ground, and the NPN architecture works well in that configuration because it implies positive signals on the base. Second, NPN devices are easier and cheaper to make.

In an NPN transistor, the base must go positive with respect to the emitter for the C-to-E junction to turn on. So, in a normal negative-ground circuit, the emitter will be found connected to ground, either directly or through a resistor, transformer coil or other DC path. (There may also be a capacitor in parallel with the resistor, in order to lower the impedance and increase the gain at the signal frequency, but that doesn't affect the DC performance.) The collector will be connected to the positive power supply. Again, a resistor may or may not be present. There must be a resistance, though, in *one* of the two lines (E or C) or the transistor will attempt to dissipate the entire power supply and be destroyed!

Take a look at Figure 3. When the transistor is turned on by a positive signal at the base, it looks, as far as C and E are concerned, like a potentiometer whose wiper is being wiggled by the incoming signal. Current flows between C and E, and the resistance to it varies with the current flowing between B and E. If we take our output from Point 2, it will be a faithful replica of the input signal, except that the much larger current from the power supply will be available. That's called *current amplification*. And, because the emitter's signal follows that of the base, the circuit is called an *emitter follower*.

If we take the output from Point 1, though, it's a very different story. Now, the circuit looks like two resistors in series, the two being the top one, and the transistor itself plus the bottom one. Thinking back to Ohm's Law, you can see that, as the resistance ratio between the two varies greatly, the voltage at Point 1 will swing just about all the way from ground to the full supply voltage. In fact, the signal will *invert*; as the current between B and E rises, the voltage at Point 1 will go down! And, as the base current falls, the voltage at Point 1 will go up because it isn't being pulled down to ground by the transistor. So, the output signal will be upside down, but its total voltage swing will be much bigger than that of the original input signal. That's called *voltage amplification*.

PNP

In a PNP transistor the operation is exactly the same, except that all the polarities will be reversed. PNP transistors are commonly used as positive power switches. In that application, the emitter is connected to the positive power supply, and a resistor is placed between B and E (see Figure 4). That keeps B at the same voltage as E, so no current flows between them and the transistor is kept off. When B is pulled down toward ground by an external signal, though, it is now negative *with respect to the emitter* and the transistor turns on, allowing current to flow between C and E. You'll often see this configuration in circuits which need to be turned on and off from a microprocessor or signal processing chip. A good example is the audio amp on a handheld. When the squelch is closed, the transistor is kept off and the audio amp chip gets no power. When a signal is received, the squelch circuit pulls down the base and current flows through the transistor to the amp chip. If you suspect a malfunction in such a circuit, check the voltage between E and B, not from B to ground. If it's very close to zero, the transistor is not being turned on. If the base is negative, though, it should be turning on. If there's still no voltage on C, the transistor may be open. Because they often carry significant current, transistors in this application tend to blow more often than others.

Testing, Testing

You can test a bipolar transistor with an ohmmeter, as long as the part is out of circuit. For an NPN device,

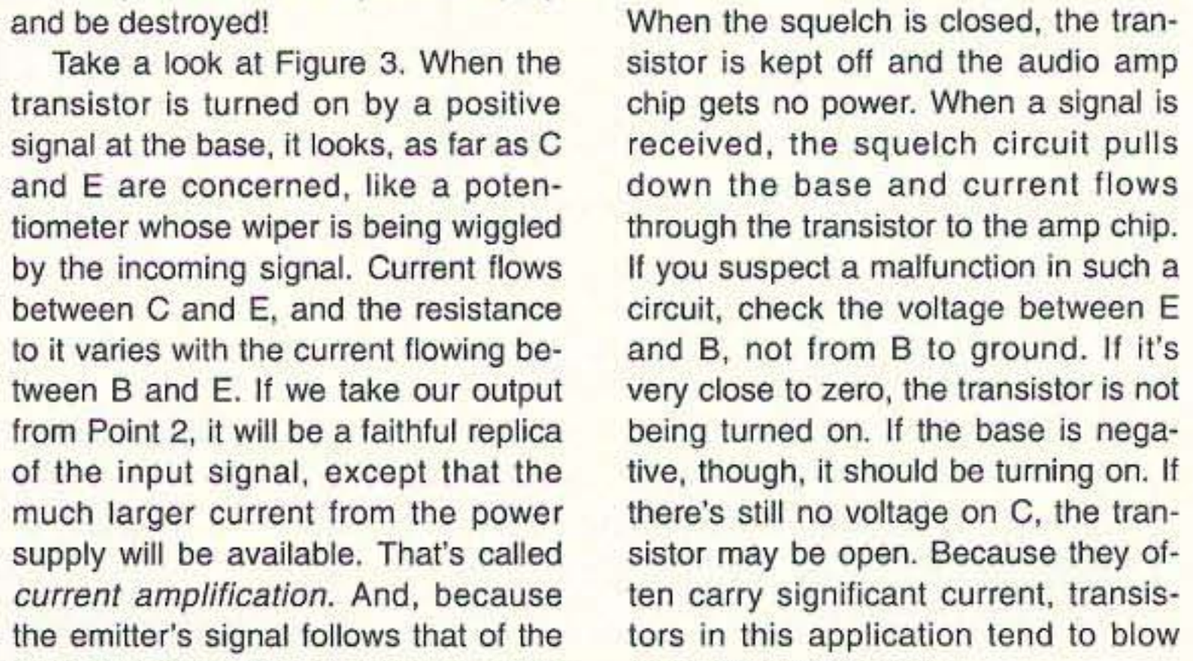

Figure 2. Theoretical NPN and PNP transistors, each composed of two diodes.

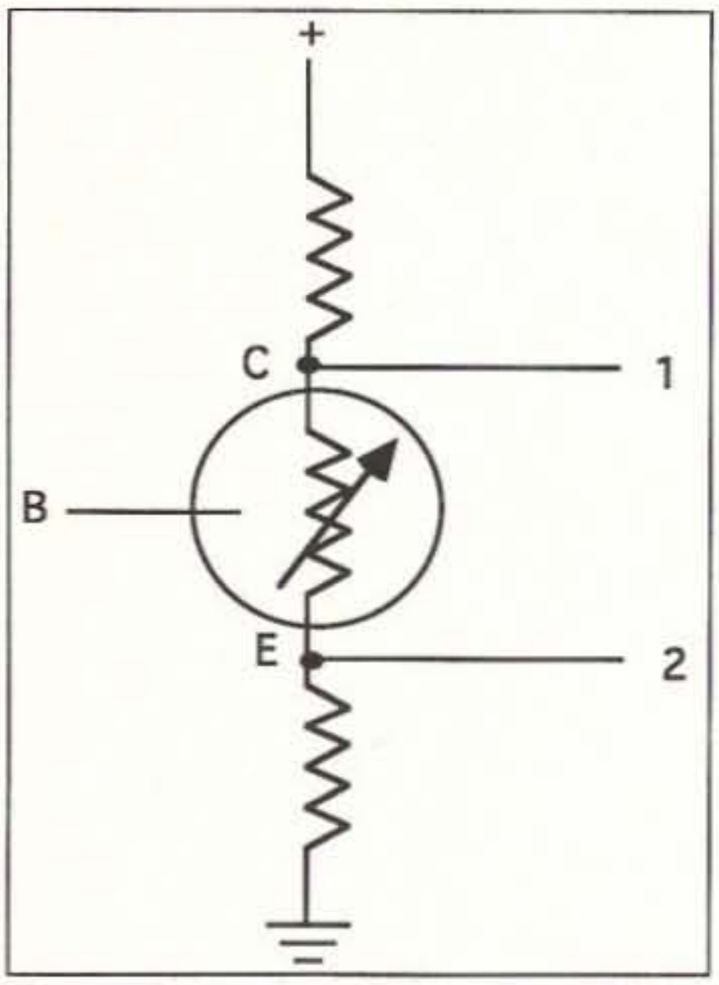

Figure 3. Another theoretical model for a transistor is composed of resistors. This model is like a potentiometer with the base-fed signal wiggling the wiper.

connect the positive lead to C and the negative one to E. With B touching E, no current should flow. Now touch B to C and the transistor should conduct. It is normal for it to have significant resistance. (If you can't get a reading, try reversing the ohmmeter leads; some ohmmeters are wired backwards.) For a PNP part, the procedure is the same, except the ohmmeter leads must be reversed from whichever arrangement works for NPNs. Once you get it straightened out, this method makes a great way to tell PNPs from NPNs.

If switching the base lead back and forth from E to C doesn't produce the desired effect, the part is probably bad. There are other problems which can occur, but this procedure will catch the vast majority of bad bipolars. Two warnings: First, be sure

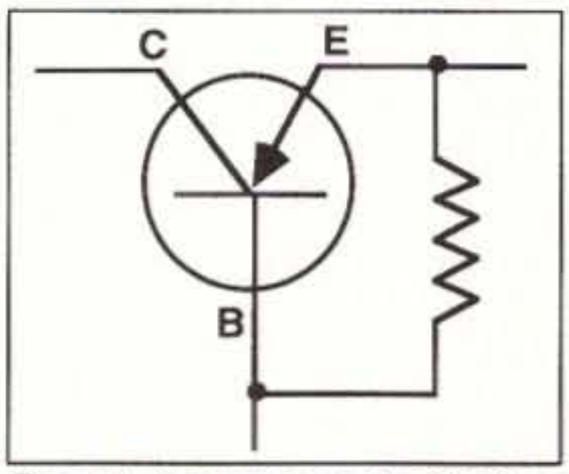

Figure 4. A common configuation for a PNP transistor includes a resistor connecting the emitter to the base.

the transistor you wish to test is, in fact, bipolar, because you can ruin an FET that way. Second, use the lowest ohms scale that will give a readable indication, so that you don't pump too much current through the transistor. But remember, you're fighting a 0.6 volt drop, so you can't test with a nearly dead battery in your ohmmeter.

Exploring the Unknown

Now that you know how a transistor is connected, you can figure out whether an unknown transistor is PNP or NPN, as long as you can figure out which lead is the emitter, without even taking it off the board. (If the case isn't marked, figure the leftmost lead, with the flat of the case facing you and the leads going down, will be the emitter. Now and then it may not be, but it usually is.) Here's how: If E is connected to ground, through a resistor, transformer or other DC path, then the part is probably NPN. If, however, E goes toward the positive power supply, then most likely it's a PNP part.

Well, I hope you've enjoyed our little journey through the world of the bipolar transistor. Remember, even though you can't see 'em, microscopic transistors are the essential elements of ICs too. Analyzing ICs, though, is much different and much harder, because there are lots of transistors on one chip and they may be connected in complex ways. But the principles of their operation are much the same.

Until next time, 73 de KB1UM.

Number 22 on your Feedback card

73 INTERNATIONAL

Arnie Johnson N1BAC
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N. Swanzey NH 03431

Notes from FN42

As I mentioned last month, the Crotched Mountain Rehabilitation Center has some new hams. Chris NØCUH sent me their names and callsigns. Three of the four new hams are on packet and I'm sure that they would love to receive packet messages from around the world. Give it a go: Kristin N1PQB, Skot N1PQC, and Katie N1QGP. All can be reached at WA1WOK.NH.USA. NOAM. The fourth, Gena N1PPX, is not on packet yet, but I'm sure you could get a message to this new ham if you send it to Chris at the same BBS.

Ah, the beginning of another new year! Time sure flies when you're having fun. 1993 has been a great year for me when it comes to ham radio. I was able to assist in a ham radio class for new hams, be involved in Volunteer Examiner (VE) tests that brought new hams into the hobby or helped others to upgrade, and be involved in VHF/UHF contests and Field Day with fellow hams. And I can't forget the fun of Hosstraders, a semi-annual outdoor ham flea market (the best deals happen on Friday night, or so they say). The proceeds go the the Shrine Burn Hospital in Boston. That's a great way for hams to help others and to enjoy yourself as well.

I don't know about you, but I'm looking for a bigger and better year as a ham in 1994. I hope that all of you have a great New Year as well! 73, Arnie N1BAC.

Roundup

Africa *Information from* STARS News, *Issue 1, September 1993.* **Sierra Leone:** Due to the political and economic situation, SLARS is unable to function effectively. Ham operations take place only in remote areas under special supervision from the Secretary of State. In Freetown, hams are still waiting to hear from the authorities. **Ghana:** The ban on amateur radio operations was lifted on March 19, 1993. On March 30, Kofi Jackson 9G1AJ inaugurated the station of the Merwede Hospital (Holland) in Dorma Ahenkro. **Uganda:** Also last March, the ban, imposed in the early 1970s, was lifted. In May, an American DXpedition operated as 5X1DX. **Kenya:** After the one at the Kisumu Academy, RSK started another school project, this time in Nairobi. Novice and Intermediate licenses have been introduced. **Tanzania:** Three SWLs passed their exams and are now working towards their CW, coached by Max 5Z5MR. **Lesotho:** Six new licensees are regularly operating the PADC (Promoting Amateur Radio in Developing Countries)-sponsored club station (7P8NUL). The new Radio Management Bureau, headed by Mr. Mandoro, invited LARS to advise on amateur radio matters. Various items have already been discussed, such as the RAE and the possibility of a Novice license. **Swaziland:** The training courses at Sisekelo High School generated 13 new licensees; on April 30, the club station participated in SAREX. Four students actually spoke to the space shuttle, causing tremendous enthusiasm around them (other students and parents were watching). Courses for a full license are in progress. Approaches are being made to have the South African exam be written in Mbabane. **Mozambique:** The PADC club station has been installed in Maputo. They are running CW courses. The club is working on its constitution and will soon apply for IARU membership. **Zambia:** RSZ held an AGM last May. Out of 40 licensees, eight showed up, along with two representatives from the licensing authority. Chris Cotton 9J2CP was elected chairman and Fred Bunce 9J2FB secretary. **Zimbabwe:** ZARS has a new president, Howard Kramer Z21EK. They have set up a club station at the university with two licensed members and 20 students.

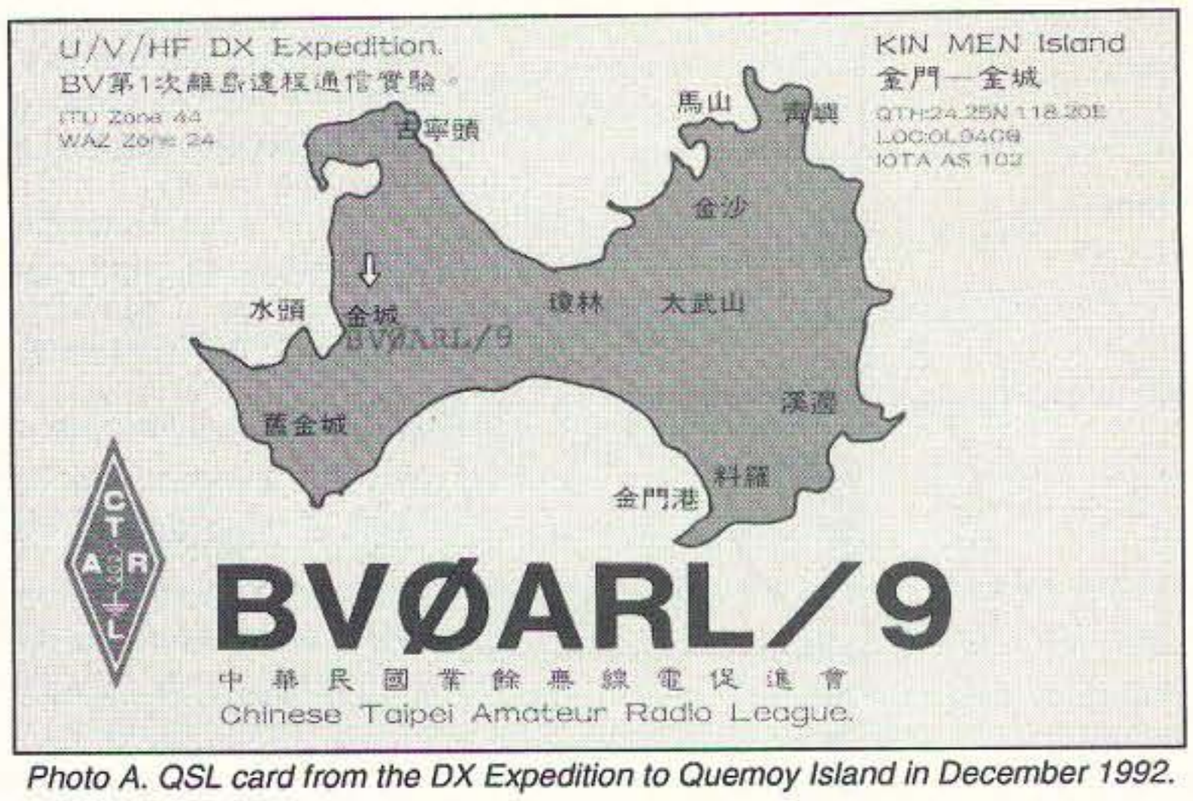


Photo A. QSL card from the DX Expedition to Quemoy Island in December 1992.

"News Focus Africa" is a weekly feature in the "Amateur Radio Mirror International" broadcast every Sunday by ZS6TJ at 0800 UTC on 7.080, 14.282, 14.292 MHz (and on 7.093 in AM) and repeated on Monday at 1800 UTC on 3.718 and 14.282 MHz (and on 7.093 in AM). Tune in and let'm have your news and info. Africa Telecom 94 will be held in Cairo from April 25-29, 1994.

If you like the information presented here, you can cut out the middle man (*73*) and receive your own copy of the *STARS News* by contacting: Hans Welens ON6WQ, Mechelsesteenweg 45, B-2500 Lier, Belgium (Tel: +32.3.4891333 or Fax: +32.3.4881357). *[A full list of members of the STARS Working Group is available in the "73 International" area of the 73 BBS (603-924-9343, 300-2400 bps, 8-N-1).—Arnie]*

The Netherlands *On Target* is the newsletter from Radio Netherlands. It carries information on the programme line-up and the personalities involved. If you have comments, *On Target* has opened many channels of communications. You can send electronic messages concerning their English programmes through FIDONET, Internet, and CompuServe. Just route the message via MCI Mail to Jonathan Marks, account number 338-2983. You can phone the Radio Netherlands answerline on +31 35 724222 (24 hours a day). They also welcome your letters sent to English Section, Radio Netherlands, P.O. Box 222, 1200 JG Hilversum, The Netherlands. You can also fax them on +31 35 724352, but please mark the fax for the attention of the English Department. If you live in the Indian Subcontinent, write to them at English Section, Radio Netherlands, P.O. Box 5257, Chanakya Puri Post Office, New Delhi 110021, India. Those letters will then be forwarded.

U.S.A. *Letter from Sociedad Internacional de Radio Aficionados (SIRA): Once again, the Miami-based Sociedad Internacional de Radio Aficionados (SIRA), or International Society of Amateur Radio Operators, performed an outstanding public service before and after Hurricane Gert slammed into the Atlantic coast of Nicaragua. The WB4ESB SIRA NCS was activated on September 14 at 9:30 p.m. EDT on 14.153 MHz and was active 18 hours a day through September 21 at 10:30 p.m. EDT. Relief communications were also handled with many Panamanian, Guatemalan, San Salvadorean, Honduran, Costa Rican, Nicaraguan, and Mexican stations.*

Several countries participated during the eight consecutive days that WB4ESB was translating all bulletins issued by the National Hurricane Center (NHC) in Coral Gables, Florida, into Spanish. The SIRA NCS started instructing other amateurs and radio clubs about the possibilities of surges, mudslides, tidal waves, flash floods, and overflowing rivers.

Also, SIRA managed to get two meteorologists, Lazaro Dominguez from WLTV-23 and Felix de la Osa WB4DLY from the NHC, to talk with several officers and personnel from Civil Defense in various countries, in order to make them aware of the danger of flash floods and complete evacuation procedures. Gert's torrential rain prediction, 5-10 inches (and more in the high regions), was a huge threat for all the Central American countries.

WB4ESB was managed in Miami by Rafael Estevez WA4ZZG, Marta Estevez KB4AW, Sebastian Jaime WB4LZR, Valeriano Builes HK4BTV/W4, Roberto Fernandez WB4RDD, and Jorge Quintero WD4JVN. The SIRA NCSs in other countries were Jose Alvarez TG9MP, Pietro Lunanuova YV4WR, Luis Peralta TI2LFP, Jaime Policart HP1MP, Cesar Landaeta YV5ID, and Rafael Garcia HI8RGQ.

Our thanks to the many other stations who acted as relays and kept the nearby frequencies clear. As usual, 7.163 MHz was also used late at night and early in the morning to continue the communications with some countries, due to the short skip.

With so many hours of prevention, the sad part of this story is that more than 15,000 people were left homeless and a total of 59 were dead in four countries (TI, YN, HR, XE). Merciless Gert was another hurricane killer

Continued on page 82

Photo B. Operation from Quemoy (R-L): Tim Chen, BV2A; Chen Chang-yee, PTD, MOC; Joe Chen BV2IJ.

ADVERTISERS

Bold listings are *73's* new advertisers this month.

*Advertisers who contributed to the National Advisory Committee (NIAC).

73 INTERNATIONAL

Continued from page 80

sweeping through Central America and Mexico.

Beyond differences of language, nationality, religion, and/or political systems, SIRA again achieved the goals defined in its motto—"Fomentamos la Hermandad y La Buena Voluntad," *"We Enhance Brotherhood and Goodwill."*

For further information about SIRA, please write, call, or fax SIRA's president: Rafael M. Estevez WA4ZZG, P.O. Box 524071, Miami Fl 33152-4071; (305) 822-1688.

CANARY ISLANDS SPAIN

Woodson Gannaway N5KVB/EA8
Apartado 11
35450 Santa Maria de Guia
(Las Palmas de Gran Canaria)
Islas Canarias, Espana

Hello again from EA8-land. The old ham radio club of this part of the island (the northwest) is becoming active again after many years. This is the same club that fielded the ham's famous "trip around the island by burro." And foxhunting seems to finally be getting started here. They also sponsored a series of evening public talks on various aspects of our hobby during the recent September holiday celebrations in Guia. This year, I finally made the "Romeria" in typical traditional costume, camera at the ready. If a friend got a decent shot of me, I'll send it along with the next report.

Most hams at least know where the Canary Islands are located, but that's not true of the general public. They simply have no idea, and neither did we when we first started thinking about moving here in 1986! We did what research we could but learned little, and most of what we learned was either wrong or outdated. So, we found lots of surprises. Nothing could have prepared us for the incredible physical beauty of the archipelago. Another pleasant surprise was finding a varied international community. Since in the afternoons and evenings I wear the hat of a private English tutor and many of these people want their children to learn English, I'm in their homes every day. For some reason most of my students are Oriental, and anyone who has bought the myth of the "inscrutable Oriental" obviously hasn't gone to their homes to teach their children English.

I well remember arriving at one apartment to start a new class. Often they will set out a pair of slippers for you to put on when you take off your shoes. As I stopped in the entryway to take off my shoes, I glanced into the living room to meet the returning glances of the mother and her friends. Then they followed my gaze down to the slippers set out for me. My size 10-1/2s were dwarfing the size seven slippers set out for me, and they were the biggest they had. The result was uproarious laughter from all sides, adults and children alike. When it had subsided, I was enjoying it too, and the apologies called for by their high sense of courtesy were made and received through big smiles and a few lingering chuckles. The ice was broken with that family.

Another time a little Japanese girl, very well disciplined but also full of spirit, had just gotten new hand puppets. So after class, while her mother and I drank tea, she treated us to a puppet show off the edge of the table. Immediately we had a sequence of classroom pandemonium, students wrestling on the floor, teachers reprimanding those responsible, all accompanied by an ample range of sound effects and more uproarious laughter. These aren't isolated incidents, so maybe you get the idea.

As any teacher, classroom or individual, knows, you can only allow students to loosen up to the degree that they will settle back down to work when you give the word. But the learning experience can be enriched immeasurably by including such digressions. So it's really worthwhile to look for the balance point and use it to the utmost from time to time. It seems to help with my rebellious children (and I get a lot; again, I don't know why), and it's one of the acceptable ways I give them to let off some steam so that, hopefully, they won't feel they have to disobey or try to thwart me on the important points.

Until next time, 73 from Woodson, N5KVB/EA8.

ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
D.N. Hanagev 85530
Israel

IARC Wins Court Precedent Against Jammers After the Israel Amateur Radio Club (IARC) jammer trackers caught two pirates disrupting 2 metre and 70 cm FM repeater traffic in Tel Aviv, the organization decided to take matters into its own hands. This came as a result of dissatisfaction with the authorities' lack of action in the matter.

After the IARC promised not to file for damages against the offenders, the jammers pleaded guilty. The tactic was to gain a legal precedent in this civil case to be used in future lawsuits against jammers. The offenders were obligated to cease all operations, so the QRM was effectively squelched.

Without going into the intricacies of the verdict, the main points of the outcome are as follows:

1. The repeater frequencies "belong" to the IARC, and there is no such thing as just happening to be conducting a QSO on the repeater's

input frequency. Thus, anyone not a member of the IARC may not use the frequencies of the IARC repeaters.

2. Likewise, anyone not a licensed radio amateur may not use the frequencies exclusively designated for the amateur service, and thus may be sued. (This may sound like a redundant reiteration of the radio regulations, but bear in mind that this is a precedent-setting judgment in a *civil* court.)

3. The government attorney general set down that the police action against intentional interference was no longer contingent on a criminal complaint by the Ministry of Communications alone (the previous procedure).

The bottom line is that the victims of intentional interference are no longer dependent on the Ministry of Communications, admittedly understaffed and underbudgeted and often accused of being ineffective. Now sufficient evidence may be collected against the jammer, and the police may be called directly. How effective will this precedent be? Only time and the prosecution of the next culprit will tell.

Rich 4X1DA published a paper in the IARC magazine *HAGAL* detailing some of the methods that are used to nab jammers. Outside of Doppler and triangulation direction finding methods, every transmitter has its own characteristic "fingerprint" in terms of how it keys up each time it transmits on the frequency, and with the use of a computer it's easy to catalog everyone's "fingerprints" and then identify an unidentified transmission. This also provides solid condemning evidence. Even a repeater "kerchunker" can be identified this way.

[We ran out of room this month, but this needs to get in. As of midnight, December 31, 1993, 4X1RU HF/VHF packet BBS will go off the air due to many reasons. Full story next month.—Arnie]

MONACO

Daniel Plett 3A2LZ
B.P. 349
MC 98007
Monaco

We've had a big month here in Monaco. Maybe this will be of interest to you.

On the 15th of October, His Serene Highness, Prince Albert, was a guest of the Association des Radio-Amateurs de Monaco (A.R.M.). The A.R.M., Monaco's national amateur radio society, was celebrating 40 years of existence and the official opening of its new facilities. This location is provided by the Monagasque government. During the ceremonies, Prince Albert was awarded the callsign 3AØAG.

Representatives from French and Italian amateur organizations also attended. Representing the R.E.F. (from France) was F6AXX. F6GEZ also came, representing the Alpes-Maritime region, which surrounds Monaco. I1BYH came to represent the A.R.I. (from Italy) and presented a pennant and plaque as a show of friendships to the A.R.M.

During the week of 10-17 October, Monaco hams activated a special callsign, 3A4ØARM. This contact is worth two points for awards offered by the A.R.M. Using 2 meters to coordinate their activities, they kept the callsign active on most HF bands and on CW, SSB, and RTTY. All QSLing is being done by the association through the bureau.

Best 73, Daniel 3A2LZ.

TAIWAN

Tim Chen BV2A
P.O. Box 30-547
Taipei, Taiwan
China

The Chinese Taipei Amateur Radio League (CTARL) dispatched an expedition group of 16 operators/technicians to initiate the first BV9 amateur radio—BVØARL/9—on the Quemoy Island, 320 km southwest of Taiwan, for an eight-day operation from December 24 to 31, 1992. The group arrived safely and came back to Taiwan by air transport. Owing to crowded air traffic, all persons were forced to book first-class seats at twice the expense. The total expenses, amounting to approximately US$9,000, were jointly borne by all participants. The Trimmer Company was most generous, lending all rigs and antennas for the operation. Also, we are grateful to those radio fans in Kinmen for volunteering all help: providing transportations, manpower, facilities for installing the radio station, and arrangements for accommodations. At last, these people have become our society's members.

The Deputy Director, Chen Chang-yee of PTD, MOC, had accompanied the group to open the ceremony on the morning of December 25th; and the Director of Quemoy Tele-Communications Directorate greeted the occasion by wishing that the amateur's activities would be further promoted in the area, where the restrictions will be lifted before long for all visitors.

The QSL cards for the expedition station BVØARL/9 are now ready and being dispatched. The participating operators were: BV2A, BV2BO, BV2FB, BV2TA, BV2AP, BV2WC, BV2DQ, BV2WC, BV2HH, BV2IJ, BV2LK, BV2QB, BV2HN, BV2UA, BV2VA, BV2ET (XYL of BV2VA, Trimmer), and BV2EW. BV2EW was at service with the military in Quemoy, and he joined the expedition unexpectedly and enjoyed it tremendously.

73 from Taiwan de Tim Chen BV2A.

[Chinese Taipei Amateur Radio League, GPO Box 93, Taipei 100, Taiwan, China]

NEVER SAY DIE

Continued from page 4

have to break loose and think differently.

Electro-Voice was started in a garage in Ohio by two chaps I knew who thought they could make better microphones. Jim Lansing started similarly, making better loudspeakers. Steve Wozniak and Steve Jobs started in Jobs' garage with the Apple I. I visited 'em in 1976, when all they had was a handmade prototype, egged 'em on, and the rest is history. At about the same time I met Bill Gates, who'd just dropped out of Harvard. He took the BASIC interpreter he'd written as a school project and joined MITS, the first microcomputer manufacturer. He's done well.

No guts, no glory. And no nice expensive ham shacks either.

How I Spent My Summer Vacation

Last year my birthday present from Sherry was a trip to Alaska. Ketchikan. Well, I told you all about that last year . . . I can't help it if you're not paying attention. It was a great trip and you've screwed up badly if you haven't gotten up there to visit that area. You're a disappointment to me, the way you've been screwing up, despite anything I advise. I'm doing the best I can to smooth out life for you . . . plodding on ahead, pointing out the rough spots so you can avoid them. And also pointing out the points of interest, so you won't miss them as you trudge along with blinders on, looking down.

Sigh.

Hey, look up! You've somehow managed to luck into the world's finest hobby, amateur radio. Now look at what you can do with it! There are some exciting things you can do in amateur radio that you haven't tried yet. Also, there are some other things you can do that are fun. There are ways you can live a longer, healthier life. There are plenty of ways you can make money and have fun doing it.

So when are you going to look into a trip to Alaska? Or getting on packet? Or making ham satellite contacts? Or maybe doing a little DXpeditioning? It can't be a lack of money because I've been telling you how to make all the money you need for years . . . and proving it by heeding my own advice. You don't have to work hard, just smart . . . though working hard as well as smart does help.

Right after that Alaska trip last year Sherry organized a short trip to Dominica so I could get in a little scuba diving. That's when she came across a special fare that Liat (Leeward Islands Air Transport) had going. But, I told you about the diving trip last year. This year, a couple weeks before my birthday I wondered if Liat might have that fare available again.

Most Caribbean vacationers head down there in the winter, so that's high season. The place is almost empty in the summer, so prices are down in the NSD range. Those are the kind of prices I like. My hordes of detractors call me cheap. I prefer to think of it as being thrifty. They say NSD stands for Never Spend a Dollar. Well, I don't like spending a dollar where a few dimes will do the trick.

Sherry reported that yes, Liat did have a corking good fare. $360 for 30 days anywhere on the airline. She asked me for a list of the islands I hadn't yet visited so she could see what she could put together. I gave her a list of 10, figuring that she might be able to organize us visiting two or three of them since I only had a few days open on my calendar. She came up with a way we could visit all 10 islands in 21 days. We'd fly a day and then I'd dive a day, hopping from island to island. The tour included Barbados, Tobago, Grenada, St. Vincent, Guadeloupe, Antigua, Montserrat, Anguilla, Nevis, St. Kitts, plus an eight-hour layover on St. Lucia between flights. That would give me eight new ham radio countries to visit, bringing my total to 128 . . . but who's counting? The 11 flights would average only $33 each!

One thing I didn't know when I was planning the trip was that the old days of having to send ahead weeks in advance for a license were long-gone. These days most of these countries let you bring along a rig and get on the air using your call with a portable slash for a few days without any official permission. And beyond that, licensing is easy. So at the very least pack an HT. Almost every island has at least one repeater. Some have repeaters linked to other islands. Some even have packet links. Plus you might want to bring along a portable rig like a 735 and some wire dipoles. Suddenly you're on a DXpedition.

The Montserrat exhibit at Dayton this year helped pound the idea of getting down to the Caribbean into my head. It didn't hurt that VP2MAX runs a great bed and breakfast place there. Wait'll you see it! And he even included the use of his station! Though I only visited Montserrat for two days they issued me the call VP2MCD so I wouldn't have to operate as W2NSD/VP2M.

I had some great minihamfests on several of the islands. One thing is clear . . . the hams would love to have you come down, see their island, and get on the air and take some of the pileup pressure off. It's one thing to be on a DXpedition and make a few thousand contacts. It's another to live there and have most hams not wanting to talk with you, but just get your QSL. That was the main reason I went to Jordan when King Hussein first got on the air. I was afraid we'd lose him as a ham if he wasn't able to actually talk with anyone, but had to constantly fight off pileups. So I went to Amman and spent two weeks grinding down the pileups, giving His Majesty a better chance to enjoy our hobby. I didn't say I didn't have fun doing it.

If you can visit an island or two armed with a rig, you'll not only have a ball, but you'll be doing the locals a big favor. Everywhere in the world I've traveled I've found the hams in rare countries hating the pileups and the DXCC Honor Roll, which is at the root of them. They've been anxious to have me work the pileups for them, so I've handled endless pileups from all sorts of weird places such as FK8, VR2, 5W4, 7P8, 3D6, 5Z4, YK, YA, 9M, VU, OD, FO8, HS, and so on.

Okay, what does it cost to get down to the Caribbean and have some fun? American Airlines cost $330 round trip from Boston to Barbados. Plus the $360 for Liat, and an average of around $75 a night for a double room at most hotels. Plus 10% service and 7% island tax almost everywhere. Plus an exit tax of up to $20 per island. I figure it cost us about $250 per island including meals, rooms, taxis, exit tax, and some ice cream cones.

The whole trip for the two of us thus cost around $4,500, and that included two dives each on nine islands. That netted out to around $205 a day for a 22-day trip which I'll not only never forget, but which I'll probably never stop talking about. Would I do it again? In a minute!

You do have to watch out for the $350-a-night deluxe hotels. There are plenty of perfectly nice hotels and guest houses for well under $100 a night.

One warning to you red-necks: Most of the hams in the Caribbean are black. But they are so friendly and helpful that skin color soon doesn't matter. They're hams and avid about our hobby. And they're not nearly as uptight about color as are so many American blacks.

A Contest? Another Damned Contest?

Well, maybe. For over 30 years I've avoided organizing *73* contests. When I was the editor of *CQ* I got their DX contest going after Perry Ferrell had let it die. It's still going strong. Then I got a prefix contest going which may still be running. I've lost track. Those, plus the ARRL DX, Sweepstakes, and VHF contests seemed like enough. While I was talking with the Caribbean ham groups I broached the idea of a Caribbean vs. North American contest . . . maybe in August, when prices are low. The idea would be to get a bunch of America ham clubs to organize groups and put the rarer islands on the air for a contest weekend. What do you think?

Before I plunge into this I'll need three things. First, I'll need a DXer or a DX club to sponsor the contest and handle all the paperwork. I can help with getting the word around via *73* and *Radio Fun*, but I'm not going to sit here and cross-check a thousand logs. I learned my lesson on that when I ran a Save Eleven contest and got buried in logs. That was before we lost 11 meters to CB, so you know how well I learned that lesson. Are there any volunteers to officiate on a Caribbean/NA contest? Think of the international fame and recognition! Wow!

My second need will be a clear green light from the Caribbean island ham groups. This is mainly for them, so I don't want to jam anything down their throats. But if we can get a dozen or two ham club groups of six to 10 operators each down to the islands, not only will the participants have a lifetime of memories as a result, the islands will generate some badly needed revenues as well. They sure can use the extra business during the summer.

The third thing I need is an indication that you like the idea. If I don't get a lot of enthusiastic letters about this I'll deep-six it in the Cayman Trench, the deepest part of the Caribbean, some 27,500 feet deep. By the way, that was a trivia question on the flight back and worth a bottle of wine to know. The other trivia question was the degrees centigrade outside the plane . . . which I won, much to my surprise, with a guess of -38°C. And I don't drink. Oh well, the wine'll be good for cooking.

There are a bunch of islands down there, so there's room for everyone. And the Caribbean includes Mexico, Belize, Guatemala, Honduras, Nicaragua, Costa Rica, Panama, Colombia, Venezuela, on up to the Bahamas. There are the Greater and Lesser Antilles, and the Turks and Caicos Islands. I count around 43 countries all told . . . with 10 kinda difficult to reach and/or uninhabited.

If you like the idea let me know. I have enough to do without spinning my wheels trying to make people happy who don't want to be happy.

A Diver's Paradise

Most of you aren't into diving. Pity, because it's not an expensive sport; it's a lot of fun, and the exercise is great. Plus you get to see a lot of the world that most people miss except when Costeau or someone shows an underwater video on TV. It's wonderful being right down there with the sharks, barracuda, lobsters, moray eels, and so on . . . just floating along.

The price had recently come down on Hi-8 Sony cameras, so I got one a couple days before the trip. Then I called a diving friend to find out which underwater housing to get. He said it was the SubXero, so I called the chap in Miami who makes 'em and luckily he had one on hand. It arrived the next morning by Fed-X. It cost less to have it shipped than to pay the Florida sales tax and pick it up while passing through Miami on the way to Barbados.

The downside was its weight. I had to hand-carry it in a separate bag to keep from making my checked baggage so overweight they'd charge extra for it. It weighs a ton out of the water, but only about two ounces in.

The upside was that the videos came out marvelously. I advise you to make a wide berth around Peterborough so you don't get nailed for two or three hours watching my diving videos. Hey, look, there's the big manta ray at Tobago! And how about that

shark going by at Nevis? Plus endless coral and small, colorful fish swimming around. And look at the size of that lobster!

It was a blast and the hams were great. But next time I probably should take along an all-band rig instead of the video camera. They weigh about the same.

My luggage was filled with books to read during the trip. By the end I was busting to start two new publications . . . one about Caribbean diving, which I might call *CD Review*. And the other, as a result of the books I read while traveling, would be *Science Frontiers*. It would cover scientific research which the establishment refuses to deal with. There are some things that researchers have been verifying that are so obviously impossible that no establishment scientist or publication would dare to even consider them.

The diving publication would cover diving services, hotels, and all the other things travelers need to know when they get to a new place. How much are taxis? Where can you get good food reasonably? Should you rent a car? How good are the diving facilities? How about the coral and fish? What rip-offs should you watch out for? And so on. Visiting hams will want most of the same info. The con artists down there are waiting for the unwary at every turn, just like here in America.

More Diving?

Maybe, if I can get away. My diving friend is organizing a trip to Truk, Palau, Majuro, and Ponape for early February. I'd sure like to go. If you're interested I'll get you the details. Majuro, by coincidence, was where I started diving, back in 1944, when we stopped off there a couple of times to rest between submarine war patrols. I converted a Momsen Lung and dove around the lagoon. That's all it took to hook me on diving for life. When they invented the Aqua-Lung I bought one of the first models. By 1953 I had my own compressor and tanks.

I must warn you that I'm dangerous to travel with. I see business opportunities everywhere and get people all excited about starting this or that business. Wait'll you read some of the ideas I had for new businesses in the Caribbean islands!

If you decide to go along for the Pacific trip I'll have my video camera and get you a videotape of yourself going in and out of the Japanese fleet at Truk, plus who knows what other exciting things we'll be seeing.

And you could do worse than bring along a rig . . . right? I'll bet I'll have one. I may even write ahead for licenses this time.

Aaargh!

I'm holding in my hand an "Order For Supplies Or Services." It's a purchase order for a subscription to *73*. This is a government form we have to fill out to get paid for one subscription. ``Contractor must submit four copies of invoice.'' This bugger is seven pages long, but at least they tell you right up front what you're up against. It says, ``Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed and completing and reviewing the collection of information."

Seven pages for a $20 subscription. This is going to cost us at least $20 to fill out in quadruplicate. I hate to think how much the government will have spent paying for the one-year subscription by the time the dust has settled, the government has settled, and the paperwork is all done and filed. I'll bet they'll increase the deficit by at least $100, just on this project alone.

Poor, Naïve Wayne

One of our advertisers called the other day and asked a question. He'd exhibited at a recent *CQ Magazine* sponsored hamfest, which he says turned out to be a true turkey. He opined that not only didn't anyone much bother to attend this bomb, but those who did had their wallets sewn shut, just in case. The question he asked was a natural one. How come, in the face of this disaster, there was an article in a ham newsletter extolling the event? He wanted to know if there was something going on here that wasn't in plain view.

He further suggested that there might be a connection between the recent plea by the newsletter for money to keep afloat and this curious coloring of their reporting. I assured him that not in my wildest dreams would I ever suspect *CQ* of paying off the newsletter in order to try and salvage their floundering hamfest investment. I don't know where people get crazy ideas like that. I'm sure there's a simpler explanation for what's going on.

The Secret Life of Plants . . .

This is a fascinating book by Tompkins and Bird by Harper & Row Perennial Library ($14). If your spirit of adventure hasn't been totally wiped out by our crummy so-called educational system, you'll enjoy this. One thing about the book worried me, I have to admit. The material was first published in 1972 in *Harpers*. Then it was published in 1973 in book form, and reprinted in paperback in 1989. So why haven't I seen follow-up books on such an important subject?

Much of the stuff in this book doesn't seem possible, which was another reason for my concern over its validity. Then a friend sent me a video on the subject he taped off the air, allowing me to see some of the amazing experiments described in the book.

This all started when Cleve Baxter, a polygraph expert, connected a galvanometer to the leaf of his dracæna. He wanted to see if it would be affected when water was poured on the plant's roots. The meter's reaction wasn't what he expected. The trace zigged down instead of up, with a pattern very similar to his polygraph charts. Hmm. So Cleve decided to burn the leaf with a match and see what that would do. He was astounded to see the needle jump the instant he thought of burning the leaf. There was less of a jump when he actually burned the leaf. Could plants have some sort of extrasensory perception? You'll find the story of his research that resulted fascinating.

For instance, he found that when he had two plants together, with one wired to his galvanometer, when someone came into the lab and trashed the second plant the first reacted violently. Then later, when that person came back into the lab the plant again reacted violently. Somehow it not only was able to sense that particular person, but was able to remember the destruction of the first plant and indicate something akin to fear.

At the Hashimoto Electronics Research Center in Tokyo, Dr. Hashimoto was able to teach a plant to count and add up to 20. I saw a video of a plant being taught to manipulate a galvanometer hooked to an audio oscillator and say letters.

And how about a scientist who was experimenting with a plant root. He had it in a shielded tube so he could aim it at other plants. One day he left the chart recorder on during his lunch break with the root pointed at the sky. Suddenly he heard whistles and a series of pulsations. He moved the tube around and found the ``signals" were coming from outer space, from around Ursa Major (the Big Dipper). But you'll have to read about all this.

Do trees and plants communicate with each other? Do they exhibit long-term memory? When a plant is taken away from a group can it die of loneliness? Can ultrasonic frequencies influence the growth of seeds? Can a healer affect the growth of seeds merely by passing hands near the water used on the seeds? Can water be magnetized? Can a plant be conditioned to tell the difference between a piece of coal and a rock placed next to it?

You'll be amazed at the work done in India by Sir Jagadis Bose a hundred years ago, despite the resistance of the British Royal Society. Botanists, in particular, hated the idea that plants have a nervous system, even though Bose proved it with his experiments.

Can people really talk with plants? Luther Burbank gave his plants most of the credit for his discoveries, saying that he took them into his confidence and had learned to listen to them. Another plant listener was George Washington Carver, who invented peanut butter, plus an endless number of other peanut products. Before Carver, the peanut was considered worthless pig food.

Can music get plants to grow faster? 200 percent faster? And why do they grow toward classical music and away from rock—and then die? Well, that's my reaction too. They seem to like jazz too.

And what happens when you add some electricity to the pot when you're sprouting seeds? Would you believe the sprouts can grow five to seven times as fast? Jean Nollet demonstrated this in 1747. Of course if you want bigger and sweeter strawberries, this book may be of interest to you. How about a bean plant that grew to 22 feet high as the result of a pot being wired to an ordinary electric outlet? How about tons of seeds passed between the plates of a capacitor and then grew one third greater harvests in Italy in the 1930s? Corn yields jumped 20% in Russia in the 1960s with a similar treatment. And activated radishes double the size of the control crops?

And wait'll you read what being near a TV set or computer does to bean sprouts and rats! These are things you can test for yourself. You might want to try some beans near your linear, with a control group further away.

Then there are questions about the role of sunlight and our eyes on our behavior.

You'll enjoy reading about how Harold Burr developed a very sensitive voltmeter for studying living things. With it he could detect the exact moment of ovulation for women, detect malignancies, the rate of healing of wounds, and with seeds he could predict how healthy the resulting plant would be. With plants he could see the changes made by the lunar cycle, sunspots, and solar storms.

There's a wonderful chapter on what's been done in the scientific investigation of auras and Kirlian photography.

Another chapter shows a parallel between the birth of retarded children and the use of chemical fertilizers. Just between 1952 and 1968 the number grew by 25 times! Plus there's been a similar rise in leukemia, hepatitis, Hodgkin's disease and other degenerative diseases. It's almost enough to get you to start buying from your supermarket's organic food section. Fifty years ago coronaries were rare. Cancer, diabetes, arthritis, cavities, etc., are rapidly increasing.

Did you know that some plants and animals are able to transmute one element into another? Chickens, for instance, can change potassium, magnesium, and silicon into calcium.

It's a terrific book. If you have any curiosity at all it should have you setting up your own research projects. But I still wonder why I haven't found any books on the subject written since 1973. Weird. I'll be doing my best to get in touch with the authors to see what's been going on. I'll let you know. I'd love to see the books Bose published describing his experiments a hundred years ago.

If you know of any more recent books along this line, please let me know about them.

The research described in the book gives us strong clues on how we can greatly reduce sickness and thus cut our health care costs. It can help us grow better crops. Check it out. 73

Number 23 on your Feedback card

SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by December 31. Provide a clear, concise summary of the essential details about your Special Event. Check ***Special Events File Area #11*** *on our* ***BBS (603-924-9343)****. for listings that were too late to get into publication.*

JAN 8-9

FT. MYERS, FL A Hamfest will be held by the Fort Myers ARC, Inc., Sat. 9 AM-5 PM; Sun. 9 AM-3 PM., at Araba Shrine Temple Hall, 2010 Hanson St., (One block East of Rt. US 41). VE Exams Sat. at 1:30 PM; Sun. at 10:30 AM (no pre-registration required). Talk-in on 147.345+ MHz. Contact: *Jerry Deutscher KQ4UW, (813) 472-5130; Dale Hardin KD4UAO, (813) 275-8360*; or *G.E. Sammons WA4DQE, (813) 936-1431.*

JAN 15

HAMMOND, LA The 1994 Hammond Hamfest, sponsored by the Southeast Louisiana ARC, will be held from 9 AM-3 PM in the SLU University Center. Talk-in on 147.00-/146.52 simplex. Contact *Tyrone Burns, (504) 294-5839; or Bob Priez, (504) 542-1470*; or write to *SLARC, P.O. Box 1324, Hammond LA 70404.*

MONTEREY, CA The Naval Postgraduate School ARC will hold its 5th annual Hamfest from 8 AM-1 PM+ at the Monterey Peninsula College Armory. Talk-in on 146.97-. Contact: *Doug KC3RL, (408) 663-6117 eves/wkends; Pat KA6IRS, (408) 649-4444 Ext 20, wkdays.*

ST. JOSEPH, MO The 4th annual Northwest Missouri Winter Hamfest will be co-sponsored by the Missouri Valley ARC, Green-Hills ARC and Ray-Clay ARC. The event will be held at the Ramada Inn from 9 AM-4 PM. VE Exams. Talk-in on 146.85 and 444.925. For Dealer info, write to *Northwest Missouri Winter Hamfest, P.O. Box 182, Cameron MO 64429.*

JAN 16

MATTAPOISETT, MA An Electronic Flea Market will be held at Knights of Columbus Hall. For more details call *(508) 993-3993.*

YONKERS, NY The Metro 70 cm Network will host a Giant Electronic Flea Market at Lincoln H.S., Kneeland Ave., 9 AM-3 PM. VE Exams. Talk-in on 440.425 MHz pl 156.7; 223.760 MHz pl 67.0; 146.310 MHz; 443.350 MHz pl 156.7. For registration, call *Otto Supliski WB2SLQ, (914) 969-1053.*

JAN 22

FLINT, MI The 2nd annual Computer and Amateur Radio SWAP-N-SHOP, co-sponsored by ARAY and SW Academy RC, will be held from 8 AM-1 PM at S.W. Academy H.S., 1-69 & Hammerberg Rd. Walk-in ARRL VE Exams at 9 AM. Talk-in on 145.29-, 224.18-, and 224.14-. To reserve tables, call *Keith N8QNA, (313) 635-4123.*

LOVELAND, CO The Northern Colorado ARC will host the 1st annual Winterfest Swapmeet from 9 AM-3 PM, at the Larimer County Fairgrounds, 700 Railroad Ave. VE Exams. Computer and Radio. For VE Exams contact *Trent Hays WB0HZL, (303) 484-8315.* For general info, contact *Musser Moore AA0PB, (303) 221-3698.* Reserve tables from *Orlin Jenkins K0OJ, (303) 353-7094.* Talk-in on 145.115 (- offset, 100 Hz).

JAN 23

EAST LANCASTER, PA The Columbia Area ARC will present its annual "Dutch Country Computer and Communications Show" from 9 AM-3 PM at the Lancaster Host Resort and Conference Center, Route 30. Talk-in on 146.715-. For display and dealer info, contact *Dutch Country Computer and Communications Show, P.O. Box 682, E. Petersburg PA 17520-0682. Tel. (717) 560-2072; FAX (717) 872-0857.*

JAN 29

LOCKPORT, NY The Lockport ARA will hold their annual Club Auction starting at 3 PM. Talk-in on 146.820- MHz.

SARASOTA, FL The Sarasota Co. Fairgrounds, 3000 Ringling Blvd., will be the location for the Sarasota Hamfest and Computer show. The Sarasota ARA will host this event from 9 AM-5 PM. VE Exams. For general info, call *Gene Marino W1IDH, (813) 355-0675.* For tickets call *Val Lopez KC4YAY, (813) 951-1072*; or write: *Hamfest, P.O. Box 31832, Sarasota FL 34230.*

JAN 30

DOVER, OH The Tusco ARC Hamfest will be held at Ohio Nat'l Guard Armory, 2800 N. Wooster Ave., starting at 8 AM. Talk-in on 146.730 W8ZX Rptr. Contact *Howard Blind KD8KF, 6288 Echo Lake Rd. N.E., New Philadelphia OH 44663. Tel. (216) 364-5258.*

ODENTON, MD The Maryland Mobileers ARC will sponsor a Post Holiday Swapfest and Flea Market at Odenton Vol. Fire Dept. Hall, 1425 Annapolis Rd., 8 AM-2 PM. ARRL sanctioned. For VE Exams, pre-register with *Jerry Gavin NU3D, 7801 Overhill Rd., Glen Burnie MD 21060; Tel. (410) 761-1423 (anytime).* To register for tables, contact *Tom Wilkison KA3OMU, 592 Eason Dr., Severn MD 21144; Tel. (410) 969-2639 (eves.).* Talk-in on 146.205/.805.

FEB 5

ST. CATHARINES, ONTARIO, CANADA The Niagara Peninsula ARC Inc. will hold its 16th annual Big Event Hamfest at the C.A.W. Hall, 124 Bunting Rd. Write or call, *N.P.A.R.C. Inc., P.O. Box 20036, Grantham Postal Outlet, St. Catharines, Ontario L2M 7W7; Tel. (905) 937-6208.*

SPECIAL EVENT STATIONS

JAN 8

ST. PAUL, MN The Minnesota Frostbite Falls Beach Party, sponsored by the St. Paul RC, will be on the air from 1800Z-2400Z. Frequencies: CW - 3.540, 3.690, 7.040, 7.140, 14.040, 21.040, 28.040, 28.140; SSB - 3.850, 7.250, 14.250, 21.350, 28.350. Send logs to *Ed Van Cleave AA0HI, 2700 16th St. NW, St. Paul MN 55112; Tel. (612) 636-0108.* Please send SASE for info and sample log. 73

Number 24 on your Feedback card

NEW PRODUCTS

Compiled by Charles Warrington WA1RZW

JADE PRODUCTS

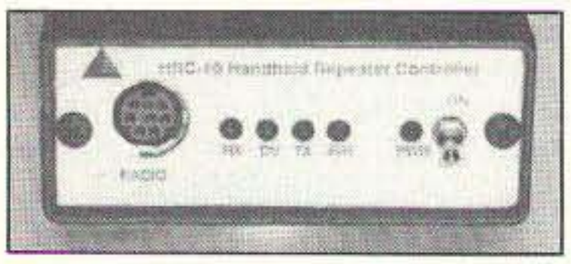
Jade Products, Inc. has announced the newest members to the FUN-KIT line: the Lead-Acid/Gel-Cel Battery Charger Kits. This series of products is based on the Unitrode UC3906 battery charger chip. This smart chip is specifically designed to sense the condition of the battery and adjust the charging requirements accordingly. The charger can be left connected to the battery indefinitely, keeping the battery ready for service at all times. It can prolong the life of the battery and protect it from overcharge/undercharge damage.

These battery chargers are intended for hams who need to keep their batteries ready at all times. Applications include: repeater back-up batteries, QRP station batteries, and emergency equipment batteries.

The chargers are available in three configurations. The BC01 is a complete kit perfect for beginners. It can be built for 0.5 to 1 amp maximum charging rate. The price is $79.95. The BC02 is the same as the BC01, minus the enclosure, RFI filter module, line cord, and current meter. The price is $39.95. The BC03 is the same as the BC02, minus the power transformer. The price is $29.95.

For further information contact *Jade Products, Inc., P.O. Box 368, E. Hampstead, NH 03826; (603) 329-6995, FAX (603) 329-4499.* Or circle Reader Service No. 201.

SPECTRUM ELECTRONIC PRODUCTS



Spectrum Electronic Products has introduced the HRC-10—the world's first hand-held repeater controller. No larger than most hand-held radios, the HRC-10 converts a single or dual-band radio into a full-featured simplex or duplex repeater system. While most dual-band radios provide full duplex and crossband repeater capabilities, they lack the station ID and control functions required for legal operation as a repeater system. The HRC-10 provides an easy low-cost solution to this problem.

The unit features a voice IDer, hang time and out timers, DVOS (Digital Voice Operated Squelch), telemetry tones, and a private voice mail slot. A DTMF command interface provides remote control capabilities. The HRC-10 is ideal for emergency use, club events, and mobile installations.

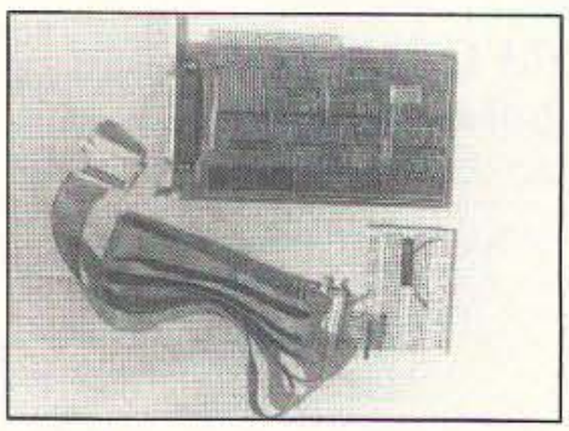
For more information contact *Spectrum Electronic Products, 4740 Scotts Valley Drive, Scotts Valley, CA, 95066; (408) 438-2788, FAX (408) 438-6027.* Or contact Reader Service No. 204.

SGC

SGC, Inc., has unveiled its new SmartLock to further enhance the severe service capability of the SG-230 Smartuner. The Smartuner is a fully automatic, microprocessor-controlled antenna coupler which covers the HF spectrum from 1.8 to 30 MHz.

The SmartLock is designed to control two antenna conditions: one where a mobile antenna is subject to violent motion which may otherwise cause the antenna coupler to automatically retune; the other to command the antenna coupler to recalculate antenna conditions at the operator's discretion.

The SmartLock may be used with SG-230 Smartuners manufactured after September 1, 1993. The SmartLock control box is priced at $59.95. Owners of earlier versions of the Smartuner, which does not have the additional control line, may upgrade to the latest version for $289 (not including SmartLock). For more information contact *SGC Inc., P.O. Box 3526, Bellevue, WA, 98009; (800) 259-7331, (206) 746-6310, FAX (206) 746-6384.* Or circle Reader Service No. 206.

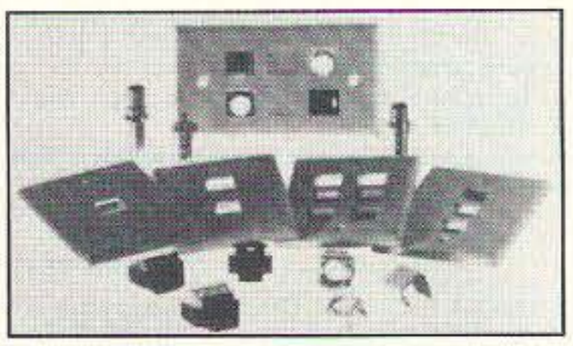


HIGHLANDS ELECTRONICS

Highlands Electronics has announced the eBoard—a new way of developing and using an embedded computer application. An embedded computer is one which is dedicated to a task; the computer inside your microwave oven, for example. Programming embedded computers is an economical way to monitor and control a wide variety of electronic devices.

The new eBoard is a PC card which eliminates the hassle and high cost of an old-fashioned computer emulator. You work with the actual CPU from the start of your project. This works to eliminate any surprise bugs that may appear at the end of development. The low-cost board can be left in place to run the application.

The eBoard runs independently of the PC and has drivers for LCDs, DTMF and more. The unit is suitable for 24-hour operation. The price is $249 ppd. For more information contact *Highlands Electronics 13720 Lake Shore Drive, Clear Lake, CA, 95422; (707) 994-1024.* Or circle Reader Service No. 207.



RF INDUSTRIES

RF Industries, Ltd., has announced a truly universal (Keystone) wall plate system. These wall plates are a must for the truly well-dressed shack. They are available in standard ivory, or any other color on special order.

The plates come in 1-, 2-, 3-, and 6-hole versions. They accept 50 or 75 ohm BNC crimp, thread-on, or feed-through connectors. They will also snap mount with 4-, 6-, or 8-contact IDC modular telephone connectors. Other types are also available.

For prices and catalog information, please contact *RF Industries, Ltd, 7620 Miramar Road, San Diego, CA, 92126; (800) 233-1728.* Or circle Reader Service No. 202.

TRIPP LITE

More and more amateurs are turning to digital operating modes to expand their horizions. The ISOBAR UltraFax is a premium quality combination AC and dataline surge supressor specifically designed to protect digital devices from WEFAX to MODEMs.

The UltraFAX has special diagnostic indicators to help pinpoint power and wiring problems before they can cause damage, saving both time and money. The unit is enclosed in an all metal housing with mounting tab for secure connection.

This product features the manufacturer's Lifetime Ultimate Insurance which protects both the UltraFax and the connected equipment. If either is ever damaged by a surge, TrippLite will repair or replace the unit and connected equipment free for life up to $10,000.

The UltraFAX is priced at $69.95. For more information contact *TrippLite, 500 N. Orleans, Chicago, IL, 60610-4188; (312) 329-1777, FAX (312) 644-6505.* Or circle Reader Service No. 203.

ELECTRONIC DISTRIBUTORS CORPORATION

Electronic Distributors Corporation has announced the availability of an all-new high performance HF receiver manufactured by AOR. The AR3030 has all the latest high-tech features and covers 30 kHz to 30 MHz with optional 108 to 174 MHz coverage.

This receiver uses Direct Digital Synthesis for low phase noise and synchro detection for better AM signal readability during severe fading. You can program 100 memories with direct keyboard entry. Other features include: TCXO, Carrier Operated Delay, RS232 computer control, optional filters, and power options.

For more information visit your local dealer or contact *Electronic Distributors Corporation, 325 Mill Street, Vienna, VA, 22180; (703) 938-8105.* Or circle Reader Service No. 205.

KENWOOD

This new series of HT transceivers from Kenwood has all of the things you want in a portable communications package. The TH-22AT (2 meter) and TH-42AT (450 MHz) single-band HTs offer a streamlined look, simple programming, one-touch controls, and easy menu functions.

A new innovative microprocessor and MOSFET final amplifier circuit enables a full 5 watts, while conserving battery power. A special EEPROM memory bank requires no backup battery. A wide range of accessories will also be available.

For more information, visit your local dealer or contact *Kenwood Communications Corporation, P.O. Box 22745, Long Beach, CA, 90801-5745; (310) 639-4200.*

Number 25 on your Feedback card

BARTER 'N' BUY

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. 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 widow 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 (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so 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 an additional 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 get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the Barter 'n' Buy, Judy Walker, 70 Rt. 202N, Peterborough NH 03458 and get set for the phone calls.

The deadline for the February classified ad section is December 9, 1993.

ALL ABOUT CRYSTAL SETS. Theory and construction of crystal set radios. $7.95 each, ppd USA. Send to: **ALLABOUT BOOKS**, Dept. S, P.O. Box 22366, San Diego CA 92192. BNB200

CUSTOM MADE-HAND TOOLED leather products with your initials, name, call letters. Photo's & estimates available. Key rings, wallets, belts, purses, hanging signs, specialty items. GREAT GIFT. **LEATHER & WEST,** 67 Causeway Rd., West Swanzey NH 03469. (603)352-6256. 9-4 pm. M-F ET. BNB215

SUPERFAST MORSE CODE SUPEREASY. Subliminal cassette. $12. LEARN MORSE CODE IN 1 HOUR. Amazing supereasy technique. $12. Both $20. Moneyback guarantee. Free catalog: SASE. **BAHR-T9**, 150 Greenfield, Bloomingdale IL 60108. BNB221

QSL CARDBOXES & INDEX DIVIDERS. Send SASE. **7-Mike HAMSTUFF,** P.O. Box 14455, Scottsdale AZ 85267-4455. BNB224

NO DSP AUDIO PROCESSING COMPARES TO JPS. Eliminate variegated noises. NIR-10 special, $329.95; NF-60 Notch Filter, $139.50. Satisfaction guaranty. Authorized dealer: **DAVIS RF CO. 24-HOUR ORDERS:** (800)484-4002, CODE 1356. BNB254

QSL SAMPLES- 50 cents. **SAMCARDS,** 48 Monte Carlo Dr., Pittsburgh PA 15239. BNB275

COMMODORE 64 REPAIR. Fast turn around. **SOUTHERN TECHNOLOGIES AMATEUR RADIO,** 10715 SW 190th Street #9, Miami FL 33157. (305)238-3327. BNB295

RADIO RUBBER STAMPS free brochure. **REID ASSOCIATES,** 6680 Mellow Wood, West Bloomfield MI 48322. BNB297

KENWOOD AUTHORIZED REPAIR. Also ICOM, Yaesu. **GROTON ELECTRONICS,** Box 379, Groton MA 01450. (508)448-3322. BNB310

WANTED: Kenwood model TV-502 2M transverter-working. (909)681-0872. BNB320

RCI-2950 OWNERS: New modification manual including Power increase. Clarifier modification. Modulation increase. Operating hints, and more. Parts included. Only $20.00 ppd in U.S. (Missouri residents add $1.15 tax). **SCOTT**, P.O. Box 510408, St., Louis MO 63151-0408. (314)846-0252. Money Orders or C.O.D. BNB340

KIT BUILDERS! Complete list of 155+ kit vendors. #10 SASE + $3.00 USD to: **RUTENBER ENGINEERING,** 38045 10th St. E. #H75-AR, Palmdale CA 93550. BNB365

QSL CARDS — Standard and custom. Your ideas or ours. Excellent quality. Foil stamping available. Many designs and type styles. Catalog and samples $1.00 refundable. **WILKINS**, Dept. A, Box 787, Atascadero CA 93423. BNB370

20 METER SUPERHET C.W. TRANSCEIVERS KIT, $49.95 plus $3.75 shipping. Check/M.O. 1994 Catalog for 2 Stamps. **DAN'S SMALL PARTS & KITS,** 1935 South 3rd West #1, Missoula MT 59801. BNB385

CHRISTIAN-THEME QSLs, "Let your light shine before men..." **JUST...QSLs,** 21645 E. 9 Mile Rd., St. Clair Shores MI 48080. BNB395

GREAT HAM LOCATION in beautiful PRESCOTT, ARIZONA. Telrex TB6, 55 ft. and 35 ft. towers. High quality 2300 sq. ft., 3 bedroom, two bath home with gorgeous views from every room. By owner, $199,900. (602)778-3370. BNB410

BROWNIES QSL CARDS SINCE 1939. Catalog & samples $1 (refundable with order). 3035 Lehigh Street, Allentown PA 18103. BNB430

UNIVERSAL PROGRAMMERS XELTEK Unipro, $129.00; XELTEK Superpro, $449.00. We carry over 15 manufacturers of device programmers. Call for free catalog. (408)241-7376. BNB645

MACRO SURFACE-MOUNT Breadboard 3" X 5" sample kit as seen in *73* for 12/93. $4.00 ppd. Brad Thompson, N1JIJ, 100 Powdermill Rd., BX-233, Acton MA 01720. BNB650

VHF-UHF-SHF Large SASE. **VHFer,** P.O. Box 685, Holbrook AZ 86025. BNB660

ELEGANT QSL CARDS AT LOW PRICES. Samples $1 (refundable with order). **AACO**, Dept. S41, 1639 Fordham Way, Mountain View CA 94040. BNB670

HAM RADIO VIDEO. Free info. **FOX VIDEO,** 13613 U.S. 36, Marysville OH 43040. BNB685

HAM RADIO REPAIR- All makes and models. Fast, Professional Service. **AFFORDABLE ELECTRONIC REPAIR,** 7110 E. Thomas Rd., Scottsdale AZ 85251. (602)945-3908. BNB700

9 1/2 INCH UTC WALL CLOCK- $26.50 ppd. **GABAY TOOL CO.,** P.O. Box 68, Necedah WI 54646. BNB705

ROSS' $$$$ NEW JANUARY (ONLY) SAVE TIME AND MONEY HAVE MODEL NUMBER AND MANUFACTURER READY. KENWOOD, TR-751A, $600.00; VFO-700, $155.00; BC-6; ALINCO, DJ-F1T, $270.00; DJ-580T, $388.00; ALM-203T, $209.99; YAESU, FT-840, $790.00; FT-709R, $290.00; YR-901,$500.00; ICOM IC-707, $830.00; IC-900, $400.00; IC-471H, $1,000.00; ALLIANCE, U-105, $52.00. ALL LIMITED TIME OFFERS. OVER 9035 ham-related items in stock for immediate shipment. Mention ad. Prices cash, F.O.B. Preston. HOURS TUESDAY-FRIDAY 9:00 TO 6:00, 9:00-2:00 P.M. MONDAYS. CLOSED SATURDAY & SUNDAY. **ROSS DISTRIBUTING COMPANY,** 78 SOUTH STATE, PRESTON ID 83263. (208)852-0830. BNB707

GIANT SOLAR PANELS $44.00 EACH! Excellent Prices/Solar Equipment/Accessories. Free Information/Send Stamped Envelope, Catalog $3.00. To: **QUAD ENERGY,** P.O. Box 690073, Houston TX 77269. (713)893-0313. BNB715

ELECTRON TUBES: All types and sizes. Transmitting, receiving, microwave . . . Large inventory = same day shipping. **DAILY ELECTRONICS,** 10914 NE 39th ST. Suite B-6, Vancouver, WA 98682. (800)346-6667 or (206)896-8856. BNB719

MINIATURE POLICE RADAR TRANSMITTER One mile range, $41 assembled, $31.00 kit, (219)489-1711. P.O. Box 80096, Fort Wayne IN 46898. BNB725

COAX CABLES! PL-259ST, 10 for $10.00. Type N for 9913, 10 for $25.00. BNC male to UHF female adaptors, $1.75 each. Quality coax cables, connectors, antennas and amateur radio equipment. Inquire about free catalog and price list. Write to **R. C. KONTES,** 465 Croft, Idaho Falls ID 83401-4419. Call (208)522-2839. BNB730

ICOM W21AT DUAL BAND HT, AC Battery charger, DC power cord, factory mod. for MARS/CAP $475. Keister Whitt, Route 1, Box 25, Ringgold VA 24586. (804)822-7005. BNB745

HAM RADIO REPAIR—Prompt service. **ROBERT HALL ELECTRONICS,** 1660 McKee Rd., Suite A, San Jose CA 95116. (408)729-8200. BNB751

SOLAR POWERED HAMS! The Sunswitch is a charge controller to protect your batteries from over charge. Power MOSFETs are used, no relays! Assembled tuned and tested. Now with Wall Mount Case, $55.00 plus $3.00 shipping. **SUNLIGHT ENERGY SYSTEMS**, 2225 Mayflower NW, Massillon OH 44647. BNB774

WANTED: HAM EQUIPMENT AND OTHER PROPERTY. The Radio Club of Junior High School 22 NYC, Inc. is not only the Big Apple's largest Ham club but also the nation's only full time, non-profit organization, working to get Ham Radio into schools around the country as a theme for teaching using our EDUCOM-Education Thru Communication-program. Send your radio to school. Your donated amateur or related property, which will be picked up or shipping arranged, means a tax deduction to the full extent of the law for you as we are an IRS 501 (c) (3) charity in our fourteenth year of service. Your help will also mean a whole new world of educational opportunity for children around the country. Radios you can write off, kids you can't. Start the new year off helping someone else and yourself. Please, write-phone-or FAX the WB2JKJ "22 Crew" today: The RC of JHS 22, P.O. Box 1052, New York NY 10002. Telephone (516)674-4072 or FAX (516)674-9600. Young people, nationwide, can get high on Ham Radio with your help. Meet us on the WB2JKJ CLASSROOM NET: 7.238 MHz. 1200-1330 UTC and 21.395 MHz. 1400-2000 daily. BNB762

POSITION WANTED: Aggressive sales representative interested in handling amateur radio equipment. Call (919)299-1298. BNB800

WANTED: clean, unused, COAXIAL CONNECTORS, ADAPTERS, RF AND MICROWAVE COMPONENTS. **IGU**, PO Box 27849, Santa Ana CA 92799. Fax (714)553-0266. BNB810

R-390-A SALES & SERVICE, PO BOX 3541-S, TOLEDO OH 43608. BNB813

FREE SHAREWARE AND HAM CATALOG for IBM or COCO. Morse code Computer Interfaces $49.95. NEW TWO METER Mobile Antenna Switcher $42.95. **DYNAMIC ELECTRONICS,** Box 896, Hartselle AL 35640. (205)773-2758, FAX-773-7295. BNB815

SENSATIONAL NEW WAY TO LEARN CODE-Do Aerobics, Sing, Jog, or **Drive** while learning code! **Now** the secret is yours! Order **THE RHYTHM OF THE CODE**-Morse code music cassette today! $9.95 ppd **KAWA RECORDS** P.O. Box 319-S, Weymouth, MA 02188. The HIT of the 1993 Dayton Hamvention! BNB824

DIGITAL SWR and **POWER METER,** Assemble, Kit, or Plans, with Alarm and Set Points. **FREE** information. **RUPP ELECTRONICS,** 5403 Westbreeze, Fort Wayne IN 46804. (219)432-3049. BNB831

FCC COMMERCIAL LICENSE PREPARATION RADIOTELEPHONE-RADIOTELEGRAPH. Latest home study fast easy audio video. Q & A pool disks. FREE details **WPT PUBLICATIONS** (800)800-7588.BNB840

ELECTRONICS GRAB BAG! 500 pieces of new components: inductors, capacitors, diodes, resistors. $5.00 postpaid. **ALLTRONICS,** 2300 Zanker Rd., San Jose CA 95131. BNB855

WANTED: COLLINS ANTIQUES, anything old from, speakers, receivers, transmitters, and all accessories, any condition. Top $$$ paid. Rick. (800)462-2972 anytime. BNB865

RF ENGINEERS WANTED SGC, a world leader in HF SSB equipment is seeking experienced RF Engineers. Experience in transmitter and receiver design, A/D converters, digital voice processing, and low noise oscillators is required. Preference to licensed amateurs. **SGC, INC.,** PO Box 3526, Bellevue WA 98009. Principals only. BNB880

TRANSFORMERS...ORTHISIL DESIGN .5KW, $89; .75KW, $125; 1KW, $142; 1.5KW, $165; 2KW, $180; 2.5KW, $195. Other sizes available. For 50% Duty=1.5 (X) KW rating. Call: **LUCAS TRANSFORMER COMPANY,** (616)229-4318. Write: 7113 N. 9 Mile, Lake City MI 49651. COMPARE! BNB895

PRINTED CIRCUIT BOARDS for *73 Magazine, QST, ARRL Electronics Now, Nuts & Volts*, projects. US orders deduct 20%. Free list. **B-C-D ELECTRONICS,** Box 20304, 858 Upper James St., Hamilton, Ontario, Canada L9C 7M5. BNB910

WANTED: BUY & SELL All types of Electron Tubes. Call (612)429-9397, Fax (612)429-0929. **C & N ELECTRONICS,** Harold Bramstedt, 6104 Egg Lake Road, Hugo MN 55038. BNB915

COMMODORE 64 HAM PROGRAMS-8 disk sides over 200 Ham programs $16.95./$.29 stamp gets unusual software catalog of Utilities, Games, Adult and British Disks. **HOME-SPUN SOFTWARE**, Box 1064-BB, Estero FL 33928. BNB917

INEXPENSIVE HAM RADIO EQUIPMENT. Send postage stamp for list. Jim Brady WA4DSO, 3037 Audrey DR., Gastonia NC 28054. BNB927

USED AND NEW AMATEUR RADIO, SWL, AND SCANNERS. We buy, sell, consign and trade used equipment. Thirty day warranty. Western Pennsylvanias' newest Amateur Radio supplier. We also offer complete repairs on most types of equipment. Call for quotes. **FOR HAMS ONLY, INC.** INFO (412)374-9744. ORDERS ONLY (800)854-0815. ROBB KE3EE. BNB929

RADIO REPAIR Amateur and commercial, professional work. Fred Fisher WF9Q, 6866 W. River Rd., South Whitley IN 46787. (219)723-4435. BNB930

SEIZED GOODS, radios, stereos, computers, and more by FBI, IRS, DEA. Available in your area now. Call (800)436-4363 Ext. C-6223. BNB940

FREE HAM GOSPEL TRACTS. SASE. **N3FTT**, 5133 Gramercy, Clifton Heights PA 19018. BNB960

QRP KITS & COMPONENTS only 2 stamps for catalog. **DAN'S SMALL PARTS & KITS,** 1935 South 3rd West #1, Missoula MT 59801. BNB964

AMIGA, MACINTOSH, ATARI XL/XE/ST Amateur Radio & Electronics PD/shareware software $4.00 per disk. Two stamp SASE brings catalog. Specify which computer! **KD-WARE,** Box 1646, Orange Park FL 32067-1646. BNB965

PRINTED CIRCUIT BOARDS for projects in *73, Ham Radio, QST,* ARRL Handbook. List SASE. **FAR CIRCUITS,** 18N640 Field Ct., Dundee IL 60118. BNB966

AZDEN SERVICE by former factory technician. **SOUTHERN TECHNOLOGIES AMATEUR RADIO, INC.**, 10715 SW 190 St. #9, Miami FL 33157. (305)238-3327. BNB979

COMPUTER & PRINTER USERS: SAVE! SAVE! SAVE! Renew your ribbons. Ink for 20 to 30 reinking $6.00 plus $3.00 shipping. **C & S ENTERPRISES,** P.O. Box 561, Clinton MS 39056. Sid Wilson, WB5GFM. BNB980

I BUY ELECTRON (VACUUM) TUBES Magnetrons, Klystrons, Planar Triodes, etc...Jeremy Madvin at the **VACUUM TUBE EXCHANGE**. (800)995-TUBE or fax at (800)995-6851. BNB987

PICTURE QSL CARDS of your shack, etc., from your photo or black ink artwork. 500 $28.00, 1,000 $44.50. Also non-picture cards. Custom printed cards, send specifications for estimate. Send 2 stamps for illustrated literature. Generous sample kit $2.00, half pound of samples $3.00. **RAUM'S,** 8617 Orchard Road, Coopersburg PA 18036. Fax or Phone (215)679-7238. BNB988

ROTOR PARTS ROTOR SERVICE, ROTOR accessories: Brak-D-Lays, Quik-Connects, Pre-Set mods. NEW models for sale. Free catalog. **C.A.T.S.,** 7368 State Road 105, Pemberville OH 43450. BNB996

Uncle Wayne's Bookshelf

REFERENCE

20N102 **Practical Digital Electronics Handbook** *by Mike Tooley BA* Contains nine digital test gear projects. Digital circuits, logic gates, bistables and timers, microprocessors, memory and input/output devices. **$14.50**

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RANDOM OUTPUT

David Cassidy N1GPH

By now, you've all probably heard about a ham in San Diego who, utilizing an amateur HT modified to transmit on public service frequencies, used a Sheriff's Department frequency to get emergency medical help for an injured friend. The ham in question stated that he first tried to use several amateur repeaters, a commercial repeater operated by his employer and a cellular phone, all without success. Shortly after the incident, the ham was called into the sheriff's office, and his HT was confiscated. As of this writing no further action against the ham is planned, though he *could* receive a year in jail and a fine of up to $100,000.

Not too many years ago, this incident couldn't have happened. You don't have to be very old to remember a time when amateur radio transceivers didn't have the capability to receive, let alone transmit, on anything but frequencies allocated to the Amateur Radio Service. Along with miniaturization and microprocessors came the capability for wideband reception. I have no hard data on this, but I'd be willing to bet that the amount of time that passed between the first sale of an HT capable of being modified to transmit out-of-band and the first HT to receive that modification can be measured in hours. The same goes for HF transceivers. Hams are by nature tinkerers, and the fastest way to get them to open the case of their new Whiz Bang 1000 is to hint that a snip here and an extra diode there will give them added capabilities. Even if those capabilities happen to be illegal.

"We have become so used to being able to modify our VHF gear, especially HTs, that we long ago stopped examining the legal and ethical ramifications."

We have become so used to being able to modify our VHF gear, especially HTs, that we long ago stopped examining the legal and ethical ramifications. Heck, you don't even have to do the modification yourself. For the last few years, every hamfest I've attended has had at least one vendor offering to do HT modifications for a price.

The incident in Southern California has presented us with the opportunity to make a little self-evaluation. Isn't possession of a radio capable of transmitting on police frequencies illegal? Certainly such transmitters are not FCC type certified for operation on public service frequencies, making them illegal in that regard. Why do hams feel the need to own such a radio — a radio they can't legally use?

I'd like to get a discussion going on this issue, so allow me to express my opinion. Taking the reality of the particular incident in question, I would have done the same thing *if* the injured person was in immediate danger (I don't know whether or not that was the situation in this particular case, but let's assume it was). To me, that is a seperate issue from whether or not hams should own police transmitters. When a fellow human being is danger, it is our moral obligation to assist with any means at our disposal. The question is really whether or not the ham who made the call should have had possession of the radio in the first place. I vote no.

The common ownership of illegal radios bothers me on several levels. In case you haven't noticed, hams aren't exactly looked up to by the general population. We are generally thought of as geeky techno-nerds, walking around with HTs on our belts to impress each other, talking incessantly about nothing of any importance. Sure, once in awhile a disaster strikes and the rest of the world remembers why amateur radio is such a good idea, but most of the time we are made fun of (whether or not this opinion of us is justified is a discussion we will have to save for another day). While you may think it's "cool" to show your neighbor that you can key up the local police repeater, I can assure you that your non-ham neighbor doesn't think it's "cool" at all. We have a responsibility to use the generous privileges we have been given with some amount of maturity. Breaking laws doesn't make us any friends.

I also have a problem with any unauthorized person having transmit capabilities on any public service frequency. Those of you who know me well may think this goes against my conservative views of the absolute authority of the First Amendment, and my "less government is better government" stand. Not so. In areas of national security or when talking about agencies charged with public safety, it is necessary to safeguard communications. The ham in San Diego certainly used his illegal HT for a noble purpose, but another person may not. If you think that hams are above such petty and harmful activity, I ask you to recall the high school radio club advisor who was arrested and convicted last year for making false distress calls on police frequencies. 73

Number 27 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

Don't expect January to be a particularly good month for operating conditions on the HF bands. As you can see on the calendar, many days are only Fair or trending to or from Fair. Also, many days are Poor or trending to or from Poor. The worst days are expected to be from the 19th through the 23rd, when the ionosphere is likely to be very disturbed and some severe geophysical "conditions" can be anticipated. The earth's magnetic field may be active or at minor storm levels on some of these days, and you may want to look for auroral contacts on the VHF bands, particularly around the 20th, 21st and 22nd of the month.

As always, WWV at 18 minutes past any hour will be your source of the solar flux values and the "A" and "K" indexes. The higher the value of solar flux and the lower the values of the "A" and "K" indices, the better propagation will be. As this is written, solar flux has been in the mid-80s to mid-90s, while the "A" and "K" indices are very low as well. As a result, DX "conditions" have been very favorable on the bands between 15 and 40 meters.

When the "K" index is between 0 and 3, and the "A" index is below about 20, together with Solar Flux values above 90, you may expect excellent propagation on the HF bands.

Even on Poor days, it may be possible to find some HF activity on north-south paths across the equator in both directions from th U.S. to Australia and New Zealand, and to Central and South America. The most active areas of disturbance concentrate around the north and south poles where the magnetic field lines are most concentrated, and often extend to latitudes between the Arctic (and Antarctic) Circles and the equator . . . that is, where we all want to point our antennas for DX to Europe and the Far East. Signal paths *across* the force fields are very difficult, whereas signal paths *along* the force fields may be useful for DX.

In general, then, plan your operating on the days marked Good on the calendar, and anticipate openings toward the east in the morning and toward the west in the afternoon and evenings (local time). Short skip will also be useful on the good and fair days out to a thousand miles or so during the daytime, and out to 2,000 miles or more in the evening and early morning.

You will find atmospheric noise from storms quite low this month, except on stormy days, and the 80 and 160 meter bands should be excellent around the US and even to DX areas, particularly in the very early morning around sunrise and in the late evenings before midnight. See you next month. W1XU. 73

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15						20	20A	15			
AGENTINA	20										15	15
AUSTRALIA	20					40	40			20	20	15
CANAL ZONE	40	40					20	15	15	15	15	20
ENGLAND	40	40	40	80	80		20	15	15	15	20	
HAWAII	20					40	20	20			15	15
INDIA							20	20				
JAPAN	15						20	20				15
MEXICO	40	40	40	40	40	40	20	15	15	15	15	20
PHILIPPINES							20	20				
PUERTO RICO	40	40	40	40	40	40	20	15	15	15	15	20
SOUTH AFRICA	40A	40						15	15	20		
U.S.S.R.		40						15	15	20		
WESTCOAST	15	20	40	40	40	40	40A	20A	15	15	15	15

CENTRAL UNITED STATES TO:

ALASKA	20				40	40	20	20				20
ARGENTINA	20	40	40	40						15	15	20A
AUSTRALIA	15					40	20	20	20		15	15
CANAL ZONE	20		40	40	40			20	15	15	15	15
ENGLAND	40	40	80	80				15	15	15	20	
HAWAII	20	20			40	40	20	20	20	15	15A	15A
INDIA								20				
JAPAN	20				40	40	20	20				20
MEXICO	20		40	40	40			20	15	15	15	15
PHILIPPINES	20							20	20			
PUERTO RICO	20		40	40	40			20	15	15	15	15
SOUTH AFRICA	20	40	40						15	15	15	20
U.S.S.R.		40	40					15	15	20		

WESTERN UNITED STATES TO:

ALASKA	15	15	20			40	40	40				20
ARGENTINA	20	20		40	40						15	15
AUSTRALIA	15	15	20				40		20	20	20	15
CANAL ZONE	20	20		40	40	40	40	40	15	15	15	15
ENGLAND			40	40					20A	20A		
HAWAII	15	20	20			40	40	40				15
INDIA		20	20									
JAPAN	15	15	20				40	40	40			20
MEXICO	20	20		40	40	40	40	40				15
PHILIPPINES	20A	20								20		
PUERTO RICO	20	20		40	40	40	40	40				15
SOUTH AFRICA	20	20							15	15	15	20
U.S.S.R.								20	20	20	20	
EAST COAST	15	20	40	40	40	40	20	20A	15	15	15	15

A=Next higher frequency may also be used.

JANUARY 1994

SUN	MON	TUE	WED	THU	FRI	SAT
						1 F
2 F	3 F-G	4 G-F	5 F	6 F-P	7 P	8 P-F
9 F-G	10 G-F	11 F	12 F	13 F	14 F	15 F-G
16 G	17 G-F	18 F-P	19 P-VP	20 VP	21 VP	22 VP
23 F	24 F-G	25 G	26 G	27 G	28 G-F	29 F-G
30 G	31 G					

FT-2200/7200
2-m/70-cm Mobiles

- **Frequency Coverage:**
  FT-2200
  RX: 110-180 MHz
  TX: 144-148 MHz
  FT-7200
  RX/TX: 430-450 MHz
- 50 Memory Channels
- Wide Receiver Coverage: 110-180 MHz
- AM "Aircraft" Receive: 110-139 MHz
- Built-In DTMF Paging/Coded Squelch
- Power Output 50/25/5 Watts
- CTCSS Encode Built-In
- 10 Memory DTMF Auto Dialer
- Selectable Channel Only Display
- Remote Operation w/ Optional MW-2
- Optional Digital Voice Storage System
- Backlit DTMF Mic
- **Accessories:**

FTS-27	CTCSS Decode Unit
DVS-3	Digital Voice System Unit
MW-2	Remote Control/ Wireless Mic
SP-7	External Speaker

"The FT-2200 answers my problem! It fits anywhere, and the 3 power levels are great!"

"Yaesu did it again!"

"I like the FT-2400H!"

"Rugged performance is my answer!"

For your sleek compact car, the sculptured FT-2200 looks terrific. With leading-edge features, performance and reliability too, it's the perfect answer to your 2-m needs.

At 5.5"W x 1.6"H x 6.5"D the FT-2200 installs nearly anywhere. And, it does "lead" with features like optional Remote Control Wireless Mic – first in the world for any 2-m mobile and AM Aircraft Receive – first in a Yaesu mobile. Performance? The FT-2200 has more than twice the memories of the competition! Reliability? Its bright, new LCD display and backlit DTMF Mic makes night mobiling safe. Features, performance, reliability – in a powerful little package. See your dealer for *this* answer to your 2-m needs.

The Yaesu FT-2400H set the standard by which all 2-m mobiles are judged. The first and only amateur radio to pass rugged MIL STD 810D tests for shock and vibration, its one-piece die-cast chassis with extra large heat sink gives years of trouble-free operation.

With 50 watts of TX power, large alpha-numeric display, auto display dimmer, exclusive backlit DTMF Mic and advanced track tuning front end for superior receiver performance, the popular FT-2400H is the choice of amateurs in the know.

Features, performance, reliability – ready to go anyplace. See your dealer for *this* answer to your 2-m needs.

FT-2400/7400H
2-m/70-cm Mobiles

- **Frequency Coverage:**
  FT-2400H
  RX:140-174 MHz
  TX: 144-148 MHz
  FT-7400H
  RX/TX: 430-450 MHz
- Rugged Mil-Spec Design
- Advanced Track Tuning (ATT)
- 31 Memory Channels
- Wide Receiver Coverage: 140-174 MHz
- Selectable Alpha-Numeric Display
- Largest 2-Meter Display Available
- CTCSS Encode Built-In
- Power Output 50/25/5 Watts
- Flip Up Front Control Panel Hides Seldom Used Buttons
- Backlit DTMF Mic
- **Accessories:**

FTS-17A	CTCSS Decode Unit
FRG-6	DTMF Paging Unit
SP-4	External Speaker
FP-700	Power Supply

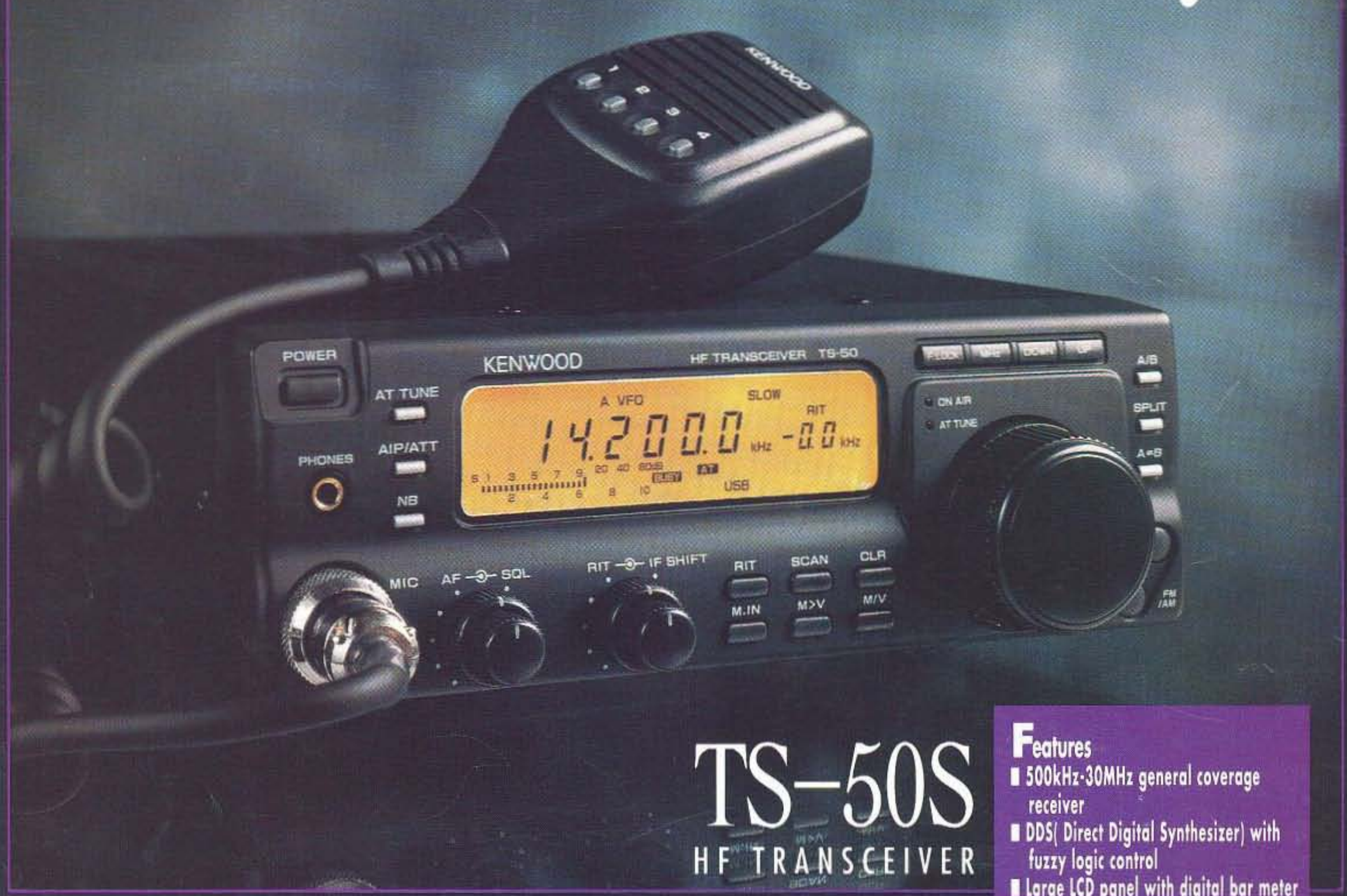
NEW

Yaesu answers your 2-m mobile needs.

YAESU

Performance without compromise.℠

Kenwood's TS-50S : Awesome HF Versatility



TS-50S
HF TRANSCEIVER

Features

- 500kHz-30MHz general coverage receiver
- DDS(Direct Digital Synthesizer) with fuzzy logic control
- Large LCD panel with digital bar meter
- Auto-mode capability
- Menu system
- AIP (Advanced Intercept Point)
- Switchable AGC Circuit (SLOW/FAST)
- All-mode squelch
- CW reverse mode
- Full break-in and semi break-in
- 20dB attenuator
- Multi-function microphone supplied
- RF output power control (100W, 50W, 10W)
- Optional 500Hz CW filter (YK-107C)
- Optional external antenna tuner(AT-50)
- Optional computer interface (IF-10D)

For the Amateur Radio enthusiast, going "beyond bounds" is what it's all about. That's why Kenwood created the TS-50S, the world's smallest and smartest HF transceiver. The choice is yours: you can mount it in a vehicle, take it on a DX-pedition, or even install it permanently as a base station transceiver. Yet despite its size, the TS-50S provides a maximum output of 100W and the sort of sophisticated features normally found only inside a shack. Take for example the 100 memory channels for independent storage of transmit/receive parameters, the microprocessor-controlled DDS with innovative "fuzzy" control, and Kenwood's own AIP for superior dynamic range. There's also a powerful menu system, IF shift and CW reverse mode for interference reduction, TF-SET, and a noise blanker--plus everything you need for split-frequency operations. So, if you want HF operation beyond bounds, check out the TS-50S at your favorite authorized Kenwood Amateur Radio Dealer today!

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