73 AMATEUR RADIO

International Edition

AUGUST 1988
ISSUE #335
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A WGE Publication

WORKBENCH ISSUE!

Digicom > 64: Cheap C64 TNC

Plus

Conversions, Preamps, Computer Controls, and more

REVIEWS

Heathkit SB1000 Amp
Realistic PRO-2004 Scanner
ARR 10 GHz Transceiver
Pac-Comm Micro TNC
Stone Mountain QSYer

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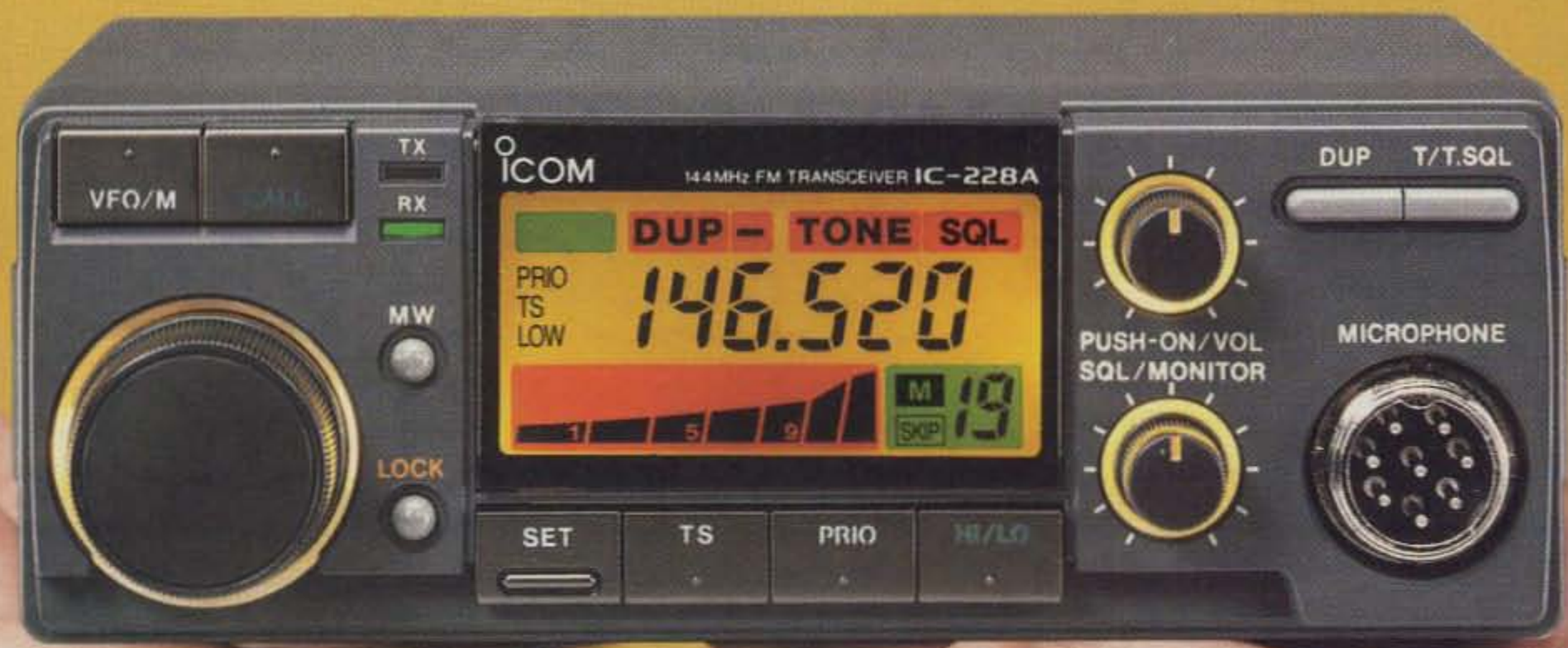
ICOM

IC-228A/H 2-Meter Mobiles



THE BEST THINGS COME IN SMALL PACKAGES

Meet the master of 2-meter FM mobiles! ICOM's easy-to-operate IC-228A/H answers your requests for custom big rig performance and maximum frequency coverage in a compact unit designed to fit today's autos. Operate odd split and subaudible-tone accessed repeaters, monitor NOAA weather and enjoy incomparable ICOM quality with every call!

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Programmable tuning steps of 5kHz, 10kHz, 15kHz, 20kHz or 25kHz.

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The IC-228H delivers 45 watts; the IC-228A 25 watts. Both include selectable low power.

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Shows signal strength when receiving, and relative output power selection when transmitting.

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Includes all subaudible tones built-in. TONE appears when the tone encoder is turned on. SQL lights when the optional UT-40 pocket beep function is activated (silently monitors for calls with your pre-programmed tone).

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Full reception of 138-174MHz including public service and NOAA weather bands. Transmit range of 140-150MHz includes MARS and CAP frequencies.

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Each memory stores any Tx offset and subaudible tone.

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- Receive incoming phone calls

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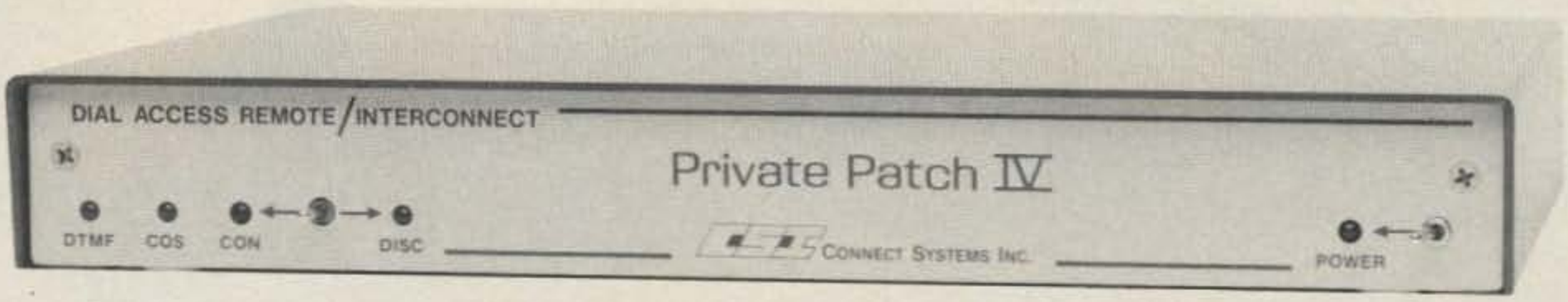
- ✓ Use as a wire remote using ordinary dial up lines and a speaker phone as a control head.



The new telephone initiated control capabilities are awesome. Imagine having full use and full control of your base station radio operating straight simplex or through any repeater *from any telephone!* From your desk at the office, from a pay phone, from a hotel room, etc. You can even change the operating channel from the touchpad!

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To get the complete story on the powerful new Private Patch IV contact your dealer or CSI to receive your free four page brochure.

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- • Secret toll override code
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- ✓ Separate CW ID level control
- ✓ 24 dip switches make all features user programmable/selectable.

- ■ Connects to MIC and ext. speaker jack on *any* radio. Or connect internally if desired.
- ■ Can be connected to any HT. (Even those with a two wire interface.)
- ■ Can be operated simplex, through a repeater from a base station or connected directly to a repeater for semi-duplex operation.
- ■ 20 minutes typical connect time
- ■ Made in U.S.A.

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2. FCC registered coupler
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CIRCLE 12 ON READER SERVICE CARD

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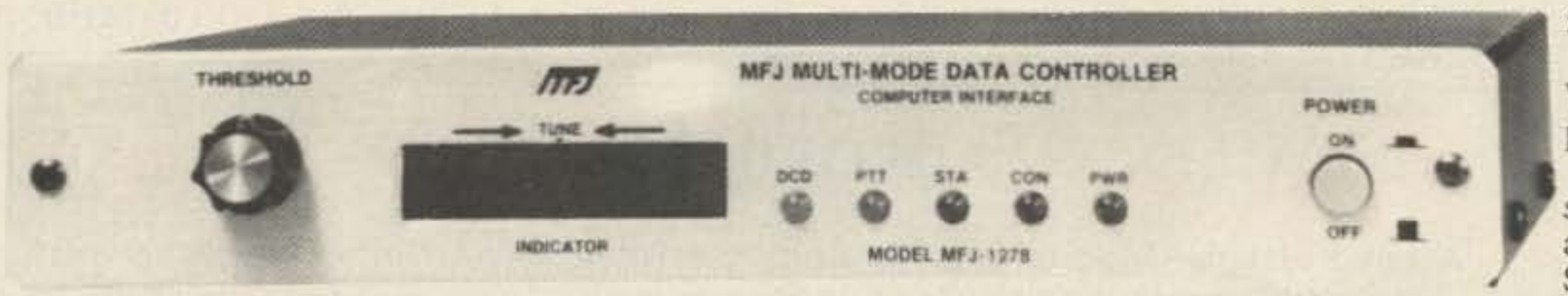
CIRCLE 10 ON READER SERVICE CARD

MFJ multi-mode data controller



MFJ *shatters* the 6 mode barrier *and* the price barrier with the MFJ-1278 and gives you . . . Packet, RTTY, ASCII, CW, WEFAX, SSTV and Contest Memory Keyer
. . . 7 digital modes . . . for an affordable $249.95

Amateur radio's newest multi-mode data controller -- the MFJ-1278 -- lets you join the fun on Packet, RTTY, ASCII, CW, Weather FAX, SSTV and gives you a full featured Contest Memory Keyer mode . . . you get 7 modes . . . for an affordable $249.95.

Plus you get high performance HF/VHF/CW modems, software selectable dual radio ports, precision tuning indicator, 32K RAM, AC power supply and more.

You'll find it *the most user friendly of all multi-modes.* It's menu driven for ease of use *and* command driven for speed.

A high resolution 20 LED tuning indicator lets you *tune in signals **fast** in any mode.* All you have to do is to center a single LED and *you're precisely tuned in to within 10 Hz* -- and it shows you which way to tune!

All you need to join the fun is an MFJ-1278, your rig and any computer with a serial port and terminal program.

You can use the MFJ Starter Pack to get on the air instantly. It includes computer interfacing cable, terminal software and friendly instructions . . . everything you need to get on the air fast. Order MFJ-1282 (disk)/MFJ-1283 (tape) for the C-64/128 and VIC-20 or MFJ-1284 for the IBM or compatible, $19.95 each.

Packet

Packet gives you the fastest and most reliable error-free communications of any amateur digital mode.

With MFJ's super clone of the industry standard -- the TAPR TNC-2 -- you get **genuine TAPR** software/hardware plus more -- not a "work-a-like" imitation.

Extensive tests published in *Packet Radio Magazine* ("HF Modem Performance Comparisons") prove the TAPR designed modem used in the MFJ-1278 gives better copy with proper DCD operation under all tested conditions than the other modems tested.

Hardware DCD gives you more QSOs because you get reliable carrier detection under busy, noisy or weak conditions.

A hardware HDLC gives you full duplex operation for satellite work or for use as a full duplex digipeater. And, it makes possible speeds in excess of 56K baud with a suitable external modem.

Good news for SYSOPs! New software lets the MFJ-1278 perform flawlessly as a WORLI/WA7MBL bulletin board TNC.

Baudot RTTY

You can copy all shifts and all standard speeds including 170, 425 and 800 Hz shifts and speeds from 45 to 300 baud. You can *copy not only amateur RTTY but also press, weather and other exciting traffic.*

A high performance modem lets you copy both mark and space for greatly improved copy under adverse conditions. It even tracks slightly drifting signals.

You can transmit both narrow and wide shifts. The wide shift is a standard 850 Hz shift with mark/space tones of 2125/2975 Hz. *This lets you operate MARS and standard VHF FM RTTY.*

You get both the American Western Union and the international CCITT character sets. Autostart for unattended reception and selectable "Diddle".

A receive Normal/Reverse software switch eliminates retuning and Unshift-On-Space reduces errors under poor receiving conditions.

ASCII

You can transmit and receive 7 bit ASCII using the same shifts and speeds as in the RTTY mode and using the same high performance modem. You also get Autostart and selectable "Diddle".

CW

You get a Super Morse Keyboard mode that lets you send perfect CW effortlessly from 5 to 99 WPM, including all prosigns -- it's tailor-made for traffic handlers.

A huge type ahead buffer lets you send smooth CW even if you "hunt and peck".

You can store entire QSOs in the message memories, if you wanted to! You can link and repeat any messages for automatic CQs and beaconing. Memories also work in RTTY and ASCII modes.

***A** tone Modulated CW mode turns your VHF FM rig into a CW transceiver* for a new fun mode. It's perfect for transmitting code practice over VHF FM.

An AFSK CW mode lets you ID in CW.

The CW receive mode lets you copy from 1 to 99 WPM. Even with sloppy fists you'll be surprised at the copy you'll get with its powerful built-in software.

You also get a random code generator that'll help you copy CW faster.

Weather FAX

***You'll** be fascinated as you watch WEFAX signals blossom into full fledged weather maps on your printer.* Other interesting FAX pictures can also be printed -- such as some news photographs from wire services.

Any Epson graphics compatible printer will print a wealth of interesting pictures and maps.

Automatic sync and stop lets you set it and leave it for no hassle printing.

You can save FAX pictures and WEFAX maps to disk if your terminal program lets you save ASCII files to disk.

Pictures and maps can be *printed to screen in real time or from disk* on IBM and compatibles with the MFJ-1284 Starter Pack.

You can transmit FAX pictures right off disk and have fun exchanging and collecting them.

Slow Scan TV

The MFJ-1278 introduces you to the exciting world of slow scan TV.

You'll not only enjoy receiving pictures from thousands of SSTVers all-over-the-world but you can send your own pictures to them, too.

You can print slow scan TV pictures on any Epson graphics compatible printer. If you have an IBM PC or compatible you can print to screen in near real time or from disk with the MFJ-1284 Starter Pack.

You can transmit slow scan pictures right off disk -- there's no need to set up lights and a camera for a casual contact.

You can save slow scan pictures on disk from over-the-air QSOs if your terminal program lets you save ASCII files.

The MFJ-1278 transmits and receives 8.5, 12, 24, and 36 second black and white format SSTV pictures using two levels.

Contest Memory Keyer

***Nothing** beats the quick response of a memory keyer during a heated contest.*

You'll score valuable contest points by completing QSOs so fast you'll leave your competition behind. And you can snag rare DX by slipping in so quickly you'll catch everyone by surprise.

You get iambic operation with dot-dash memories, self-completing dots and dashes and jamproof spacing.

Message memories let you store contest RST, QTH, call, rig info -- everything you used to repeat over and over. You'll save precious time and work more QSOs.

You get automatic incrementing serial numbering. In a contest it can make the difference between winning and losing.

A weight control lets you penetrate QRM with a distinctive signal or lets your transmitter send perfect sounding CW.

More Features

Turn on your MFJ-1278 and it sets itself to match your computer baud rate. Select your operating mode and the correct modem is automatically selected.

Plus . . . printing in all modes, threshold control for varying band conditions, tune-up command, lithium battery backup, RS-232 and TTL level serial ports, watch dog timer, FSK and AFSK outputs, output level control, speaker jack for both radio ports, test and calibration software, Z-80 at 4.9 MHz, 32K EPROM, and socketed ICs. FCC approved. 9x1½x9½ inches. 12 VDC or 110 VAC.

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CIRCLE 24 ON READER SERVICE CARD

Welcome, Newcomers!

A Lost Art?

Q: How much do **hams** nowadays indulge in "home-brewing"—the practice of building, testing, and troubleshooting their own radio equipment? What are the benefits?

A: Home-brewing is enormously popular, even in this age of the ready-made-just-add-juice amateur radio station. Though we include at least a few such articles in every issue, the most consistent remark on *73*'s reader feedback cards is "more construction projects." It's no longer imperative to home-brew, but, as many hams see, it adds a huge dimension to the hobby. Read on to find out why!

Home-brewing is Alive and Well

Building, testing, and individual innovation thrives for these reasons:

•Amateur radio technology has blossomed. There are many more avenues to explore and refine—plenty of room for both commercial and individual development.

•Cost. Kits are often cheaper than the assembled product. Most of the commercial amateur equipment is made in Japan. The strong yen/weak dollar has driven the prices of transceivers to unseemly levels. For example, a particular series of **VHF** and **UHF single-band** transceivers, now retail for $1400 each! In this particular case, many hams are buying **transverter** kits to build and install on their **HF rigs**, cutting their costs by many hundreds of dollars.

•Transceiver technology is by far the most involved. Other elements of the ham station—such as the **linear amplifier**, the **antenna system** and the **antenna tuner**—remain relatively simple and comprehensible to the dedicated hobbyist. You can easily and relatively cheaply put together these three items at near state-of-the-art levels.

•Radio frequency spectrum crowding. There are several million hams in the world today. The push is on once again to fit a signal into a smaller **bandwidth**. Many hams, as well as commercial interests, are now working on this. There is a lot of work being done now with **digital** and **synchrony** techniques toward this end.

•Simple troubleshooting often saves much time and money. The **Volt-Ohm-Meter** (VOM) is the most useful shack test instrument. It's able to perform a bevy of simple tests. It can check to see whether a circuit is open (broken) or shorted (contacted with another circuit). It can also check a transceiver's **power supply**, which is a relatively simple circuit, and often a trouble source. It can also make at least some kind of test on most electronic components.

Finally, there's the deep satisfaction of operating a piece of equipment you've built yourself. You can't help but feel closer to the hobby, and you can't *not* help learning a great deal! 73

...de NS1B

GLOSSARY

Antenna system—All the components of a radio station to which a transmitted signal from a transceiver goes. It's most basic form has only two parts: the transmission line, which carries the signal to the antenna, and the antenna which radiates the signal into the atmosphere. The transmission line should allow as little of the signal as possible to radiate from it, in order to get as much of the signal as possible to the antenna.

Antenna tuner—This device matches the antenna system to the transceiver. A poorly matched system results in a lot of the output power from the transceiver being reflected to the transceiver by the antenna system. The tuner has two principal aims: to allow the antenna to radiate as much as possible, and to prevent as much signal energy as possible from returning to the transceiver.

Band—A range of frequencies in the electromagnetic spectrum, as in the AM broadcast band. Collections of bands are further grouped into subspectra. Examples of these are: High Frequency (HF), Very High Frequency (VHF), Ultra High Frequency (UHF).

Bandwidth—This usually refers to the amount of frequency range a signal occupies.

Digital—Information in this mode is represented in a limited number of discrete units. Morse Code, for example, conveys information using only five units—"dihs"(dots) and "dahs" (dashes), and spaces of three different lengths.

Federal Communications Commission (FCC)—This is the US government agency responsible for the allocation of frequencies for radiocommunications and broadcasting in the US.

Ham—Short for "amateur radio operator."

Linear amplifier—The device that takes a signal from a transceiver and increases its power before sending it to the antenna system.

Modes—Mode has many meanings, but here it refers to the form the information is packaged in on an electromagnetic wave. Examples of such modes are: amplitude modulation (AM), frequency modulation (FM), single side-band (SSB), and continuous wave (CW), which is more commonly known as Morse code.

Power supply—This is the circuit that converts the electrical current from the wall sockets in homes into a form the piece of equipment can use.

Radio frequency spectrum—The portion of the electromagnetic wave spectrum which covers waves whose wavelengths range from 30 kilometers to 1 millimeter. The corresponding frequencies are 10,000 cycles/second (10 kHz) to 3000 billion cycles/second (3000 GHz).

Rig—Jargon for transceiver.

Single-band—A transceiver that operates on only one band of frequencies.

Synchrony—Sychronous modes are those where the two stations in communication use the same timing cycle.

Transceiver—A transmitter and receiver combined in a single unit.

Transverter—A device that allows a transceiver to to operate on a range of frequencies different from the transceiver design.

Volt-Ohm-Milliammeter (VOM)—A device that measures the three most common electrical quantities—resistance (in units of Ohms), voltage (in units of Volts), and current (in units of Amperes).

QRM

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73 AMATEUR RADIO®

AUGUST 1988 — Issue # 335

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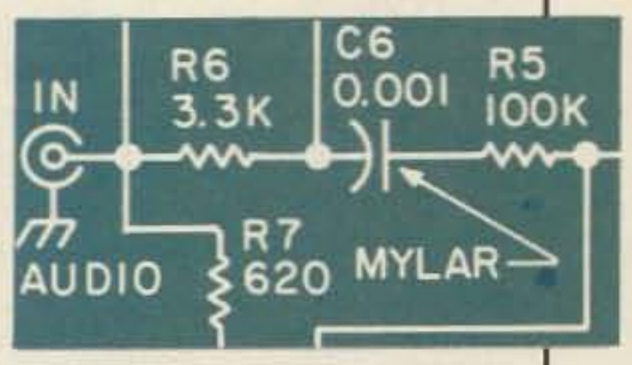
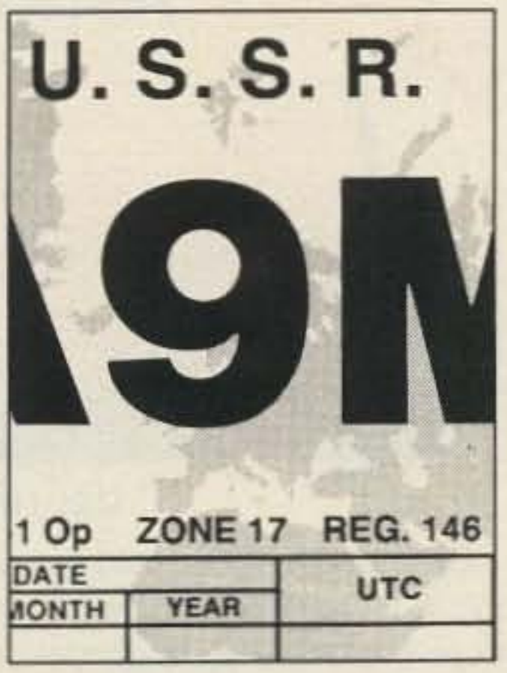


REVIEWS

DEPARTMENTS

FEEDBACK... FEEDBACK!
It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 81. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.

Cover by Deborah Smith
Photography by Suzanne Torsheya



Number 2 on your Feedback card

NEVER SAY DIE

DAYTON!

Too bad if you screwed up and didn't make Dayton. I started going 33 years ago and have missed only few years since.

The Hamvention was its usual madhouse, with hundreds of inside commercial exhibits and zillions of flea marketers outside. The weather couldn't have been better.

Another Rouser

My talk was well-attended again—SRO. Despite the heat given off by an estimated 70 tons of warm ham, very few fell asleep. The Hamvention people tell me I pull the biggest crowd of all at my talks. That's good for my ego... which could use some plumping up now and then.

Now, I suppose since you didn't bother to come and hear me, you're going to want to know what I talked about. Lotta things. Fortunately, no one made a tape, so nobody can prove anything. Heh.

Ham Clubs Too Cliquish

I remember telling about a talk I'd given just a few days before at Nichols College. When I mentioned amateur radio to the students I got the fish eye—most of 'em had never even heard of amateur radio. Is it something like CB?

Look here, you turkeys, at the next meeting of your club you appoint someone as the PR coordinator and you charge 'um with making sure that anything and everything your club or any member does of even remote interest is written up and submitted to your local papers and broadcast station. We're going to get the general public informed about amateur radio if it kills you.

While I'm on you about your crummy, do-nothing ham club and the terrible fix you've gotten us in by being lazy about PR, let me assure you that I'm still getting letters from all over the country from youngsters telling me how hostile your club is when they come to a meeting. Give me a break!

Stop that baloney and start getting kids to come to your meetings—and make the meetings fun for them. Got that? If you don't know how to deal with a ten-year-old Novice or potential Novice, find out and clean up your act. Your club meetings are supposed to be for the benefit of all the members, not just two or three fat old men with serious ego problems. Got that?

You say that your ham club isn't crummy, that you do, too, have youngsters coming to meetings? Oh, yeah? Well, prove it. Send me a picture of your next club meeting with those youngsters showing where I can see them. Send me some pictures of the Novices your club has gotten licensed. Put some photos where your mouth is.

Take That!

Now, Dayton...oh yes, I mentioned the recent Canadian government proposal for a no-code license. That ought to blow the lid off things. This one seems most likely to go through, which means the pressure will be on again here in America for a no-code license. I love it.

I explained for the umteenth time that while I favor getting rid of the code as a requirement for a ham license, I have always tied this to a more demanding technical exam. I have this crazy notion that amateur radio should be a technical hobby, not one of skill.

Indeed, I believe we'll find here in America, as they have in Japan, where they'd had the no-code license for many years, that a great many amateurs become proficient at the code for the fun it offers. If we ever get rid of the code requirement in America, you may be sure that I'll have a series of code proficiency certificates available in short order. I'd like to see one of the major activities at hamfests the administration of code speed contests, with award certificates for the hamshack wall.

I explained, too, that it's as easy to learn the code at 13 words per

Continued on page 39

QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

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- **SW-100B** Compact SWR/power/volt meter (140-450 MHz)
- **SW-200A** SWR/power meter (1.8-150 MHz)
- **SW-200B** SWR/power meter (140-450 MHz)
- **SWT-1** Compact 2 m antenna tuner (200 W PEP)
- **SWT-2** Compact 70 cm antenna tuner (200 W PEP)
- **SWC-4** 1200 MHz Directional coupler.
- **SP-40** Compact mobile speaker
- **SP-50B** Mobile speaker
- **PG-2N** Extra DC cable
- **PG-3B** DC line noise filter
- **MC-60A, MC-80, MC-85** Base station mics.
- **MC-55** (8-pin) Mobile mic. with gooseneck and time-out timer
- **MA-4000** 2 m/70 cm dual band antenna with duplexer (mount not supplied)
- **MB-201** Extra mobile mount

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  IF shift, tuneable notch filter, noise blanker, all-mode squelch, RF attenuator, RIT/XIT, and optional filters fight QRM.
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- **Computer interface port**
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- **VOX, full or semi break-in CW**
- **AMTOR compatible**

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- AT-250 external auto. tuner (160 m—10 m)
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- PS-50 heavy duty power supply
- PS-430/PS-30 DC power supply
- SP-430 external speaker
- MB-430 mobile mounting bracket
- YK-88C/88CN 500 Hz/270 Hz CW filters
- YK-88S/88SN 2.4 kHz/1.8 kHz SSB filters
- MC-60A/80/85 desk microphones
- MC-55 (8P) mobile microphone
- HS-5/6/7 headphones
- SP-40/50B mobile speakers
- MA-5/VP-1 HF 5 band mobile helical antenna and bumper mount
- TL-922A 2 kw PEP linear amplifier
- SM-220 station monitor
- VS-1 voice synthesizer
- SW-100A/200A/2000 SWR/power meters
- TU-8 CTCSS tone unit
- PG-2S extra DC cable.

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QRX . . .

EDITED BY BRYAN HASTINGS KA1HY

Mission Accomplished

Canadian and Soviet Polar Bridge Skiers completed their 2000 km trek on June 1st. At 1435 UTC, the 13 arctic explorers reached Canadian shores in good health after three months crossing the north polar ice cap from the USSR. Dr. Dmitry Shparo UA3AJH, expedition leader, eight other Soviets and four Canadians were assisted by HF and satellite amateur radio communications throughout their trip. The success of the polar trek depended largely on the cooperative spirit between Canada and the USSR as well as the effectiveness of amateur communications. Congratulations to all participants. Watch for a detailed story of the polar trek in a future *73*.

Trajectoire Nominale!

That's right . . . the Ariane 4 rocket carrying Phase 3C and two other satellites was successfully launched 15 June at 11:19:01 UTC, 6 minutes later than planned. The weather was perfect and the rocket functioned flawlessly, putting all three satellites into orbit. Approximately three hours after lift-off, Ian ZL1AOX was able to receive OSCAR 13's beacon very strongly and decoded the telemetry error-free. He commanded the satellite to switch telemetry to the engineering beacon to verify that command is possible. Stations in South Africa, Italy and Israel also reported hearing the beacon.

The telemetry from OSCAR 13 indicates a perfect orientation and a spin rate of 7 RPM. All important telemetry values are quite satisfactory.

The next events are the precise determination of the actual orbit and raising the perigee to a safer altitude.

Amateurs who are unable to hear the general beacon on 145.812 MHz should listen for the engineering beacon on 145.985 MHz.

No Longer Just "QSL via Box 88"

***Glasnost'* ("openness") is filtering down to Soviet Amateur radio.** Gennady UA9MA, *73's* USSR correspondent, recently attended the All-Union Amateur radio conference in the Soviet Union in Moscow 9–10 April. He sends *73* these four revisions:

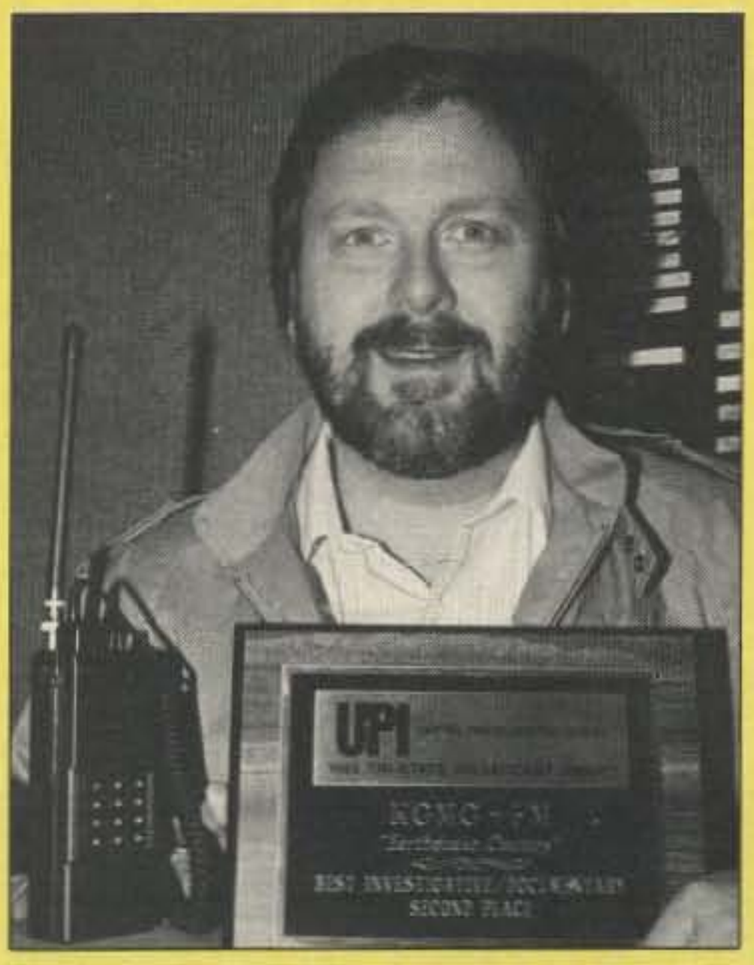
1) Foreigners may now QSL direct to USSR hams, who likewise may also QSL direct out of the country.

2) USSR hams may print their pictures and addresses on their QSL cards.

3) USSR hams may now publish their addresses in any callbooks.

4) USSR hams may now QSO with Israeli stations.

All this is a promising start. Is reciprocal licensing just around the corner? See "73 International" for details.



Broadcaster and Ham Steven Sellers N5GZP recently received an award from the United Press International for the "Best Investigative Documentary." The honor was awarded for a one-half hour program that Steve had written, produced and reported, entitled "Earthquake Country." This was broadcast over San Diego radio station KGMG-FM where he is news director.

Fore or Aft?

In response to a petition filed by the ARRL, the FCC amended Part 97 amateur regulations to permit foreign operators under reciprocal operating agreement to put their location prefix ahead of their callsign when identifying. In its petition, the ARRL claimed that this identification method had already been endorsed by the International Amateur Radio Union (IARU) and that many nations worldwide had already inplemented it.

By way of example, an operator from Australia visiting Florida who in the past had signed VK3BKL/W4 will now identify as W4/VK3BKL.

Australian VEC!

Australia now has its own all-volunteer amateur radio testing program. This puts an end to the quarterly and very expensive ($30 Australian) testing program. VEs may hold exams as often as they wish. Examination fees are left to marketplace forces.

Australia adopted *none* of the restrictions of the United States all-volunteer testing program. Those under 18 years of age, persons in commercial industries allied to amateur radio, and hams of any license class will also be eligible. In some cases, the Australian Department of Transport and Communications (DOTC) will accept as examiners even those without ham licenses, such as members of technical colleges.

Even a single examiner is allowed to give any class of test if he or she posts the exam date with the DOTC in advance and notifies the DOTC in advance of any unscheduled examination sessions.

Australian Novice class operators also have the use of two meter FM. Prior to June 1, Australian Novices were restricted to CW, AM, and SSB, on segments of the 80, 15 and 10 meter bands. Now, they can also operate 146–148 MHz at 10 watts FM. 146–148 MHz is the Australian FM repeater subband.

Pappy is SK

Bandel "Pappy" Linn K4PP, a distinguished cartoon illustrator and well-known radio personality, passed away on 7 May, at age 76. Bandel's cartoons appeared in a host of national magazines, including the *Saturday Evening Post*, *Colliers*, *Cosmopolitan*, and the *New Yorker*. *73 Magazine* had the good fortune to run Bandel's cartoon series, "Well . . . I Can Dream, Can't I?," from the the early 80s, until ill health compelled Bandel to stop. *73* regrets the passing of one of amateur radio's more illustrious members.

Thanks To . . .

UA9MA, VK2BVS, WA6WZO, K8TMK, the *Herald Palladium* of Benton Harbor, Mich, and *Westlink Report* for this month's news items. Send news items and photos to: *73 Magazine*, WGE Center, 70 Rt. 202 N., Peterborough, NH 03458, Attn: QRX.

Holy Mackerel, What A Mess

FP/W2NSD DXpedition

It sounded like hundreds of stations calling when I stood by! I couldn't make out anyone's call. Is there a greater excitement in amateur radio than being on the hot-seat end of a DXpedition?

The *73* crew—Larry, Bryan, and I—headed to St. Pierre (FP/W2NSD) over the Memorial Day weekend. What an incredible weekend it was! And what a magnificent DX location. It has everything. It's easy to get to—we flew there. It's inexpensive. And it's located so the propagation into the U.S. couldn't be much better.

Where's St. Pierre? It's a tiny French island right below Newfoundland. Check it out on an atlas or globe. It's even on the *73* World DX Map.

We started from New Hampshire on Wednesday, flying from Boston to Halifax that day. There were no connections to St. Pierre until the next morning, so we met with the local Nova Scotia hams at the Airport Hotel that evening. Despite the hotel being about 20 miles out f Halifax, around 60 hams turned out.

I put on a W2NSD performance for about an hour, convincing some very hard-bitten dyed-in-the-wool CW fanatics that no-code was the way to go. Talk about a challenge! As usual, I talked about everything under the sun as well as amateur radio.

The next morning the weather was lousy, so the flight was delayed. And delayed. And delayed. After five one-hour delays the flight was finally cancelled. "Come back tomorrow." Time to spare, go by air. Oh well, I suppose it's still better than an 18-hour boat trip.

At Last

On Friday morning the weather was beautiful, so we got off on schedule, an hour and a quarter flight. St. Pierre immigration and customs were no problem, even with all our big suitcases of ham gear. We had along six large heavy aluminum suitcases.

We took a taxi into town, about a kilometer. This is a very small island. Hotel Robert is right smack-dab in the middle of the downtown area. The Annex (40 rooms) faced the town square. Being early in the season, we were the only ones using the Annex. Fine, we could make all the noise we wanted. Planning ahead, I brought earplugs so I'd be able to sleep through the din. This turned out to be a shrewd safeguard. I needed 'em.

Room 36 came complete with coax connectors going to a defunct minibeam and a vertical on the roof. We set up our three rigs, using the ICOM 761 as the main station.

After a few dozen CQs and distressingly few contacts I began to suspect that the minibeam lacked a little in effectiveness. I tried rotating it and found no change in signal strengths. Hmm. It was merely a lump and what signals were sneaking out were probably coming from the coax feedline, not the "antenna."

Photo A. Was Wayne really there? Here's proof for skeptics.

Fortunately Bryan had brought an emergency dipole. Once that was up we began to seriously fill the log sheets. The pileups sure did get the adrenaline going. What a high! My experience operating from other rare spots made it possible for me to whup down the piles quickly, right on down to the weakest mobiles and QRP callers. Hams don't need a kilowatt to work W2NSD, no matter where I am in the world, just some patience, and not even a lot of that.

Working Pile-ups à la W2NSD

Here's my speed system for working pile-ups. I call CQ long enough to get the attention of any stations that may be breaking in on my frequency. Then, before standing by and facing ten minutes of pure hell, I tell the assembled throng that I will be listening for the last two letters of their call only. I want one call, and wait a bit. Space it out so I can write down the two letters. Constant breakers get no QSL. Yes, I get downright mean when my adrenaline is going strong.

Then, as I sort out the two letters I repeat them and ask the caller to stand by. This goes on until the channel is completely clear. About halfway down the stack I start getting breakers wondering who the DX is on frequency, so after about ten are stacked up it's time to make another short general announcement with my call and the rules. Then I keep on getting the last two letters of the callers, asking each in turn to stand by. Finally I get down to the noise level, then the mobiles and QRP ops. I've worked 1/100-watt stations right along with the multi-kilowatts.

When I have all the callers written down on a worksheet it's time for the complete exchanges. First I give the QSL information, then I start down my list, giving each their signal report and their two letters. Five-nine. I stand by and log the whole call and my report. Then I repeat back the call and received report as my acknowledgement (QSL) and go immediately to the next caller, giving his or her report.

If I wait until after I have their call to give them a report I'm going to have two more transmissions—and the potential of presenting a long-winded op who can't prevent himself from telling me his location, name, rig, antenna, microphone and so on—an opportunity he can't pass up. Geeze!

All I'm looking for are the call letters and report. That's all it takes for the QSL card, so why waste my time on names and other trivia? I'm not there for rag chewing, I'm there to give as many ops a QSL as is inhumanly possible during my few hours on the air. And don't forget it.

Photo B. Many homes on St. Pierre are colorful. The weather couldn't have been nicer—4c (40 F) at night and up to 18 C (66 F) during the day.

Special Point of View

I realize that after years of automatically and unthinkingly swapping names, QTHs, rigs, antennas and so on, it's difficult to get into a DXpedition frame of reference. The ops contacting me want to know I have their call right and they want their signal report. They also want to know where to send their QSL card. Ops in Russia often won't let go without getting a name in their log; it must be a government regulation, with heavy gulag time for those who don't get a name.

By the way, it sure helps to write down the information you're going to give. There's no problem remembering it the first few hours, but by 2 a.m. you have to look at your cue sheet to remember your own call. Oh yes, use a pencil for log entry. You're going to make lotsa mistakes.

Other than being easy to reach, friendly, a great radio location and inexpensive, St. Pierre doesn't have a lot of plusses. Bryan and I rented bicycles ($4/hr) and pretty much covered the island in a couple hours. Don't miss the elephant train two-hour tourist tour on Sundays.

The local language is French, but most of the people who come into contact with visitors speak English. After all, St. Pierre is surrounded by English-speaking countries. I didn't notice the usual French arrogance either, which was nice.

The hotel continental breakfasts come with the room: very buttery, delicate croissants, coffee (or tea), butter and jam. In season people can get other meals at the hotel or at any of the many other restaurants and snack bars. We loaded up on cheese, crackers, fruit and sausage at a local grocery so we wouldn't have to stop operating for a two-hour lunch. They even sell bananas there, which is more than one can say for the USSR.

St. Pierre's heydays were from 1922–33, when they were making zillions as a rum-running stop between Scotland and the US. Old whiskey crates are the decorative motif here. Since then they've been living mostly from fishing and hand-outs from France. If we can get a small DXpedition business going it'll help 'em out. I'll bet we can get 'em to issue some special DXpedition calls too. How about FP73A and so on?

Loggings

What did we work? Well, tons of W/K/N, of course. Plus loads of G's, Russians, LA, SM/K, OH, OZ, DL, Y88, ON, PA, EA, OE, YU, OK, SP, LZ, YO, PY, LU, YV. One African 5Z4, nothing from the middle east. Most of the ops in the rarer countries were busy with their own pileups, so we never heard each other. I heard the piles now and then as I tuned the band, but I wasn't anxious to spend a half hour or more in a pileup; and few DX ops are very fast. Most of 'em just stand by and try to pick out the loudest caller. This keeps the QRM level high and the contacts down to one every minute or so instead of three or four a minute average. Without a powerhouse signal I knew I'd just waste my time chasing DX, and that wasn't why I was there. I was there to be chased.

Of course, if more DX ops would use my system for working 'em right down to QRP, most of us would have more countries worked and wouldn't get as fed up with the whole danged thing.

One secret for building a pileup—it takes a pileup to attract contacts—is to call CQ with a very excited voice. Call it fast and feverish as if calling a rare one yourself. That'll get 'em as they tune across the band. Raise your voice—call fast and furious.

I've DXed from some rare spots—Navassa Island (KC4) in '58 and '72, Jordan in '70 and '73, a whole bunch in '59 and '66, so I'm familiar with pileups. I'll tell you this: No one ever forgets a single minute of any DXpedition they go on. It's an experience you'll always treasure.

Photo C. Bryan FP/KA1HY racks 'em up with the ICOM 761 on 14.165. Note the Koss stereophones—why not go first class, eh? The Oreos are for Wayne.

Photo D. FP/W2NSD looking jealously while FP5DF makes a contact.

Club DX

It was so simple getting to St. Pierre and operating and so inexpensive. I got to talking with Larry and Bryan about maybe setting up a DXpedition club—Club DX, Larry christened it—to make it so you, too, can get on and enjoy the pileups trying to work you, so you can have the time of your life.

What would it cost to set up a first class ham station up there? I'll bet we could put in an all-band rig, a linear, a beam, a vertical, RTTY, packet, SSTV and maybe even OSCAR for about $6,000. If we could keep it active 100 days a year we'd be able to cover the cost of the equipment and occasional repairs for maybe $50 a day. In that way, DXers wouldn't have to lug hundreds of pounds of rigs and antennas, keyers and so on. Heck, anyone could easily get up there, operating permit in hand, and be on the air instantly.

The hotel might run $500 for four days for a regular room plus the hamshack room, plus $350 air fare each from Boston. You could take the wife for a fantastic four day DXpedition for under $2,000. Going alone, you won't need the second plane ticket or room, you cheap old buzzard.

Alas, considering so many hams today are retired and living on fixed, meager incomes, perhaps there aren't enough red-blooded DXers to make it feasible to develop a dream DX site.

With the average ham age in the mid to high 50s, about half may be retired already. Judging from my contacts on the air recently over 90% of the active hams are retired. Also, judging from the stacks of letters from hams claiming to be too poverty-stricken to even be able to afford $20 for *73*, much as they'd like to, that also makes me wonder if there are enough hams with even the relatively small small investment it would take for a mini-DXpedition—even though it might be one of the most exciting ham experiences of their lives.

When I remember the pileups I handled from 5W4AZ (bet you have to look it up), from VR2FD, from 7P8CA, JY1 and JY8AA, YK1AA, YA1NSD, 5Z4, EP2, KS6, KW6, KR6, 9N1, 9M8, 9M6...sigh. Even racking 'em up from KV4AA was a delight, and that was before I really knew how to handle the pileups fast.

If you do decide to get into the most exciting phase amateur radio has to offer, don't forget to take a camera and word processor. Your experience could bring some bucks from a ham magazine, perhaps even one of the regular consumer magazines such as *Geriatric Adventures, Trivia & Leisure* or *National Photographic.*

If there are enough hams who have not lost the spirit of adventure, whose flame of life isn't about flickered out, maybe we can get St. Pierre fired up. Heck, I could get similar sites going in a dozen other easy to reach, yet fairly rare countries, mostly in the Caribbean. Yes, it'll be hard work making the arrangements and testing out such sites, but no one said publishing a ham magazine was going to be easy.

Should I look for spots where you can combine hamming with skin diving? Or would you prefer to make the Silent Key list without ever being on the live end of a pileup? It's your life, your priorities. 73

Auto-VIM

Part I

A Dual 5–15 Volt Bench Supply with Automatic Voltage and Current Monitors

by L.B. Cebik W4RNL

The advent of three and four pin monolithic voltage regulators in both fixed and variable voltage models for two dollars or less each has simplified the construction of bench supplies for the ham shack or experimenter's workshop. A few dollars and a few parts yield perfectly good supplies in the 5 to 15V range, which covers most building and testing needs. Current capabilities depend only on the particular regulator model and the size of the heat sink we choose. It's a snap now to build a well-regulated bench supply!

Challenges of Convenience

The new challenge of bench supplies is building in user conveniences. Voltage and current monitoring, for example, are extremely useful. A first glance at the problem, however, suggests the need for at least four meters: a positive voltmeter, a negative voltmeter, a positive ammeter, and a negative ammeter. If the ammeter is to cover more than one range–say, 50 mA and 500 mA full scale–then more manual switching is needed. Short of installing some autoranging, autopolarity DMMs inside the power supply case, the problem of comprehensive power supply monitoring seems either complex or expensive.

Far from it, however. A batch of inexpensive and easily accessible ICs and transistors, along with a few resistors and fewer capacitors, gives comprehensive voltage and current monitoring for most small bench needs. This article describes a half amp bench supply with the following features:

- ± 5 to 15V output with mechanical tracking to within a few hundredths of a volt.
- Automatic voltage monitoring with electronic switching between plus and minus voltages and with manual override for close monitoring of one of the voltages.
- Automatic current monitoring with electronic switching between plus and minus supply loads, again with manual override for close monitoring of one of the current loads.
- Automatic current ranging between 50 mA and 500 mA full scale ranges, regardless of voltage polarity.
- A parts cost of about fifty dollars or less.

Auto-VIM stands for AUTOmatic Voltage and current (I) Monitoring. In addition to providing circuit and construction details on this bench supply, this article supplies enough background to vary the circuits to personal needs. This includes the adaptation of the circuit for use with digital voltmeter circuits. For supply monitoring, I prefer analog meters, but preferences vary according to the type of work prescribed for the bench supplies. In addition, there's a one meter voltage and current monitoring circuit.

Basic Design Concept

The basic design of the power supply appears in Figure 1. Since the power supply itself is fairly standard, except for the secondary regulators, which feed a fixed ± 15V to the monitor circuits. A clock (555 or 7555) and flip-flop (4013) provide the control pulses for changing polarity in the two monitors. Connecting the Set and Reset pins of the D-type flip-flop to a switch allows the operator to override the clock and force the circuit to the high-low combination which permits reading either the positive or negative voltages and currents.

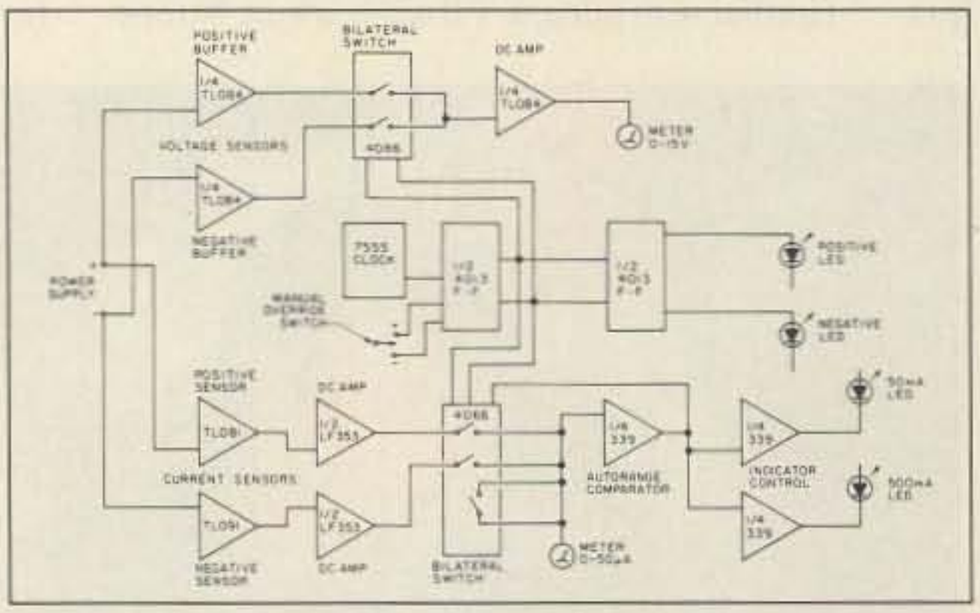


Figure 1. Block diagram of the voltage and current monitoring system.

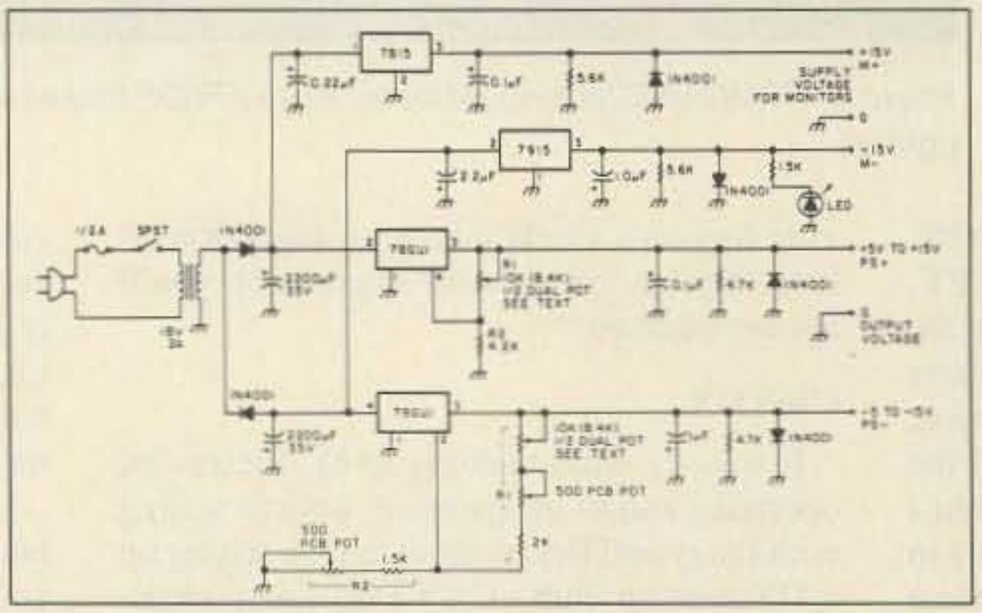


Figure 2. Schematic of the dual, variable power supply and fixed 15 V supplies.

The voltage monitor consists of a quad op amp (TL084) used to sense a set fraction of the supply voltage. A bilateral switch (4066) controlled by the flip-flop selects the output from the non-inverting unity gain buffer for positive voltages or the inverting buffer for negative voltages, thus providing succeeding stages with only positive voltages. A non-inverting DC amplifier raises the voltage to a maximum of 10V (well within the linear capabilities of the TL084) for readout by a modified 0-to-15V voltmeter whose external series resistor has been changed to track the DC amplifier output.

The current monitor uses the same flip-flop signals to control another bilateral switch (4066) which feeds voltages from the sensor input stages to the meter. The sensors use both normal Bi-FET (P-channel) and NFET (N-channel) op amps to sense the current drawn from the positive and negative supplies, respectively.

The TL081 and TL091 op amps feed a low level voltage proportional to the current to standard DC op amplifiers (LF353 dual op amp), with the negative voltage inverted so that the meter circuit sees only a positive voltage. Which current-proportional voltage the meter sees is controlled by the 4066. One section of a quad comparator (339) senses the voltage in the meter circuit. Above a certain point (1.2V), it switches in additional meter circuit resistors to increase the range by a factor of ten, thus giving automatic ranging between the 50 mA and 500 mA scales. Unused portions of the

4013 and 339 control panel LEDs indicate polarity and ammeter range.

Accuracy

Minor inaccuracies introduced by imbalances in the current sensing op amps and calibration errors limit the absolute precision with which the circuits will read out either voltages or currents. Current residuals depend upon the tracking accuracy of the positive and negative supplies, and are minimized by splitting DC amplifier duties between the sensors and the follow-up 353 stage. With careful mechanical adjustment of tracking, these reduce to 2 mA or less (apart from other sources of calibration error).

The accuracy of the voltage monitor depends upon the accuracy of the calibration results. Power supply monitors provide general indications rather than specific measurements of test circuit performance. The latter require more precise measurements with the usual array of test bench equipment. Therefore, an accuracy of 10% in general monitors is usually good enough, and 5% accuracy is more than most applications require. Careful construction and calibration permit these circuits to better the 5% mark plus or minus the inherent accuracy of the analog meters themselves (generally 2 to 3%). These figures suggest that the monitor can provide a valuable service to the builder and experimenter. In fact, it has already saved me nearly its own cost in components that did not die in test circuits.

Achieving good circuit results depends on careful component selection and calibration throughout the supply. Ordinary ham shack-VTVMs and DMMs are fine. In fact, the circuit requires only 5% tolerance components at its critical points, plus some care. The care contributes to the circuit's fairly low cost. In order to catch all the salient circuit features, let's explore the major circuit divisions one at a time.

Variable Dual Power Supply

Figure 2 shows the dual power supply that forms the core of the project. The supply is standard in almost every feature. The 18V, two amp transformer provides ample reserve capacity for the supply at peak loads, despite the simple half-wave rectifiers. The large filter capacitors minimize ripple to the regulators. Tracking with the 78G/79G series four pin regulators is quite simple, compared to others on the market. Moderate size heat sinks for the TO-202 packages will handle the supply's requirements. The remaining components are standard data book recommendations.

The 7815/7915 positive and negative fixed regulators provide the voltage for the monitor components. For the small load involved (under 20 mA exclusive of BEDs, which are set at about 10 mA each), Zener regulation might do, but the fixed three pin regulators are cheap, nearly foolproof, and run cool without heat sinks.

To establish the values of the control components R1 and R2, measure the actual value of the dual 10kΩ potentiometer. Most inexpensive varieties top out at less than 10kΩ. In my case, I found 8420Ω the maximum value. I obtained several pots and chose the unit whose individual maximum values were most nearly equal. The closer the values, the better the tracking of the two supplies.

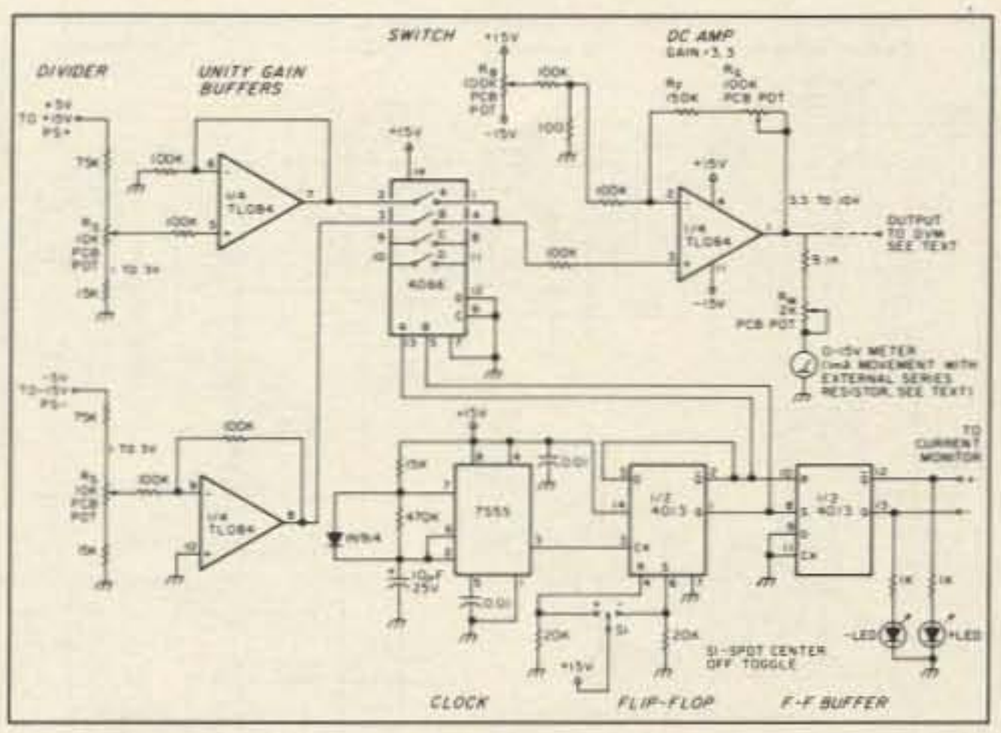


Figure 3. Schematic of the auto-polarity voltage monitor.

The rest of the process is a matter of following data book formulas, with a few adjustments. For both regulators, the output voltage (Vo) equals the sum of R1 and R2 divided by R2, with the result multiplied by the control voltage (Vc). For the 78GU1, Vc is 5V, and for the 79GU1 it is 2.23V. The data books recommend a 1 mA control current, which gives 5kΩ and 2.2kΩ for the positive and negative regulator values of R2. With the less than nominal maximum pot value, however, (8420Ω instead of 10 k), 4.2kΩ yielded a positive output range from 5 to 15V with the 78GU1. Applying similar logic to the 79GU1 negative regulator gave a value of 1875Ω for R2 and a series resistor of 2345Ω for the potentiometer leg. Breaking the fixed values into fixed resistors and circuit board trimmer pots yielded the values in Figure 2.

The procedure for calculating the negative regulator values begins with the formula for R1, which equals R2 times the difference between the output voltage (Vo) and the control voltage (Vc), all divided by the control voltage. At minimum output (5V) when the potentiometer is also at minimum, R1 will be 1.25 R2, and at maximum voltage (15V) with the pot also at maximum, R1 will be 5.73 R2. Since the difference between R1 at maximum and minimum is 8400 Ω (the measured range of the pot), 5.73 R2 minus 1.25 R2 will also be 8400 Ω. R2 thus equals 8400 divided by 4.48 (i.e., 5.73 - 1.25), or 1875 Ω. A 1500 Ω fixed resistor plus a 500 ΩPC board trimmer give room for adjustment. Since R1 at minimum (when the pot is at 0 Ω) is 1.25 R2, which we just set at 1875 Ω, then the series resistance for the R1 pot leg of the control circuit will be 2345 Ω. A 2kΩ resistor plus a 500 Ω trimmer again provide room for adjustment.

Calibrating the tracking is easy. Check the positive supply range and later the 4.2kΩ resistor until the output extends from 5 to 15V. When the positive supply voltage range is satisfactory, then set both negative PC board trimmers to midrange. With the dual pot set to minimum value, adjust the trimmer in R2 to let the negative voltage equal the positive voltage (about 5V).

Turning the dual pot to maximum, adjust the trimmer in the R1 leg to let the maximum negative voltage equal the maximum positive voltage. Retrimming both the circuit board pots once more should yield stable results. Now output voltage tracking will depend on how well the dual pot sections track. Even with inexpensive dual pots, the variation should run less than a tenth of a volt between supplies. If the error is greater, but consistently high or low for one supply, then repeat the calibration. If the error varies across the voltage range, a different dual pot may be in order. Careful pot selection can thus save the cost of precision potentiometers and the complexity of electronic tracking circuitry.

As the photographs show, construction is not critical. Perfboard works very well when placing one set of stand-off pillars under the transformer mounting wings, rather than at the corners of the board. Use heat sink grease between the variable regulators and their finned sinks. Also note that the pinouts of corresponding positive and negative regulators differ. Do not let local QRM cause a reversal here! My experience says that at least one of the regulators will fry at first test.

My perfboard construction techniques make use of T-46 pins for off-board connections. In this project, there are many board-to-board and board-to-panel connections, so have a good supply of pins and plan their placement carefully. Since, as the photos show, the project will fill the case, be sure that no pins interfere with cabinet screws.

Voltage Monitor

The voltage monitor makes use of some automatic metering principles previously reported in *73*, but updates them to eliminate the need for measuring the forward voltage drop of diodes and for taking the drop into account when designing the power supply section. By using op amps to sense a portion of the positive and negative voltages, it's possible to control the voltage and not exceed the op amp limits, while still making accurate measurements. The trade-off for this convenience is the need to calibrate the circuit carefully.

As in the earlier voltmeter circuit, it begins with a timing clock (7555 or 555). The clock circuit provides short square wave pulses, as the on-time is controlled by the 15kΩ resistor. The diode shunts the 470kΩ resistor during capacitor charge, but the discharge goes through the resistor, extending the off-time to about 3 seconds. The 4013 flip-flop provides alternate 3 second periods for reading positive and negative values. The builder can alter the 470kΩ resistor to change the read periods, or insert a 500kΩ circuit board trimmer pot in series with a 330kΩ resistor to provide for an adjustable period.

The 4013 D-type flip-flop is in a standard divide-by-two circuit. Be sure to bypass pin 14 to ensure good action. Some combinations of clocks and flip-flops will miss some or even all beats without it. The extra portion of the two-section chip keys the indicator LEDs and provides clocking pulses to the current monitor. The Set and Reset pins (6 and 4) are grounded for clocked operation through 20kΩ resistors. Setting either high with the single pole, double throw, center off toggle switch will override the clock, locking the readout either positive or negative, along with its indicator LED.

If complement-Q controls the positive readout, then a high Reset line locks the circuit for continuous positive readout. Likewise, a high Set pin locks the Q output high for continuous negative readout. Returning the switch to center allows the clock to take over, and the circuit will cycle with the next clock pulse. Thus, There is a simple but effective manual override for the automatic circuit whenever we wish to closely monitor any one of our voltage or current readings.

The voltage sensors consist of unity gain buffers following a simple resistive voltage divider network. Feeding between one-tenth to one-third of the voltage to the buffers ensures that the voltage will never rise to near the op amp supply voltage. Near that point, op amps cease to amplify linearly, and accuracy deteriorates. For this circuit, the network provides 20% of the supply voltage to the buffers. The positive voltage buffer is non-inverting, while the negative buffer inverts. The result is that the rest of the circuit always gets a positive voltage. The circuit is similar to one developed by Pepper (*Radio-Electronics*, March 1983, page 64).

Following the buffers is the 4066 bilateral switch, whose individual switches close when their associated control pins go High according to the output from the flip-flop. The 4066 is an improved version of an earlier switch chip and shows a resistance of only about 80Ω per switch section. This low resistance is insignificant for these circuits. A DC amplifier follows the switch to set the voltage fed to the meter circuit.

For some applications, the builder may wish to use separate DC amplifiers for each buffer and install them ahead of the 4066 switch. A gain of 3.3 provides a maximum of 10V for an analog meter, well within the op amp limits. For use with digital voltmeter circuits, adjust the gain of this amplifier according to need. For example, with an original one-tenth sample at the resistor divider and a unity gain amplifier at this point, the circuit will show .5 to 1.5V for power supply settings of 5 to 15V (either polarity). Digital measurement would thus require only a change in decimal point position.

Since the DC amplifier is non-inverting, the feedback resistor network of Rf and Rg is easily altered. Keeping the 100kΩ trimmer and the 100kΩ input resistor, Rf then equals 100kΩ times the difference of the desired gain and 1, with another 100kΩ subtracted for the trimmer pot. Unlike the unity gain buffers, which require no offset balancing, the DC amplifier shows a remnant offset voltage which detracts from accuracy. The external balance circuit at the inverting input terminal provides easy adjustment for no output when the 100kΩ input resistor to the non-inverting terminal is grounded rather than connected to the 4066.

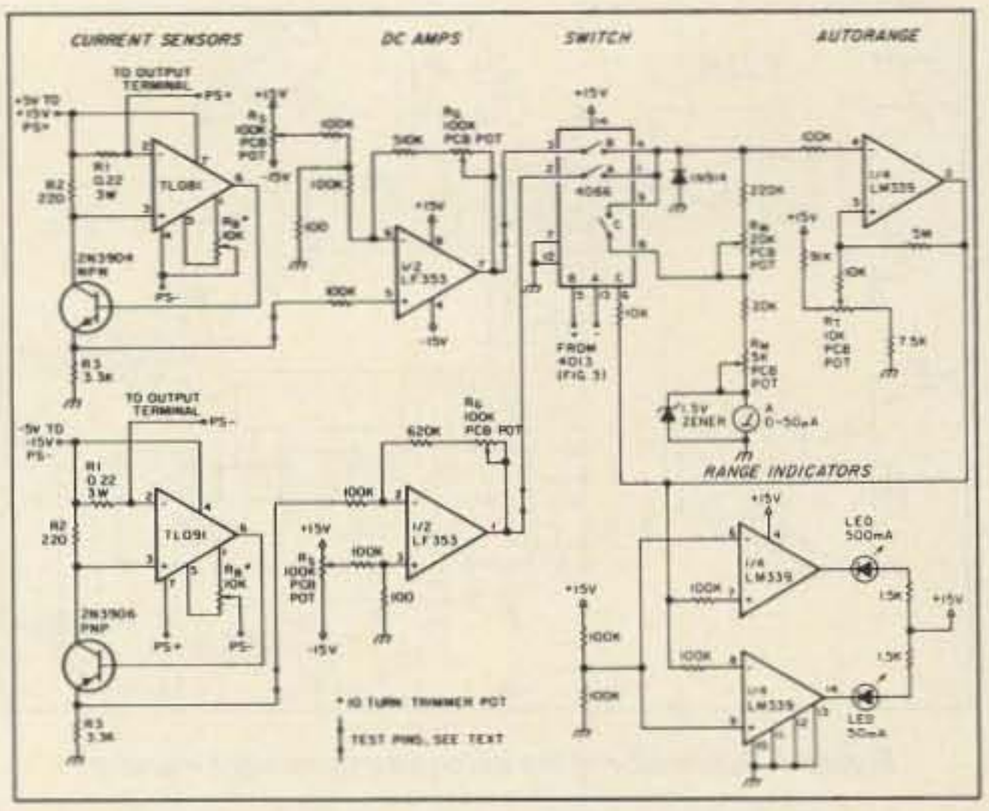


Figure 4. Schematic of the auto-polarity, auto-ranging current monitor.

The analog meter circuit uses a Radio Shack 0-to-15V voltmeter which comes with an external series resistor of about 15kΩ. This circuit replaces the series resistor with another combination to drive the 1 mA meter movement. Since the op amp output voltage corresponds to the sensed voltage, 10V from the DC amplifier equals 15V at the resistor divider terminal. Ten volts at 1 mA requires a 10kΩ series resistor, which is shown as 9.1kΩ plus a 2kΩ trimmer pot for calibration.

Construction is not critical here either, since only DC and slowly timed pulses are involved. Use IC sockets for construction ease. As with the supply board, use pins liberally for off-board connections. The 3 x 3 ½-inch perfboard squares shown in the photos easily hold the circuitry with room to spare. Be sure to place the trimmer pots in easy access areas for calibration after mounting the board in the cabinet. Since lead length makes no difference, mounting all trimmers along the top edge of the board will ease later calibration.

Voltmeter Calibration

Calibration of the voltmeter is a cinch. Balance the DC amplifier by grounding the 100kΩ input resistor at the switch (4066) end and adjusting the trimmer marked Rb until the output is zero. Adjust the input voltage setting trimmers so that the voltage to the buffers is one-fifth (or the desired fraction) of the power supply voltage. Using a convenient voltage, adjust the DC amplifier gain trimmer, Rg, so that the output is 10V (or the desired amount) for 15V from the power supply. Finally, set the meter trimmer, Rm, so that the meter shows 15V for 15V from the power supply. The only other cautions concern the flip-flop. Identify the positive and negative control lines and be sure that the manual override switch and indicator LEDs correspond correctly to these lines. Identify the positive and negative control lines for the current measuring circuit so that the meters will read together.

Current Monitor

Although voltage monitoring circuits are growing more common in bench supplies, there's still little useful current monitoring. A single meter for gross current measurement provides little help for monitoring low current circuits, while a sensitive meter pegs long before the supply nears its maximum rated output. Automatic monitoring of both positive and negative current drain appears only in expensive industrial and lab equipment in the $2,500-and-up class. A simple, reliable, and effective current monitoring circuit, however, has long had a place in the data books.

The current monitor in Auto-VIM owes much to National Semiconductor's Linear Databook circuit for routinely converting current drain to a voltage output without resorting to ultra-precise resistor matching.

The sensor circuits in Figure 4 use different op amps to sense positive and negative current flow. The TL081 (or LF351) Bi-FET op amp uses P-channel inputs which work with input voltages close to the positive supply value, but fail as the input voltage approaches the negative supply voltage. By contrast, the newer TI NFET op amp, the TL091, with its N-channel inputs, shows precisely the opposite characteristics. Between the two, we obtain separate but parallel sensors for positive and negative supply currents.

The transistors, whose base current is controlled by the op amp output, control the voltage seen at the 3.3kΩ resistor. In fact, the circuits provide an output voltage per mA of line current equal to .001 times the product of R1 and R3 divided by R2. The circuit shown provides .0033V per mA, or 1.65V at 500 mA. Sensor circuit output is positive for the TL081/2N3904 combination and negative for the TL091/2N3906 duo. Although most data book circuits show FETs rather than transistors used with the FET input op amps, the bipolar transistors work better at the 5V end of the power supply range. Note the 10-turn trimmer pots marked Rb, which will receive attention during circuit calibration.

A DC amplifier follows each sensor to increase the voltage to a level desired for measurement. As with the voltage monitor, the negative amplifier inverts while the positive does not, thus yielding positive voltages for the bilateral switch. Each amplifier has a gain of 6.7 so that the metering circuit will see 12V at 500 mA, which is within the linear range of the op amps and within the switching range of the 4066. Each section of the LF353 includes an offset balancing circuit to decrease errors introduced by remnant voltage outputs.

(to be continued)

73 Review

by William J. Mick K3RVN

Number 6 on your Feedback card

Heathkit SB-1000 Linear Amplifier

Shake and bake test results of a low-priced amplifier from Heath

Heath Company
Benton Harbor MI 49022
Price Class: $700

Whew!

Heath had me worried there a while. For years, hams could count on them as a reliable source of HF linear amplifier kits for the amateur market. Then, to widespread dismay, ham amplifiers disappeared from the product line. Many hams would think twice about building a micro-controlled transceiver, but an amplifier is something comprehensible, probably even repairable, the perfect kit-based station addition. Fortunately, Heath came up with something nice to fill the vacuum. The SB-1000 proves that hams still have friends in Benton Harbor.

The SB-1000 is a classic tuned cathode fed, grounded-grid design using a single 3-500Z power triode. The basic circuit has been an ARRL handbook staple for years. Variations on the 3-500Z theme, with one or two "bottles," have been marketed by numerous manufacturers since the mid-seventies. In fact, under the skin, the design of the Heath SB-1000 is based on the popular AL-80A linear built by Ameritron.

The SB-1000 is not a kit for the first-time kit builder. It contains a 3000 VDC supply, and obviously demands a workmanlike approach in assembly and checkout. Don't rush through this kit, or skip steps, unless you like to live dangerously.

Packing

Everything comes in a fifty-pound box internally sectioned with separate boxes and bags of parts to support each phase of construction. The manual and accompanying foldout charts are of the usual high Heathkit standard. There are also a few pages of errata, mainly typographical and pictorial corrections, that must be integrated with the instructions. None of them appear to be concerned with the kind of detail that endangers life or property.

Subassembly

The amplifier is built on a heavy gauge steel chassis, with an internal partition that separates the RF deck from the power supply and control circuitry. In typical Heath fashion, the first few evenings of construction concentrate on various subassemblies. For me, there were about twelve solid hours of piecework before the thing started to look like the picture in the catalog. In a moment of weakness, I fell victim to the old kit-builder's affliction, cantwaititis. There I was, loosely bolting the chassis' panels together for a preview of the final product on the operating bench. This of course aggravated the condition, as the SB-1000 looks pretty good. The compact size, simple control layout and gray-toned color scheme go very nicely with most modern ham equipment.

PS Rectifier Board

The first piece to build is the power suppy rectifier board, which requires about an hour. This board needs double checks of rectifier diode polarity, as each is soldered in place. The rectifier board was not easy to solder, even though it was pre-tinned. The instructions stated about two or three seconds of heat per joint, but it took twice as long as that to yield sound joints. Fortunately, all the diodes survived despite the additional heat.

The power supply filter board takes another hour or so, and took solder much more easily than the rectifier board. It uses ten large electrolytic capacitors in series, so polarity is crucial. The instructions state that the polarity of each can should be rechecked when the board is complete, but I couldn't do it. The little plus signs on the capacitor tops were out of sight under the board, and not even a dental mirror helped. Builders who don't have a proctoscope may want to mark the sides of the cans before bolting them to the board.

Less than two hours were required to build the boards that handle ALC, power measurement, and meter switching. Construction is fairly simple, except for diode polarity and a couple of multi-colored wiring harnesses.

In contrast to the circuit boards, the input filter unit construction demands patience and dexterity. This unit is a small shielded box that surrounds part of the bandswitch, and it contains a number of slug tuned coils and capacitors. These form individual pi-networks for each band, and there is ample opportunity to connect the wrong bandswitch contacts, or to short some of the longer leads. Liberal use of spaghetti tubing and artful dressing of the numerous wire leads will avoid problems. The Heath assembly pictorials are very clear, and therefore invaluable at this stage. The coil forms snap into holes in the sides of the filter box, and carefully controlled leverage is the only way to install the coils without breaking them.

"Special" RG-58/U

At one stage of input filter assembly the instructions call for a length of small coaxial cable. After twenty-five years of hamming I tend to associate the term "small" coax with something like RG-58/U. In due course a piece of cable marked RG-58/U was found among the SB-1000 parts, but the length wasn't right. A piece of subminiature coax was discovered, and its length did correspond to the instructions, so obviously this was intended for the input circuit.

I've used subminiature 50Ω coax with 100 watt transmitters before, so the use of this really small cable wasn't too much of a surprise. However, it was now obvious that the "large" cable used in the amplifier's output circuit was the piece of RG-58/U. This caused me some concern. Consultations with several other long-time hams didn't offer any comfort. The ARRL Handbook tables show 650 watts and 1900 VDC as the upper (albeit conservatively rated) limits for RG-58/U. In fact, the SB-1000 operating instructions actually recommend that RG-58 and RG-59 feedlines be avoided in favor of heavier RG-8 or RG-11 coax.

I made inquiries of both Heath and Ameritron concerning the use of RG-58/U for the amplifier's output circuit, and received quite similar replies. Although the piece of cable in question is simply marked RG-58/U, it is actually a special Teflon™ insulated cable rated at 2500V. This is not garden variety RG-58, and it is certainly easier to handle than RG-8 when wiring up the amplifier. Cables of this type can be found in a number of modern commercial amplifier products. Its heat resistance is a useful property inside power tube enclosures.

The rear part of the bandswitch assembly handles switching of the plate tank circuit, a tapped pi-network design that incorporates a big tapped toroid inductor for 80 and 160 meters. Doorknob padding capacitors are switched into the circuit on the lower bands, which permits the use of reasonably sized variable capacitors. It's a compact and practical design, and looks a great deal like handbook amplifier designs of recent years, except for the bandswitch.

Bandswitch

Almost every homebrew transmitter, amplifier, or high-power ATU I've ever built has involved a careful search for a heavy duty wide-spaced RF switch for the tank circuits. The SB-1000 bandswitch, a CentraLab designer-type unit, is not typical of handbook amplifiers, which usually specify something like the Millen 51000 RF switch, or a heavy-duty surplus monster. Now, it's hard to believe that I, or the ARRL, have been overbuilding

power amps all this time. On the other hand, neither homebrewers nor the ARRL lab are much constrained by the realities of commercial competition.

In response to my queries, Heath stated that the ceramic bandswitch in the SB-1000 is conservatively rated at 9 amps AC and at 2500V. Furthermore, Heath said that the SB-1000 was run through a rigorous series of FCC tests involving all manner of electrical abuse without any switch problems. Ameritron pointed out that similar switches have been used on kilowatt linear amplifiers of various manufacturers, including Drake, Swan, Dentron, and Heath itself, for some years.

Final Assembly

At this point, I attempted to suspend my prejudices and do the appropriate thing: finish assembly of the amplifier and proceed to beat the hell out of it. The rear panel went together in about three hours, complete with heavy duty primary power relay and RF-filtered AC cable. Phono plugs for external RF relay control, 12V accessory support, and ALC output voltage were also wired up. Also on the rear panel is a safety interlock switch that cuts the AC power when the SB-1000 lid is removed.

The center partition panel holds the two big transmitting capacitors and cooling fan, and is an easy job. Likewise, the front subpanel, with meters and accompanying meter lamps, went together smoothly, right down to the Jackson vernier reduction drives used for the tuning caps. The method used to mount the meters is not very rugged, being a couple of solder lugs at diagonal corners, but it does hold once the panels are bolted together.

Integration of the front subpanel and center partition with the chassis base was not easy. A fair amount of warping and twisting is necessary to make screw holes and capacitor shafts line up properly. Various hardware items must be loosened and aligned to permit smooth control rotation and squaring of all the corners. Another hour or two saw the installation of the power supply rectifier and filter assemblies, and connection of the rear panel. Numerous flying leads and wiring harness ends must be interconnected. Except for minor glitches, like a couple of bad screws, and an out-of-reach solder junction, everything went together pretty much according to the detailed instructions. There was one resistor whose leads could not be trimmed to the specified length because they were already too short.

Fitting of the front fascia and the 3-500Z tube were almost anticlimactic, and after about fifteen hours of construction, the SB-1000 was at last ready for testing.

For obvious reasons, one does not plug in and go at this stage. I spent a good forty-five minutes verifying connections and checking for solder bridges and pinched wires. The rear panel barrier strip was wired for 240V AC input, so the 120V plug was removed and a suitable 240V plug was installed. The lid was set in place in order to engage the interlock, and the unit was plugged into the AC mains.

The thing I hate about high voltage equipment is having to get near that front panel the first time the main switch is thrown. I pushed the SB-1000 power switch with a piece of broomstick and a resounding THUNK! shook the house as the transformer field sucked in the sides of the loose lid. The power supply hummed a bit, but there was no sparking, no arcing, no smoke. The front panel voltmeter showed 3300 VDC, and the 3-500Z glowed encouragingly. Home-brew or kit-built, you get a lot of satisfaction when you first put the juice to the product of your labors and nothing bad happens.

Final Pre-op Tuning

A detailed set of alignment procedures takes the constructor through the tuning of the input matching networks. For this step, the lid must be slid back a fraction of an inch from the front panel while a nylon alignment tool is used to peak up the coil slugs. This is definitely a situation where one hand stays in the pocket. It is worth enlisting a second operator to dictate the instructions, key the exciter for you, and act as safety man. Everything went by the book, and after heating up the Heath Cantenna for awhile, the moment of truth had arrived—it was time for the SB-1000 to speak to the world.

SB-1000 On The Air!

It spoke very well for itself, reaping a lot of favorable comments and no criticisms from any of the stations worked. An FT-102 and an IC-751A were initially used to drive the amplifier, and both had more than enough power to yield full output from the SB-1000. In fact, as the amplifier is rated at 85 watts maximum drive, the exciter carrier levels were reduced slightly to avoid overdriving it. The input tuned circuits are fairly broadbanded, but the drive sometimes has to be brought up a bit when the frequency is away near a band edge.

The SB-1000 has adjustable ALC output of up to twenty volts to help regulate the drive for a clean signal, although this required some fiddling to adjust. The first few months of testing took place in a club environment, and the ALC connection seemed to be unplugged as often as it was connected. It is probably just human nature to resist something which seems to be retarding those satisfying meter swings.

During three months of on-the-air use, there was no evidence of breakdown or other inadequacy in the special RG-58/U, the bandswitch, or even in the antenna relay, which is a plastic insulated AC power type. The antennas used were a well-worn tribander beam and a G5RV multiband dipole, without benefit of an ATU.

The testing environment was one of the worst possible: a club hamshack. A number of hams had the chance to stress it and abuse it, and that's just what they did, mostly unintentionally. Appliance operators accustomed to auto-tune rigs have treated the SB-1000 like a broadband device, changing the bandswitch, but neglecting the tuning controls. Some people take a long time to tune up or forget to watch the grid current meter. In spite of the rough treatment, the amp worked well until halfway through the ARRL DX contest.

What actually happened no one seems to know, except that serious internal arcing was heard on 15 and 20 meters. Examination showed that the safety RF choke at the output of the pi-network was open, but it was hard to tell if this component was the cause or a victim. It was clear that some pretty high RF voltages had jumped from a stator contact on the bandswitch to the metal shaft. There was a great deal of carbon build-up on the rotary wafer, but the rotary contacts were clean. The stator contact, which connects the padding circuit for the plate variable capacitor, was eroded completely. Replacement of the small RF choke and removal of the doorknob cap permitted operations to resume on 80 through 10 meters, but the bad wafer will have to be replaced in order to reenable 160 meter capability.

Despite my original misgivings about the switch, I don't feel that it was the source of the problem. It did work for three months, and it took a contest operation with a lot of different operators to bring about the failure. An insulated shaft might have prevented the arc-over, but after seeing the amount of dust and fuzz collected on the air intake vent and on the floor of the RF section, I am inclined to believe that it was dirt that started the arc.

Top Dollar Value

The price of the SB-1000 is very attractive at about $700. Compared to the big "dollar-a-watt" amplifiers on the market, this amplifier is an economical way for a guy who isn't QRO-crazed to boost his signal when he needs to. It is not built to be indestructible, but it isn't priced like a continuous service amp, either. While the amplifier is advertised as covering 160 to 15 meters, any technically competent ham will be able to figure out how to make it work on 10 meters as well. If you know what you're doing, you won't even have to buy any additional parts.

One thing Heath might do is to review the list of required tools, which seems to be the same list whether the kit is a simple noise bridge or a high power antenna tuner. I found several points during construction where a 25 watt soldering pencil was not hot enough for the job. A 100 watt gun was needed for some of the heavy power supply and tank circuit connections, and it was necessary to use a 250 watt gun when soldering the safety RF choke in the output circuit to the bandswitch frame.

Conclusion

Heath, traditionally the friend of the ham on a budget, has once again provided a cost-effective piece of gear that will do both the manufacturer and the constructor credit. Thanks are due to Denton Bramwell at Heath and Tom Rauch at Ameritron for their courteous and helpful responses to my questions. Although I personally would have selected heavier components for the bandswitch and antenna relay, I am satisfied that the supplied parts are adequate for the job. The club members are enthusiastic about the SB-1000, and while we have asked more of the amp than we should have, we look forward to a lot more heavy use in the future. 73

Handheld Transformation

Update your Kenwood Mini HT

by Rich Greenberg N6LRT

The Kenwood TH-XAT (21, 31, 41) series handheld transceivers are fine rigs. Being the smaller units, they fit inconspicuously into places other HTs just won't go. Unfortunately, with the Kenwood CTCSS (Continuous Tone-Coded Squelch System) unit inside, changing CTCSS frequency is inconvenient at best. The newer Kenwood TH-X1BT rigs solve that problem by adding front panel dip switches to set the CTCSS frequency. With a few parts from Kenwood, anyone can easily upgrade his or her HT and have the added convenience of selecting the CTCSS frequency from the front panel.

Carefully follow these instructions to install the modification.

First open the radio's case by removing two screws from the bottom and one from the side near the top, opposite the PTT button. Loosen, but do not remove the screw just above the PTT button (Figure 1). Pry the front panel off the chassis. See the TU-6 instructions for this disassembly.

Next modify the TU-6 by clipping the PC board opposite the programming pins 1–6. Remove the narrow piece of PC board so that the pins are clear. Do not disturb the seventh pin, which is grounded to the board. See the sketch on the TU-6 instruction sheet. Install the TU-6 unit at this time if the HT does not yet have this option. Do not solder the programming pins yet.

Carefully pry the speaker and microphone out of the old front panel. Straighten out the tabs holding the speaker grill onto the old front panel, remove the grill and mount it onto the new front panel.

Using a fine-tip iron, unsolder the four wires running to the PC board mounted in the old front panel. Remove excess solder from these wires. *Do not* overheat and melt the insulation on these wires. Set the old front panel aside.

Now tin the six programming pins on the TU-6 and the seven pads on the PC board in the new front panel. **Caution:** Don't overheat the chip.

On the flex PC board (or substitute), tin the seven copper leads at each end. Note that one end matches the spacing on the PC board in the new front panel. The other end matches the spacing on the TU-6 programming pins. On the TU-6 end, bend the copper tabs at a right angle where the tabs leave the plastic. Solder the flex PC board to the TU-6 programming pins on one end, with the seven pads on the PC board in the new front panel on the other end. The seventh tab at the TU-6 end is soldered to the grounded pin on the TU-6. This flex PC board will be routed in a zig-zag and folded to close up the front panel. If the user has access to a factory TH-X1BT (I didn't), copy the way its flex PC board is routed.

One at a time, unsolder and discard the four short wires from the PC board in the new front panel. Then connect the four wires (follow the colors) that were disconnected from the old front panel to the new front panel.

Mount the speaker and microphone in the new front panel. Then secure them with a few drops of glue. **Caution:** Don't get glue on the speaker cone.

Now reassemble everything in reverse order of disassembly. The output levels most likely have to be reset for the TT pad and the CTCSS. Put the gummed label showing the CTCSS frequencies inside the battery compartment The bottom edge should be flush with the bottom edge of the battery compartment.

With a needle or fine bladed knife, gently remove the TH emblem from the lower front of the old panel. Then glue them onto the new front panel. (The old glue may still hold.) Transfer the lanyard to the new front panel. And that is it. 73

1. **Top case assembly with DTMF pad. Part number A02-0745-05.** This includes the six position dip switch. Price, $21.80.
2. **Flexible PC board, part number J25-3469-05.** This part is optional but suggested. A short piece of seven conductor ribbon cable or individual wires can be used instead, but this part will make the wiring simpler. Price, $17.90.
3. **Label, part number B42-2450-14.** This is a gummed label that shows the switch positions needed for the various CTCSS frequencies. Price, 55¢.
4. **The TU-6 standard CTCSS encoder board** for these radios, if the user doesn't have it already. The price is $36.95 from the local dealer, *not from the Kenwood parts department.*

When ordering parts directly from Kenwood, the operators will charge the order on MasterCard or Visa. The phone number to call for parts is 213-639-9000, ext. 421, 422, or 429. Prices shown were verified in late March 1988, and do not include shipping or sales tax.

Table 1. Parts required to upgrade any TH-21/31/41AT handheld transceiver to a BT model.

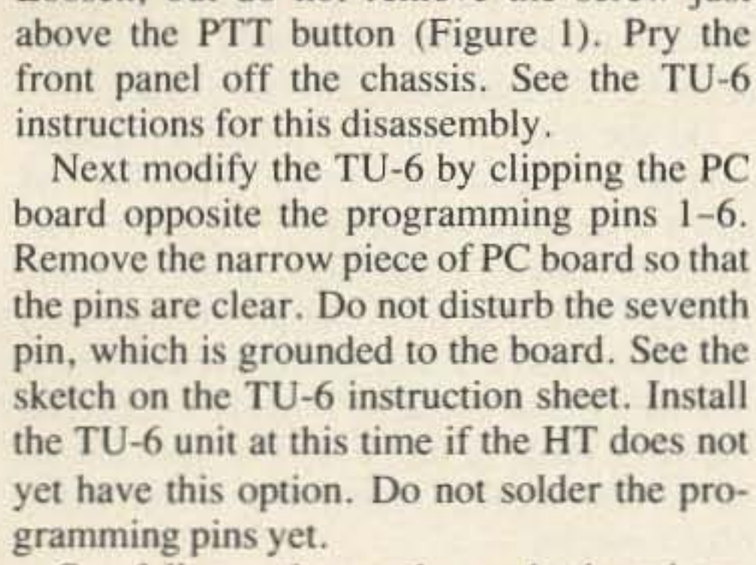
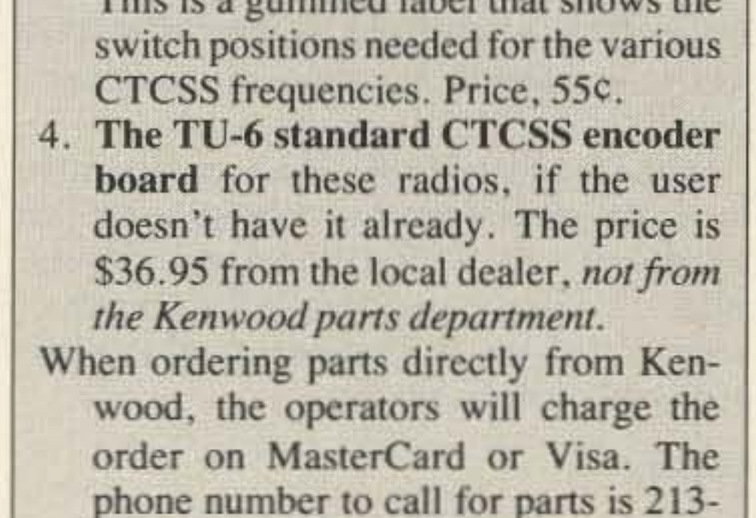


Figure 1. Disassemble the case by carefully removing three screws (A) and loosening screw B.



TU-6 Unit Leads	Transceiver Terminals
Brown	To pin EB
White	To pin STO
Black	To pin E

Figure 2. Placement of the TU-6 CTCSS assembly. The assembly is soldered in two places and secured with one screw.

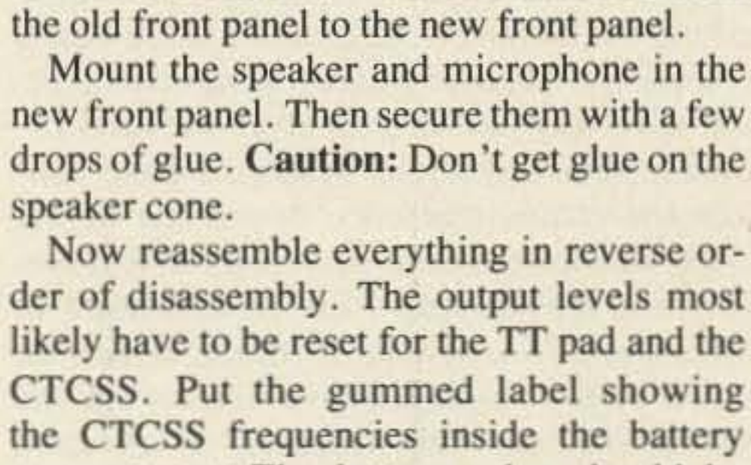


Figure 3. TU-6 CTCSS IC pin designations. Note pin 1 is nearest the notch in the IC.

The Quest For Ultra Portability

Part 7 in the High-Tech Nomad series

by Steven K. Roberts N4RVE

When I first set out on my strange 8-foot-long, 140-pound bicycle back in 1983, I received a lot of serious advice from my Ohio neighbors. "Never turn onto a road with 'mount' or 'hill' in its name," said one seasoned cyclist. "Never let anybody nicknamed 'Moose' ride your bike." "Carry a weapon, but make it a light one." "Don't mess with camp cooking gear." "Drill out your toothbrush." "Get a lighter tent." "Make everything you carry do double duty."

I noted that most of the advice had something to do with weight, which is not unreasonable given the fact that a good percentage of the bicycle-touring lifestyle involves hauling possessions up steep hills. The Winnebiko system has since grown to over 275 pounds, and believe me . . . I feel them all.

But it's worth it. With every QSO, every piece of packet mail, every chapter completed via the handlebar keyboard and on-board computers, I become more and more delighted with my solar-powered mobile-radiotelecommunications system. I have broken the chains that once bound me to my desk, beat the freedom-versus-security trade-off, and moved into a life of adventure in Dataspace—a constant flirtation with that sweet piece of asphalt I have come to call the Other Woman. This rhapsody is all quite lovely, but I have one BIG problem.

Got a Gizmo?

I'm addicted to gizmology. I love the gleam of blinking control panels, the birth of complex systems, the precise crackle of distant voices amplified through the tight spectral aperture of a fine radio.

I get goose bumps at hamfests and trade shows. I view every new toy in the context of its bikeability, and I'm now getting dangerously carried away with dreams and development of the Winnebiko III: OSCAR Mode L, Packsat, 10 FM, ATV, LORAN-linked CD-ROM mapping on 640 x 400 graphics, improved HF, Oki cellular phone, FAX, 40 watts of solar power, 54-speed computerized automatic transmission, trackball interface, packet/laptop remote control, hydraulic brakes, integrated bike/tent system . . . I want it all. Yes, it's a big problem.

"Some problem!" you say. "There ain't an OM alive who wouldn't deed over his solid-gold Vibroplex for a toy collection like that."

Well, that may be, but the catch is that I still gotta *pedal* it.

Mindful Minimization

Given that constraint, I have a very strong motivation to maximize efficiency. How light can I make it? Can an amplifier (or a computer, or a battery, or even a piece of coax) do double or triple duty? Can interconnections be software-managed to minimize the number of heavy, inflexible switches and wires? Can I eliminate cases and replace only the metal necessary to provide adequate shielding? Are there "sleep" modes available that let me maximize battery life? Can I reduce battery weight by increasing antenna weight—or would the opposite make more sense?

With the understanding that more and more hams are interested in portability (now that equipment size is finally making it worthwhile), I'd like to maunder on for a bit about some of the ideas that have emerged from the 5-year Winnebiko project . . .

Weight

Let's take the obvious points first. Keep it light. It took me years to learn that putting a lot of light things together gets heavy—and shaving away lots of ounces adds up to pounds. Amazing.

As the most-significant digit of the Winnebiko's revision number increments for the third time (yes, there was a 0.1), I am drilling holes and machining away excess aluminum, G-10, and plastic. Mounting plates can be perforated, angle brackets shaped, circuit boards trimmed, cases eliminated, tools drilled. New logic, wherever possible, is surface-mount. The steel base of my Bencher/Pacesetter keyer is history. And I'm taking a hard look at former indispensables like juggling balls, frisbees, kites, water filters, DB-25 spares, flares, and the like—weighing their value beside such things as LORAN-C boards and mast-mount preamplifiers.

Closely allied with this issue is the ongoing quest for lighter, smaller versions of existing tools. Two manufacturers that I know of (Leader and Dolch) now have combination LCD oscilloscopes and DMMs—a bit heavier than my existing DMM but well worth it for the added functionality. The MFJ-313 VHF downconverter plugs into a 2-meter handheld to replace the Radio Shack weather radio while saving 80 grams (and many new HTs like the Yaesu FT-23R can be tricked with a jumper change into tuning 162.55 . . .). Even the obvious—like buying an Xcelite screwdriver set to replace a bunch of Stanleys—can knock nearly a pound off the mobile tool kit.

Multi-Functionality

This can be a tricky one. There's a big trade-off here: The more functions you perform with each piece of equipment, the fewer you can perform simultaneously. Let's look at cables, for example, since wire is heavy.

On the bike, I have a standard "power extension" cable with an RCA on one end and a coaxial power plug on the other. The RCA fits any of eight jacks on the console (system voltages, solar charge current, etc.) and the coaxial fits entertainment electronics, tent lights, and a jack on Maggie's bike. But the same cable, used in reverse, also allows her UNGO security sensor to be slaved to my bike's system.

Obviously, I can't do this while watching TV on the Watchman under bike power, but then . . . why would I want to? The trick therefore is to make multifunctional cables for functions that don't normally go on at the same time.

Another example: Maggie's bike carries a 5-watt Solarex photovoltaic module, and mine has a pair of 10-watt units. Due to the need for wire antennas on QRP, I only operate HF when we're stopped for a day or more. I have found to my surprise that quality IC sockets hold chips better than I expected. For a few thousand miles, I kept a camping pillow bungeed over the main logic board, but it turned out to be unnecessary. Anything delicate with significant mass, of course, needs special treatment . . . I mounted the Yaesu 290 on a foam pad, held down with springs that pull it slightly forward into an undersized console cutout lined with channel-rubber. The H-P computer lives in a foam-lined case

resting atop clothes and tent fabric. And the new radio pack with the OSCAR and HF hardware will be a case within a case, nestled snugly in soft foam. Don't be tempted to spring-mount a system if overall balance is critical—the whole mess will exhibit resonant modes that require heavy damping hardware.

Moisture can be a serious problem outdoors, of course, and not just from rain. As I mentioned in an earlier article of this series, the console electronics on the Winnebiko are well protected by the fairing, fabric side-panels, and velcro-on cover. But condensation can be a real problem, and fighting it calls for either a true hermetic seal or free ventilation—the former to maintain a truly dry environment and the latter to quickly undo the damage if you don't have the former. I have found better results from leaving the whole system outside on a cold night instead of bringing it into a tent filled with the moisture of human bodies, and a simple tarp in combination with the waterproof fabric cover keeps the worst of the condensation at bay.

And then there's heat. Normal electronics can withstand the temperature range of this planet, but parking anything in New Mexico sunshine invokes a phenomenon known as solar heat gain, which takes effect when air spaces exist under transparent covers. Examples of this situation are: LCD, panel meter, and lexan fairing. Solar heat gain can be tragic—it blew my computer's mind in Mendocino. I have found two solutions: a space blanket, shiny side out, will keep any piece of equipment comfortably at ambient all day long; failing that, a DC fan running from the solar panel moves enough air to keep the temperature under control. Mine is a little EG & G unit from a hamfest, drawing 270 mils from the 12-volt supply. On hot sunny days, that's about 40% of the output of one of my 10-watt photovoltaics. (The space blanket works much better, of course, but it's messy and has to be tied down in the wind.)

No discussion of environmental abuse is complete without at least a passing acknowledgment of dirt: crud, grime, mud, dust, sand, grit, goo, cigarette smoke, sludge, salty spindrift from oceans, corrosive airborne industrial contaminants, cat hair, and worse. Again, modern electronic hardware can put up with incredible abuse, but pay special attention to coax, stripline, moving parts, magnetic media, and high-impedance analog circuitry. Human sweat, dripping on a circuit board in a humid environment, can dissolve uncoated traces.

Salty residue on antennas can soak up RF like a dummy load. And don't forget the effects of dirt on cooling: If for some strange reason a piece of equipment requires an internal cooling fan, keep a close eye on filters (a mixed blessing if ever there was one).

Prototyping Techniques

All of the factors mentioned so far impact the choice of construction technique, right down to IC packaging. Keep connectors to a minimum...but use them wherever necessary to simplify service (another trade-off). Use R-N quick-connect instead of wirewrap for logic prototypes—or printed circuit boards if possible. I'm discovering in the design of Winnebiko III that it can actually be cheaper to prototype at the PCB level. Depending on complexity and quality, custom boards can be delivered within 2–3 days from CAD artwork for $50–250. And—delight of delights—it's turning out that there is no real premium (other than assembly effort) for making surface-mount instead of DIP boards. SMDs are the devices that have made the new class of personal electronics, including micro-sided HTs, possible.

I'm doing PC boards for the easy stuff that requires little debugging (memories, crosspoint matrices, and the like), and sticking with Quick-connect insulation-displacement prototyping boards for the logic that changes shape everytime I see some new chip that looks interesting...

Software-Hardware Trade-offs

...which is a good point to start talking about software. In the past, we as a class (tinkerers, experimenters, engineers, and techs) tended to do most of the fiddling in hardware. Proto-boards, #22 and #30 wire, wirewrap tools, soldering irons, and junkboxes were always close at hand. The problem is that all this stuff is heavy—and not the best way to protect the investment in technology.

The biggest flaw in the Winnebiko II design is that, despite the five microprocessors, there is little architectural flexibility.

Front-panel switches are necessary to change modes, bring up supplies, override the serial communication matrix, control battery charging, and so on. This is heavy, and lends itself poorly to further development (largely because any significant design change implies considerable down time).

The new bike will be considerably different. A 16 x 16 analog switch matrix under computer control allows any combination of audio sources and sinks to be connected together—with spare points handling inter-processor communication outside the domain of the high-speed LAN. A window on the graphic display can be used to edit special interconnects, but normally the processor will simply toggle the 256 crosspoints as dictated by the tasks in progress (ranging from a cellular phone call through the bike helmet to OSCAR operation with two transceivers and a patch to the tape recorder). Touch-tones, mike audio, mixer inputs to the console speaker—all are processed through this board, and NONE of them require a drop of solder or a twist of the present clunky rotary switch that's a pain to use and even harder to "edit."

Other functions appear in software as well: battery charge management, temperature control, the transmission-control shell, navigation, and just about everything other than basic survival hardware (lights and horn). Knowing that I'll never get some of these things right the first time, the use of software control makes good strategic sense from an engineering standpoint (butane soldering irons notwithstanding).

And best of all, it cuts weight while adding capability. Another trade-off bites the dust—which is what it's all about! 73

Readers who would like to order a reprint of Steve Robert's series (seven articles to date) should send $3 for the first and $1.50 for each additional article, to 73 Magazine, WGE Center, 70 Rt 202 N, Peterborough, NH 03458-1194. Attn: Reprints.

Readers can also order Steve Robert's book at Computing Across America, 1306 Ridgeway Ave, New Albany, IN 47150. They can buy a signed copy of Computing Across America, the 350-page book that talks about the first 10,000 miles of Steve Robert's biking odyssey, for $9.95 (softcover), or $15.95 (hardcover). Add $2 per book for postage and handling.

DIGICOM>64

A software-based packet radio system for the Commodore 64

by Barry N. Kutner, MD W2UP

Cheap n' Easy Packet!

Packet radio is a relatively new and exciting mode of communications. Unfortunately, there's still often considerable expense to get on packet. A personal computer (or ASCII terminal) and a terminal node controller (TNC) are required for packet operation. Fortunately, the former is already in many ham shacks today. The TNC consists of two main parts: the packet software (in ROM), and a modem circuit for tone encoding and decoding. Together, they produce and decode the packet signal.

I'd often wondered why no one has written a program to emulate the functions of a TNC that would eliminate the need for a somewhat expensive and mode-specific piece of equipment. Well, it *has* been done! Several German hams wrote the system I describe below for the Commodore 64 (or C128 in the 64 mode). It is public domain! While popular in Europe for several years, it remains relatively unknown in the United States. I and others have been providing copies of this software for the ham community.[1]

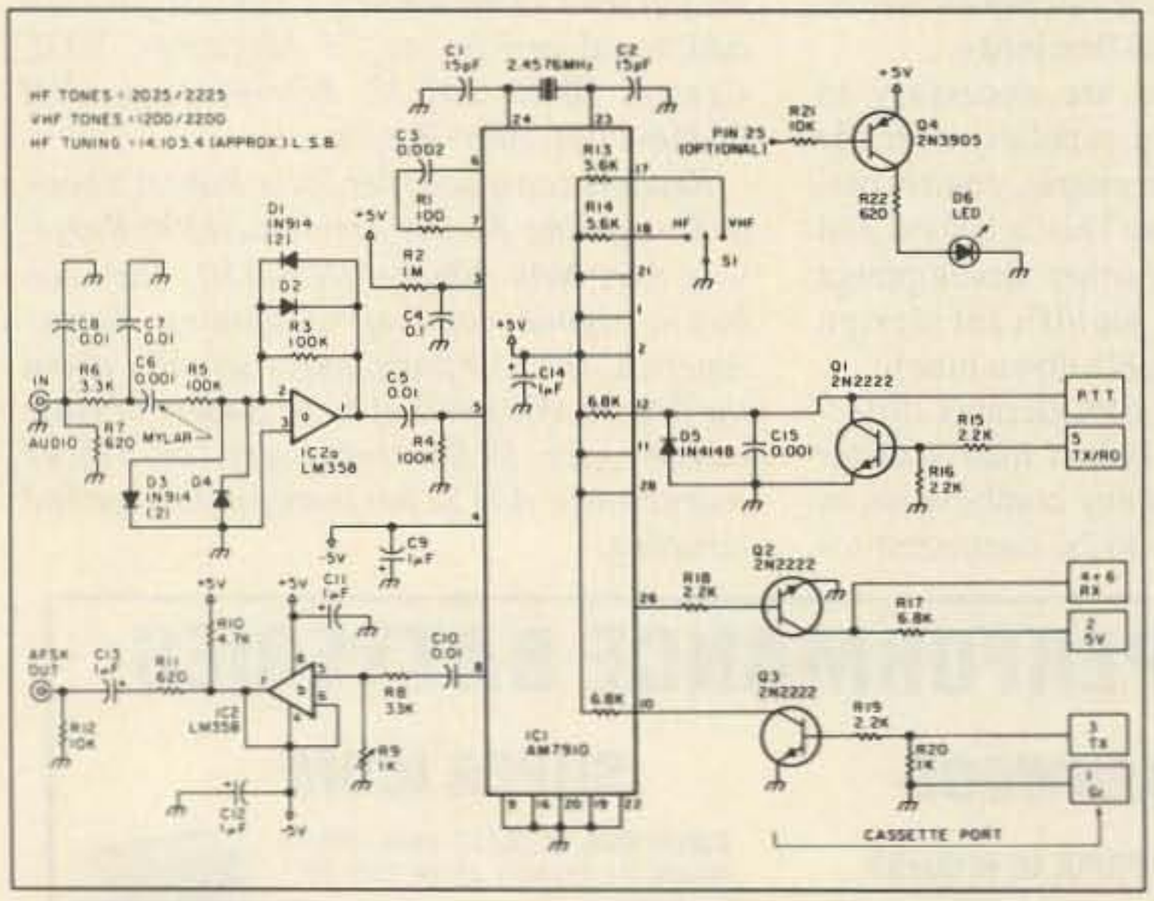


Figure 1. Modem for VHF and HF use, designed by Willy Pedersen YV1AQE. Tone frequencies are 2025/2225 Hz for HF and 1200/2200 Hz for VHF. Switch is SPDT with center off. Center position is for VHF operation with Equalizer on (for receivers with rapid high frequency roll off). Optional lock detect LED is shown. If not used, leave pin 25 open. Pins 13, 14, 15, and 27 are not connected. The AM7911 may be used in place of the 7910. If used, change R1 to 910Ω.

Why take this approach to packet radio? Personally, I don't like being an "appliance operator." I like to build, modify, and troubleshoot my own equipment. The miniaturization of solid state gear, however, has made this difficult for the non-engineer. I am an eye surgeon who operates through a microscope, and the compactness and complexity of my own equipment intimidates me! Further, with the number of Commodore 64s out there, this system provides inexpensive and easy access to packet radio for many.

In this article, I briefly describe the Digicom>64 software and a relatively simple and inexpensive interface. Complete software documentation is a available with the program.[2]

Program Basics

The current release of Digicom>64 is version 2.00. It has all the capabilities of the common commercial packet systems, plus some. It has multi-connect capability as well as direct read and write of both PRG and SEQ files to disk (full 8 bit transfers). *True store and forward digipeating (similar to Net/Rom and KA-node) is available.* Remote command capabilities allow for operation as a mini-BBS, including different security levels of each command for specific stations. Disk logging functions allow one to see which stations have logged on and which commands have been used. Standard buffer texts may be stored for instant retrieval. Up to 10 different parameter files may be stored on disk for HF, VHF, BBS operation, etc. Both 40 and 80 character modes are available. The list goes on....

The program is written entirely in machine language and is about 30K long. Unfortunately, the authors will not release the documented source code (I have asked), so there is no program listing available. Since the program is machine language and data is transferred through the cassette port of the C-64 or C-128, it is machine-specific and will not function with other computers, including the VICs and the SX64.

The Interface

Since the computer takes care of all our packet housekeeping functions, the interface between the computer and the radio needs only act as a modem. It must take the voltage levels from the computer and turn them into audio tones for transmission, and must turn the incoming AFSK into voltage levels the computer can interpret. There must also be control of receive-transmit switching.

The interface circuit (Figure 1) uses the AM7910 chip, a complete asynchronous FSK modem in a 28-pin DIP package. Signal modulation, demodulation, and filtering functions are performed by digital signal processing (DSP) techniques. Analog-to-digital and digital-to-analog converters are included on the chip. It is used in several of the higher

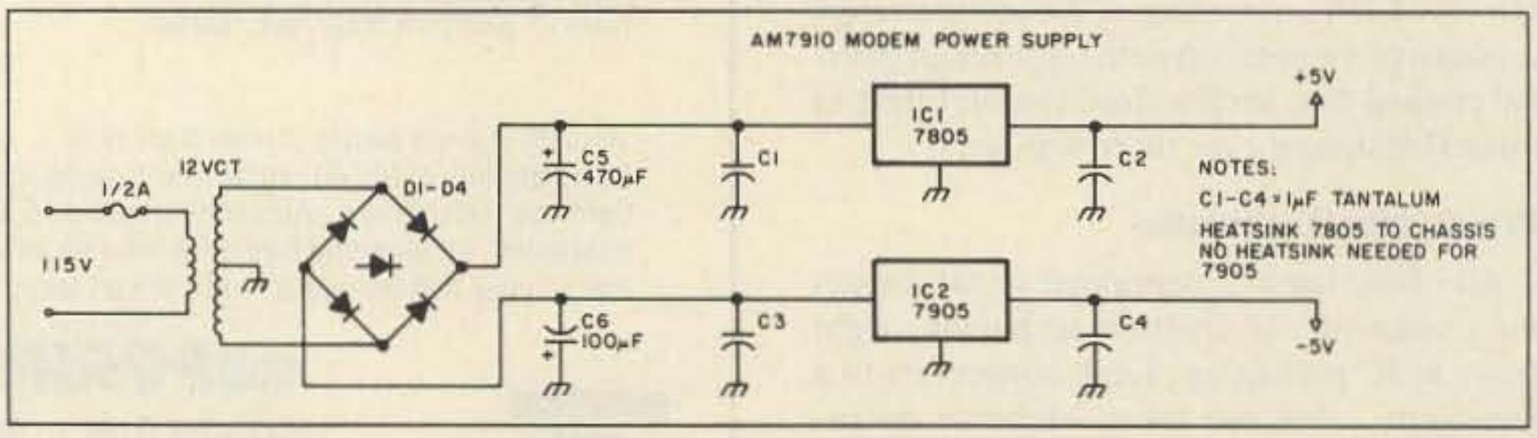


Figure 2. Sample power supply for the AM7910 modem. Heatsinking 7805 to chassis is sufficient. No heatsink is needed for 7905.

Photo A. The main screen illustrates a connection between port 1 and the Frankford Radio Club's DX spotting Packet Bulletin Board. Split screen operation allows viewing of both transmitted and received data simultaneously.}

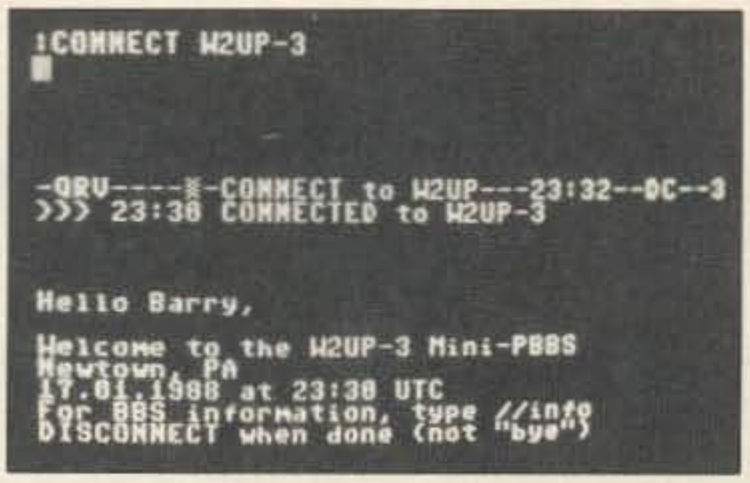


Photo B. Digicom > 64 can perform unattended BBS operation. The bulletin board can be used for file transfers or as a personal mail drop.

Photo C. The MHEARD screen (displayed by hitting the F7 key) shows recent packet activity. This screen is from actual operation on 20 and 2 meters. Other stations can retrieve this information to see what signals have been heard recently.

priced commercial TNCs. This circuit permits both VHF and HF operation, and no alignment is required (other than setting the audio output level).

Circuit Description

The mode control pins are 17–21. S1 is used to select one of three modes: HF, VHF, or VHF with Equalizer. All three operate in "loopback" mode so that receive and transmit frequencies are the same (half-duplex operation).

The HF mode makes use of the Bell 103 Answer protocol. Tones are 2025 and 2225 Hz keyed at 300 baud. This mode has been chosen to make the switch as simple as possible (SPDT center-off). Many commercial modems use the CCITT V.21 Answer mode, which has different tone frequencies (more on the significance of this later).

VHF mode uses the Bell 202 protocol with 1200 baud operation and tones of 1200 and 2200 Hz. The Equalizer mode accentuates the 2200 Hz tone for use with those transceivers with a rapid roll-off of the higher frequencies.

The analog audio output from the receiver passes through an op amp, used for buffering, into pin 5 of the 7910 and is then processed by the modem chip. The TTL level output appears at pin 26. It is buffered by a switching transistor before going into the computer for "decoding." Similarly, the transmit data from the computer is presented to pin 10 after passing through a buffer transistor. After being processed by the 7910, its analog tones (at pin 8) pass through an op amp before going into the audio input of the transmitter.

Transmit/receive switching is software controlled and occurs at pin 5 of the C64 cassette port. As this output is 6–7 volts, it is divided in half by a resistor network before being presented to the chip. When the PTT goes low, pin 12 goes low. This instructs the modem to enter transmit mode. A high level on pin 12 turns off transmission of data.

The power requirements are +5 volts at 150 mA and −5 volts at 15 mA. A sample power supply circuit is provided (Figure 2).

A few other comments are in order concerning the AM7910 modem. The circuit does not have a tuning indicator. No tuning is needed for VHF. Just set your transceiver to a packet frequency (e.g., 145.01 MHz) and it's all set. For HF operation, tuning is critical and must be within 50 Hz for proper operation. Since the tones generated and decoded are 375 Hz higher in frequency than some commercial TNCs (using the CCITT V.21 protocol), on 20 meters, for example, tune to about 14103.4 kHz, 14105.4 kHz (lower sideband), and so on.

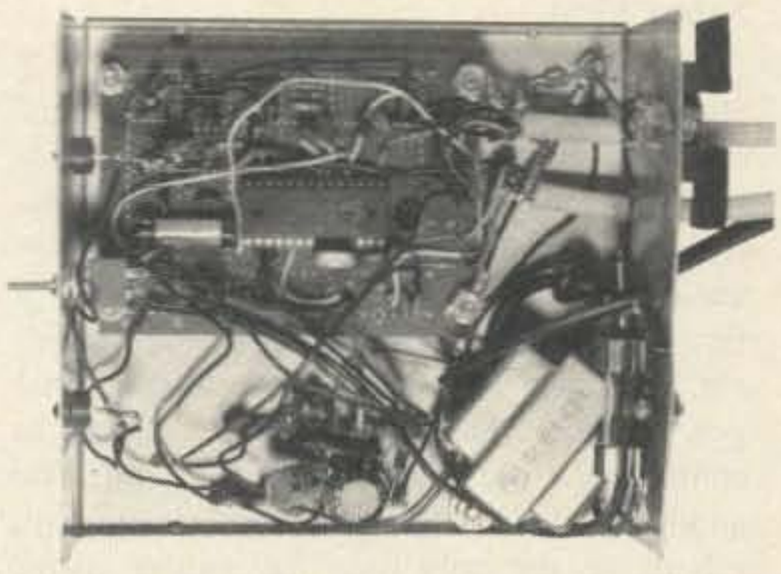


Photo D. This modem was breadboarded. The optional reed relay is shown in front of the 28-pin AM7910.

Watchdog Timer

I included plans for a "watchdog timer" circuit (Figure 3). It is based on the 555 timer chip, and goes in series with the PTT line. This circuit provides a timeout of the PTT line after about nine seconds key down. This time constant may be altered by changing the values of R6 or C3 in the 555 circuit. It's not necessary to always be present during packet operation. Should the computer crash, or if a power failure occurs during unattended operation, it's possible for the transmitter to remain in the key-down state. This is unhealthy for the transmitter and causes unnecessary interference. This simple safeguard prevents any problems.

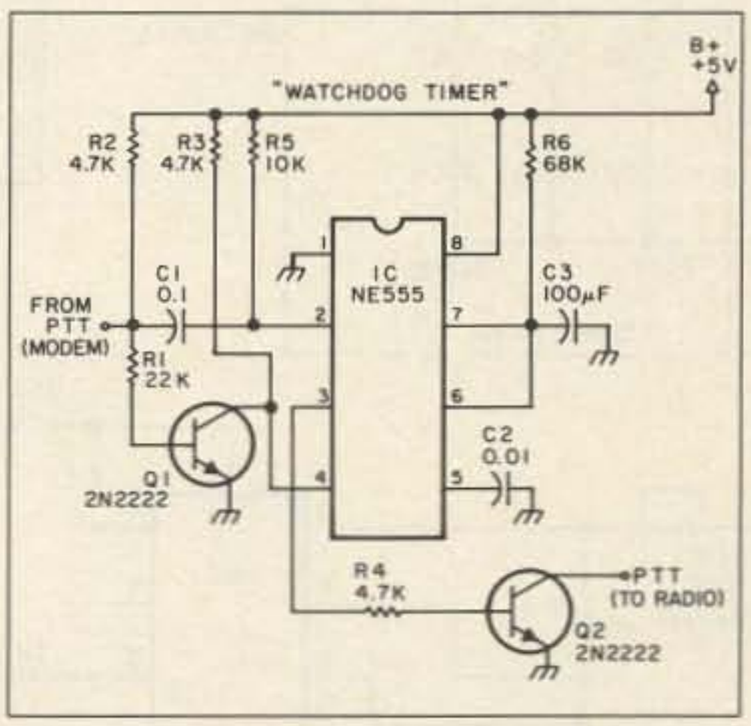


Figure 3. PTT timer for unattended operation. The input is taken from the collector of the 2N2222 at the PTT output of the circuit (AM7910, pin 12 PTT output). PTT to transmitter is taken from Q2. Reed relay may be used.

Photo E. The HF/VHF modem with a self-contained power supply. A DPDT switch was used with the center position for power off. The VHF with Equalizer mode was not used.

Auxiliary PTT Output

The 2N2222 should be adequate to key most transmitters. An optional accessory PTT output (Figure 4) has been provided for those who prefer or need to key their transmitter with a reed relay (e.g., Kenwood TS-430S).

Construction Tips

One thing that often puts a damper on home construction projects is trying to find the parts. Not so here—all parts are available from Jameco Electronics[3] and Radio Shack. I bought the reed relay and 2″ x 4″ x 6″ chassis box from Radio Shack, and all other parts

Continued on page 75

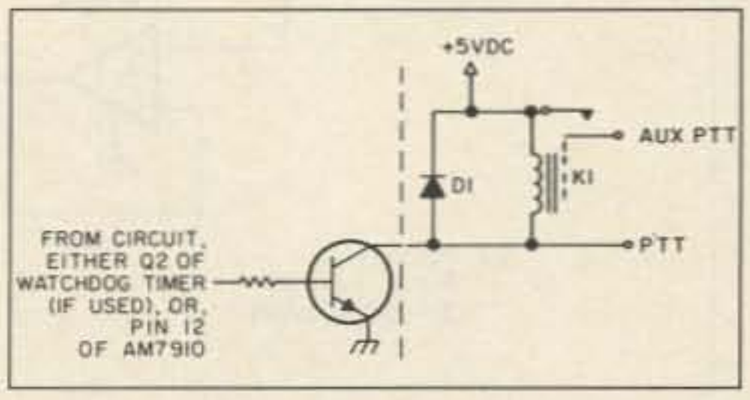


Figure 4. Optional reed relay output for PTT line. Use Radio Shack 275-232 (5 VDC relay).

SMART "S" METER

A circuit designed for T-Hunters.

by Kuby Kubichek N6JSX

This design is for an external signal strength meter that is analog, digital, and audible for mobile "T-hunters." The S meter can easily be made into a small box and placed on top of the T-hunters automobile dash. The S meter also incorporates my secret weapon: a gain circuit. This circuit is nothing special, except that it is able to obtain optimal metering for a good beam bearing. An optional addition to this design is a dampening action. The S meter signal dip that over deviates, is averaged out by modulated transmitter signals or a common occurrence with this dampening action.

The analog meter is a 0–1 mA milliammeter, which is ideal for observing or comparing peak signals when beaming a transmitted one. The analog calibration pot is used to calibrate the external meter with the radios internal meter and control the amount of meter action.

The digital LED bar graph display has a very fast response time and is ideal for nighttime T Hunting. The digital calibration pot works the same as the analog calibration pot. The 3.3KΩ resistor near LM 3914 can be replaced with a 5K pot to control LED brightness.

Safety First

The audible S meter was added for T Hunter safety. The audible allows a T Hunter to swing the beam while traveling in heavy traffic, not requiring his attention to be distracted from the road. This is especially useful when in pursuit of a jammer or on a first-in-first-win T Hunt when speed is critical. The tone pitch will go higher as the signal gets stronger. The tone adjust pot is used to center the audio for optimum listening. The audible meter is not connected to the gain circuit; as the only time the audible meter would be used is when the hunter is close to the hidden transmitter where gain isn't needed.

Key to Success

The gain part of this design is what allowed me, in part, to be a rather successful T Hunter in the L.A. area. When a signal is so weak it is barely audible, this gain feature has allowed me to get a good beam bearing; while all the other hunters switch in their preamps and saturate the radio front ends with off frequency noise. The S2A position gives a 2:1 gain and the S2B position gives about a 50:1 gain. The calibration pots control the amount of meter action relative to the gain. When the signal is heard but not registering on the radio S meter, turn back the calibration pot to zero and the meter will now show the 2:1 gain. If the meter is not showing a significant signal, switch to the 50:1 gain. The hunter needs to recalibrate for an optimal meter indication.

The optional dampening circuit is used for the averaging of a transmitted signal that has modulated power or when a dip on the voice peaks occur. The capacitors may be switched one by one or switched into a very slow response using 5.8 uF total capacitance.

To minimize the loss of eye contact with the road, I used velcro strips to attach the box to my automobile dash. Three conductor shielded mike wires were used between the radio and the external S meter. A subminiature stereo plug was used for the interface. The tip of the plug for the S meter has the power of +12VDC from the radio. The mid-section of the plug is for the signal and the shield is used for the ground. This makes a very neat looking arrangement to the radio. All parts where obtained from Radio Shack. Many alterations and customizing can be done to further enhance this basic circuit for your needs. 73 (Credits to: K6KYW and KF6GQ)

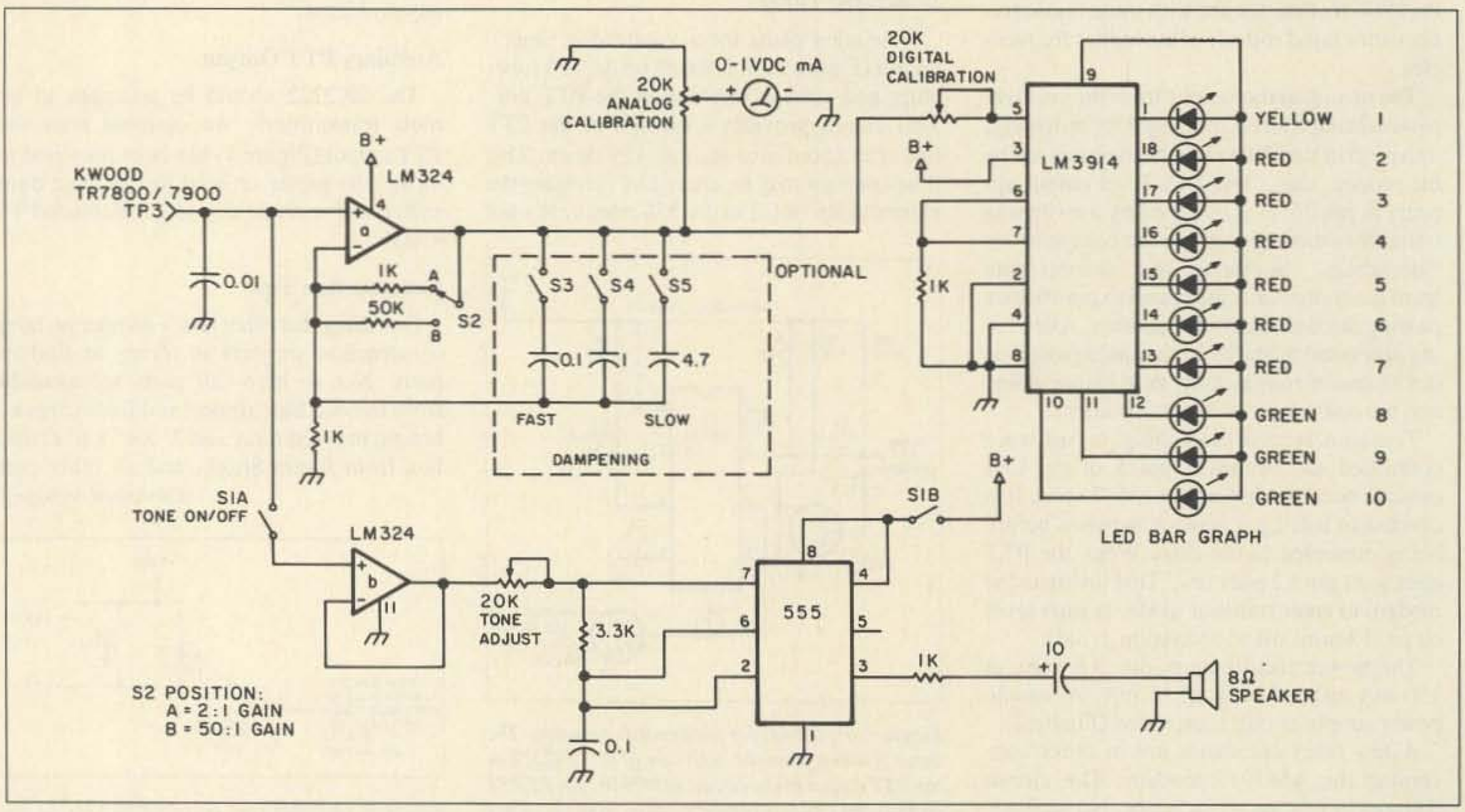


Figure 1. Circuit board for the smart S meter including the analog, digital, and audible for hidden transmitter hunters.

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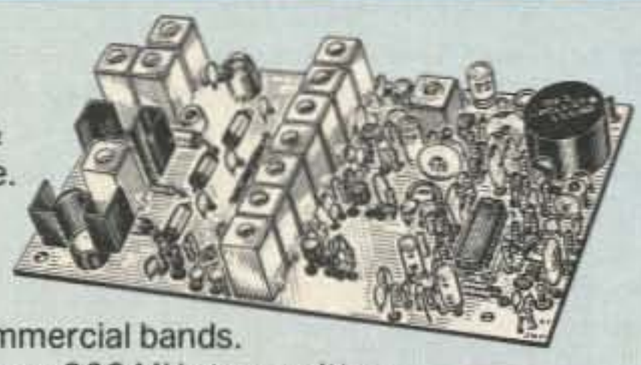

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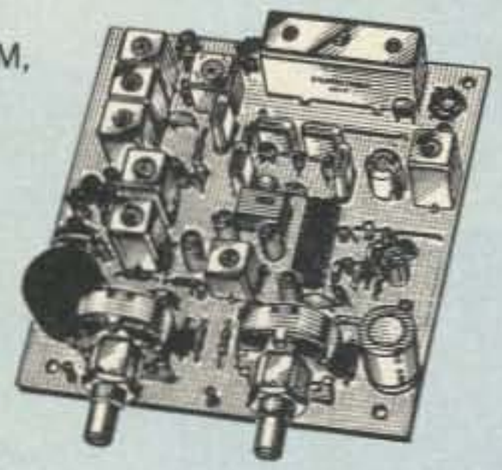

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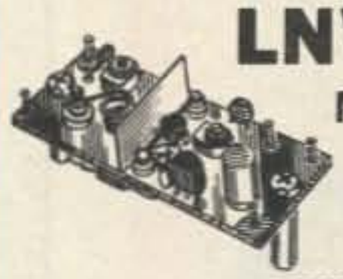

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220-222	28-30
220-224	50-54
222-224	28-30
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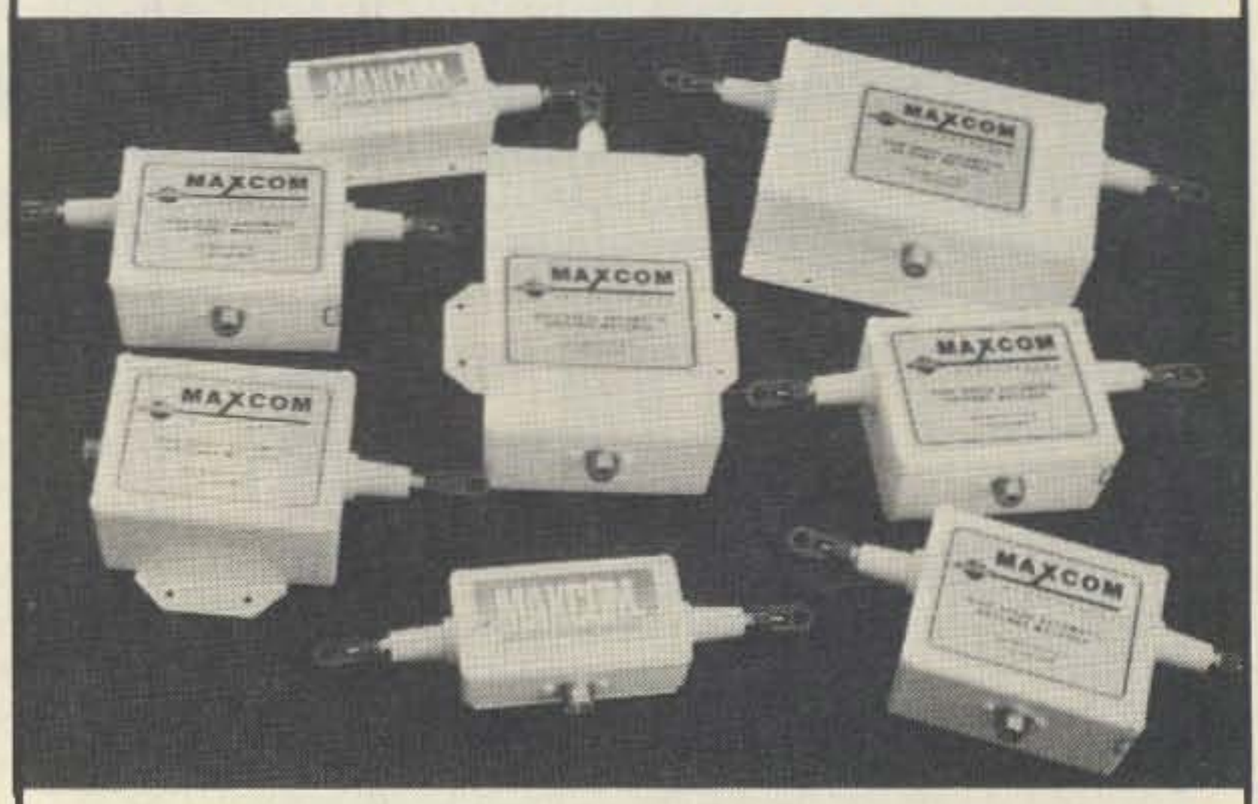

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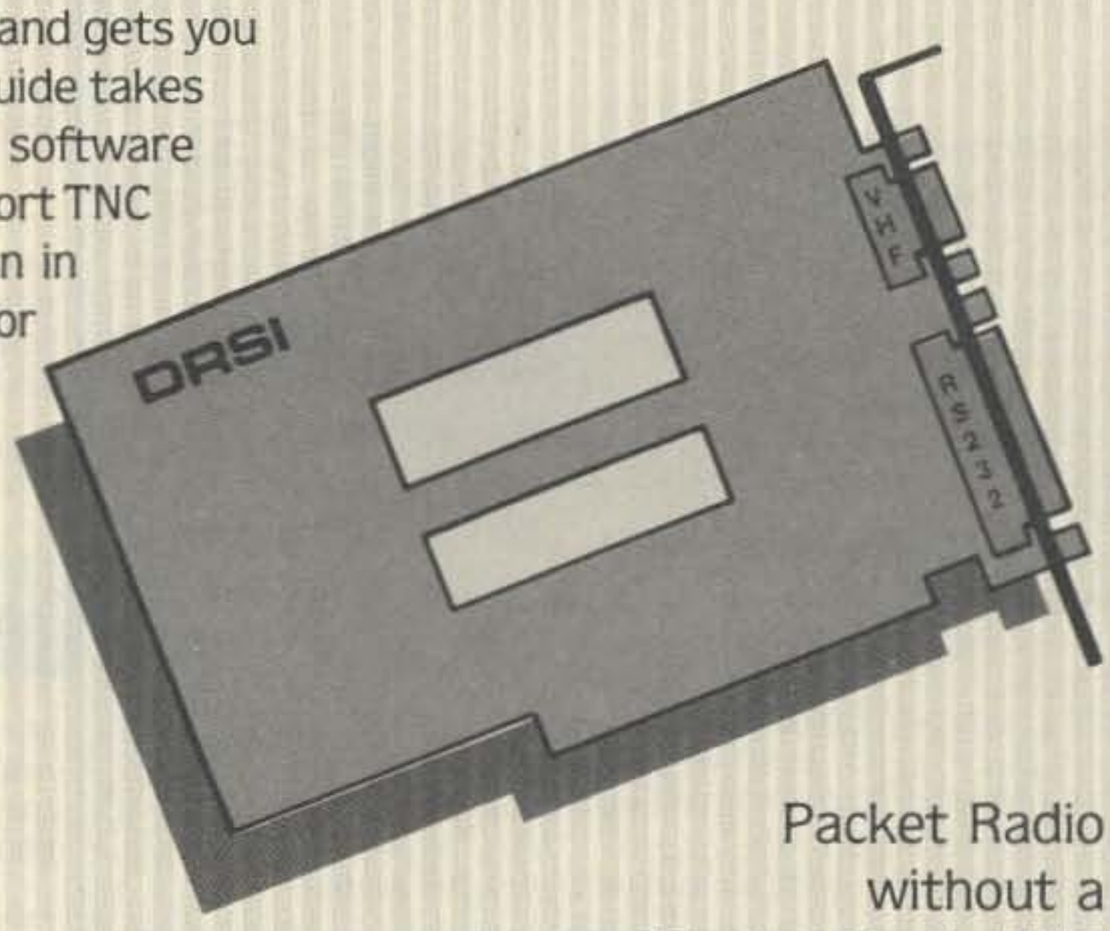

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IBM PC Clones

An introduction to the less expensive brothers of the IBM PC/XT.

by Steven K. Stroh N8GNJ

The terms "compatible" and "clone" refer to computers functionally identical to IBM's PC and PC/XT—such computers can use the same hardware and software as the PC. This article hopes to explain a little bit about the extremely popular IBM Personal Computer compatibles, used more and more in amateur radio. It discusses some things the prospective buyer should look for, and look out for. This article doesn't pretend to give enough information for the buyer to rush right out and buy one, but it's a start for more in-depth research.

Why Not a Commodore 64?

It's true the Commodore 64 is so far the most popular computer in use in amateur radio. There's more amateur radio software written for it than any other computer.

The C-64, however, was designed as a home rather than a business computer. It's priced reasonably but there are some drawbacks. The disk drive is slow, and doesn't hold much data. The screen is hard to read. The power supply is unreliable. Furthermore, it's tough to expand with external hardware.

In contrast, the PC is designed as a business computer. Although the early PCs suffered from many of the problem the C-64 did, it was designed on a highly expandable foundation. The PC has survived basically unchanged for more than 5 years—many times a microcomputer's normal lifetime.

The PC was designed with expansion in mind. There are expansion "slots" or connectors built into the computer, capable of connecting many different kinds of equipment, such as high capacity fixed (hard) disks, many different kinds of video displays, extra memory, modem cards, and networking cards. The PC's solid metal case gives the PC much better RFI immunity than a C-64 with its power supply and disk drive cables exposed to the high RF environment found in a typical shack. The PC uses a more powerful microprocessor than the one used in the C-64. The PC's 8088 microprocessor can access a total of 1MB (1 Megabyte) of memory, of which 640KB (640 kilobytes) the PC can use. That much memory lets the PC run much more sophisticated software than the C-64.

IBM puts a high price on all of this sophistication. Fortunately, clones are often much less expensive and fuller-featured alternatives.

The Clones

Get over the aversion of buying a computer without the initials IBM on the front panel. The clones are often as well engineered and reliable as the IBM PC. Clone manufacturers often buy components, such as microprocessors and floppy disk drives, from the same sources IBM uses. The one major advantage to owning an IBM PC is that it's possible to get it serviced anywhere. A clone buyer has to be careful to choose a clone for which he can get good service.

Most Clones Now Fully Compatible

Shortly after the IBM PC first came out in 1981, many manufacturers came out with clones that were almost compatible with the IBM PC. Early clones had incompatibility problems with certain hardware and software that ran fine on the IBM PC. These problems dwindled as the IBM PC's architecture became more thoroughly understood. Software and hardware manufacturers make more effort to ensure their products will work on the more popular clones as well as the IBM PC, because the clones now have a big market share.

Make Sure It's FCC Certified

One of the latest problems to emerge for clones is the issue of FCC certification. The FCC has been cracking down hard on computer manufacturers whose computers exceed the FCC's RF noise specifications, and have shut down some manufacturers until they are in compliance. The owner of an uncertified clone is liable for the RFI it causes! Hams should be especially interested in this, since RFI is a major hamshack issue.

The More the Merrier

Many of the clones now come with 640K of RAM. If possible, get at least 640K of RAM when buying the computer. Many of the larger programs, such as dBase II and Lotus 1-2-3, work much better when more memory is available. "Memory resident" utility programs—those which stay permanently in a sectored-off section of RAM (while the computer is powered up)—are extremely useful because they require almost no access time and save wear on the disk drives. Having 640K of RAM is well worth the modest cost.

Dual Clock Speeds

Dual clock speeds are a handy feature of most of the clones. The clock is the master timing system in the computer regulating the speed at which all operations are performed. IBM never made a PC using the 8088 microprocessor with a clock speed greater than 4.77 MHz. The clones, on the other hand, take advantage of the ability of the Intel 8088-2 (faster version of the 8088) microprocessor to run at 8 MHz, and process data faster. Programs running at 8 MHz scream along compared to running at 4.77 MHz. Although most software and hardware has no problem running at the increased speed, some do, so the clone computers offer the 4.77 MHz speed to accommodate those few fussy programs.

Dual Floppy Disk Drives

So far the most common data storage device is the 5 ¼" floppy disk, which can store up to 360K of data. Most of the clones come with a single 5 ¼" floppy disk drive. Even in a system with a hard disk drive, dual 5 ¼" floppy disk drives really come in handy. Backing up 5 ¼" floppy disks is a real chore without two drives, yet the user will see the need of this the first time he accidentally erases the disk that contained the program he's worked on for 3 weeks. Buy a name brand floppy disk drive, such as Teac or Panasonic. Half-height drives are a better choice than full-height drives for the simple reason that the user can have two half height drives in the same amount of space as one full height drive.

3 ½" Disk Drives

With the introduction of IBM Convertible Computer (IBM's "laptop"), the 3 ½" disk is now standardized in the PC world. A 3 ½" disk is much more reliable than a 5 ¼" floppy disk, and holds up to 800K of data—at least twice that of a floppy.

I deliberately didn't say "3 ½" floppy disks." These disks aren't all that floppy—The actual disk is well protected inside a hard plastic shell, with a cover that is spring loaded to cover the medium access slot, and normally is opened only when the disk is inserted into the drive. The 3 ½" disk is here to stay, and will become increasingly popular in the coming months. Many users now equip their clones with both 3 ½" and 5 ¼" disk drives—the 3 ½" drive allows them to use the much more reliable 3 ½" disks, and the 5 ¼" drive allows them to continue using their old software and exchange disks with other users.

Hard Disks

I won't go into why hard disk drives are such fantastic devices for PCs—rest assured it is one of the main reasons for buying a PC or clone. Keep in mind for now that they move data in and out of the computer much more rapidly than, and store many times the data of, floppies.

Software that's irritatingly sluggish to read from a floppy disk loads in a fraction of a second from a hard disk. Also, the operator will eventually tire of switching floppy disks every time he wants to load up a different program. One hard disk drive that is well thought of in the PC industry is the Seagate ST-225 which has a storage capacity of *20 Megabytes*. It's very reliable and reasonably priced. The user needs also buy a hard drive controller card to plug into one of the expansion slots—I suggest the Western Digital hard disk controller. The 20M hard drive and controller card runs 200–300 dollars.

A Legal BIOS

The IBM PC BIOS ROM (Basic Input Output System Read Only Memory, or bootstrap ROM) is at the heart of the compatibility issue. The BIOS is the lowest level of software in a PC or clone—it's the "glue" that interfaces the the computer's hardware and DOS (Disk Operating System).

Avoid buying a clone from a company who installs BIOS ROM that are direct copies of the IBM PC BIOS ROM. This is a copyright infringement. Once discovered, the company either has to change the chip immediately or suffer a lawsuit from IBM. Rather, look for a clone that has, or will accept either Phoenix or Award ROM BIOS chips. They are the best combination of PC ROM BIOS compatibility without copyright infringement, and price.

8087 Math Coprocessor Socket

Most clones, and the PC, have an empty socket beside the microprocessor reserved for the Intel 8087 math coprocessor. The buyer should make sure this is in the clone he's considering. The 8087 is a special processor optimized for fast, efficient execution of math calculations. With software designed to take advantage of the 8087's features, the difference in execution speed can be startling. If the 8087 is not present, the calculations can be done using the microprocessor, but this slows down overall processing speed.

The coprocessor is especially useful in spreadsheet programs that do a lot of number crunching, and programs such as AMSAT's latest IBM PC satellite tracking software. When buying an 8087 chip, make sure that it's specified for an 8 MHz clock if the clone has dual speeds.

Automatic Time and Date

A nice feature of the IBM PC is that every time a file is written to disk, it's stamped with the time and date. It's hard to appreciate this feature until the computernik has a hard disk full of files, and can't remember the name of the letter he typed up last night. With the stamp, he needs only to look at the date and time of each file. Whenever the user turns on or reboots the computer, it asks for the time and date. Many expansion boards that include memory, serial communication, and parallel printer ports ("combo" or "multifunction" boards) come with a battery-backed real time clock/calendar chip that takes care of this chore when the user runs a small program inserted on the start-up disk. A battery-backed real time clock is a very worthwhile feature.

Reset Switch

Sometimes a user wishes to reboot the system. Rebooting means clearing *everything* out of RAM, including the DOS system, and reinstalling the DOS. A very common reason for rebooting is because a software crash has locked-up the computer.

A user can reboot his computer several ways. The reboot least stressful for the system—and the one the user should try first—is keystroking the <Ctrl>, <Del>, and <Alt> keys simultaneously. Some software crashes are so major, however, that the computer won't accept any commands from the keyboard. At this point, the user should press the reset button. As a last resort, he should turn off the computer, put the system disk in, and switch it back on.

The IBM PC and all other IBM Personal Computers don't have a master reset switch. Look for this on a clone. Those debugging their own software will appreciate having the reset switch, because the recovery cycle is much shorter than with a power down, and much gentler on the computer.

Keyboard

Those who type a lot, such as those who have discovered the joys of word processing and packet radio communications, quickly tire of using a keyboard with the same layout as the original PC's keyboard. Fortunately, when IBM introduced the PC's bigger brother, the PC/AT, it introduced a keyboard with a much improved layout. Many clone manufacturers, in their ongoing quest to go IBM one better, now include a keyboard with the same layout as the AT with their PC clones.

The PC 8700 keyboard from DataDesk International has received excellent reviews. Another DataDesk keyboard is the Turbo-101 Enhanced keyboard, which features the improvements that IBM has implemented in their latest keyboards (separate function, cursor, and number pad keys) while retaining the large backwards "L" shaped return key. The DataDesk keyboards work with any IBM PC, and virtually all clones. I also heard good words about the Maxi-Switch, a keyboard with the same layout.

Which Display?

There are many articles devoted to the various display options available for the PC. The PC doesn't come with circuitry to drive a video monitor like the C-64 does. What follows is a summary of the wide variety of display options.

The most basic display is the monochrome text adapter. (The adapter is another name for the circuit card that plugs into the expansion slots in a PC or clone and generates the signal for the monitor in use.) The mono text adapter doesn't allow graphics, but does have nice sharp text display. The color of the mono screen is determined by the color of the phosphor of the monitor. Hercules came out with a mono adapter card that could do graphics, but only for those programs written specifically for it—it's not compatible with the color graphics adapter mentioned in the next paragraph. Nonetheless, the Hercules card has become a standard in its own right, in addition to the IBM cards.

The color graphics adapter can display text, graphics, and color and can only be used with a color monitor. Its text display, however, is very grainy and hard to look at for a long time. Those who intend to work mainly with text shouldn't get this card.

IBM then came out with its Enhanced Graphics Adapter (EGA), at a much enhanced price. This, however, greatly improved graphics and text resolution. Fortunately, reasonably-priced EGA clones soon appeared. The EGA is quite usable for both text and graphics.

For all-around use, a Hercules-type mono system is likely the best choice—it's the cheapest and easiest to read.

Selecting a suitable display is one of the few items in buying a computer best left to do personally at a computer store.

Specific Clones

There are some very good deals out there on clones, especially for those willing to deal by mail. Good deals are also possible, however, at the local dealer.

The first is Tandy/Radio Shack. Some of Tandy's computers have the Radio Shack label, others the Tandy label. Tandy, the parent company, has learned a lot about making IBM PC compatible computers. There are many Tandy/Radio Shack Computer Center nationwide that will service these clones.

The user should know, however, of which peripherals he wants to interface with the Tandy. Tandy's 1000 series computers have a reputation of being very hardware incompatible.

Don't think that the only place to buy Tandy/Radio Shack computers is at the local Radio Shack store or Radio Shack Computer Center. Pick up an issue of *80 Micro* magazine and look at the classified ads. There are also several companies selling Tandy/Radio Shack computers by mail as Radio Shack Associate (as opposed to Tandy owned) stores. The same ease of servicing is available to a Tandy/Radio Shack computer purchased through the mail as one purchased locally.

The second is Epson. Epson started out making a very successful line of printers and has now branched out into IBM PC clones. Epson has been fairly successful in getting store and mail-order dealers to carry their line.

The third is Leading Edge. Leading Edge made a big splash with their "Model D"

computer—it was even rated a best buy by *Consumer Reports* magazine! One can also buy Leading Edge's computers through the mail and have them serviced locally. The Leading Edge company, however, are sometimes difficult to get through to for technical support. They refer the great majority of technical inquiries to their dealers, which is a problem when the system or software in question has a problem about which the dealer has no experience.

The fourth is Heathkit/Zenith. Heath/Zenith computers are good, rugged, compatible, and reliable workhorses. Zenith has been doing a booming business selling their computers to the government in large numbers, beating out even IBM with great regularity. The Heathkit counterparts can be built by a hobbyist, just like other Heathkit products. Heath/Zenith computers can be bought through the mail and serviced locally at Heath/Zenith Electronics Centers, or increasingly by local dealers (Zenith only).

The fifth, and last discussed here, is PC Source, sometimes called CompuAdd. Although strictly a mail order vendor, they have some innovative policies that make buying from them a more promising than usual proposition. They offer a free one-year warranty, one year of free technical support on an 800 number, good quality, and reasonable prices.

Although their technical support responsiveness has become more sluggish as the company has sold more systems, it's still head and shoulders above the great majority of mail-order clone vendors.

Build It!

Many people build their own computers. All of the components to build a PC are readily available on the open market.

Be aware of several potential trouble areas. The builder performs the function of a systems integrator, insuring that all pieces of the system work together with every other piece. It's sometimes impossible to know exactly what one gets when buying strictly by mail. There's no dealer tech support service to which to resort. The builder has to scrounge documentation from all quarters. On the flip side, those who select their components carefully and have a mentor can save a bundle of money. *Byte* and *Computer Shopper* magazines are good parts sources.

What's In Cleveland?

Just to give you some examples of what might be available through a local dealer in your area, here are some of my experiences with Cleveland-area computer dealers. One computer distributor sells a clone they themselves assemble. The buyer has no idea who manufactured the components in it, nor does he really care. The main points are that it's IBM PC compatible and locally serviceable.

Another company in the area that used to sell only typewriters is now a dealer for several well respected clone manufacturers. This dealer services the lines they sell, of course, and has many sales offices throughout the Cleveland metropolitan area. Another local computer dealer is run by a ham and distributes a clone that almost no one has ever heard of; but they support it, and it's compatible with the PC, so again, it's a pretty good deal.

Three Vital Accessories

I consider these next few items absolutely indispensable for those thinking about buying (or who already own) a clone. These accessories will end up saving the owner untold amounts of aggravation and money.

The first is *PC Magazine*. Twenty-two issues—one year's worth—is only $25. PC is literally an encyclopedia of PC knowledge, updated every two weeks or so.

The second is the local PC User Group. User groups provide ongoing support and encouragement, usually a newsletter, occasionally a Bulletin Board System, and almost always a public domain software library.

The third is the PC-Software Interest Group. PC-SIG is an organization that gathers, organizes, and distributes public domain software for the PC for a modest fee.

Final Words of Wisdom

Many people get in a pattern of constantly waiting for the prices of personal computer systems to go down, since it does so regularly. For example, IBM recently announced their new Personal System/2 line of computers, which has an unusually good price/performance ratio. The PS/2s, however, don't really offer any features of practical use for the average PC user.

The point is this: If a particular combination of software and hardware will accomplish what the user wants now, he should buy now. Otherwise, he should wait.

Summary

- Make sure it's FCC certified!
- Make sure it has at least 640K of RAM.
- Look for dual clock speeds (4.77 & 8 MHz typically).
- Get dual floppy disk drives.
- Don't try out a hard disk unless you can afford to get one—they're too addicting!
- Make sure the BIOS is legal. The user isn't liable, but it's difficult to get any support.
- Make sure it has an 8087 socket.
- Keep in mind the battery backed clock/calendar option.
- A reset switch, though not necessary, is very handy.
- Look for a keyboard with the same (or better) layout as an IBM PC/AT keyboard. The PC type keyboard is the pits!
- Define the text/graphics use balance before buying the video card.
- Subscribe to PC magazine.
- Join a PC users group. Computer Shopper magazine publishes a list of users groups nationwide.
- Check out PC-SIG. It's quite possible to find all the needed software, except DOS, in public domain software.
- If there's a need, buy the clone now, rather than waiting for something better to come along.

Good luck! If you have specific questions about PCs, feel free to write—SASE please! 73

Further Reading

For further reading about IBM PC clones, check out the following articles, books, and magazines:

Articles

Guttman, Michael. "Zenith 151 Computer," *Computers and Electronics* August 1984, pgs 32–33, 91–93.

Kanter, Elliot S."PC Compatible Computer," *Radio Electronics*, July 1985, pgs 43–46, 82.

"IBM Compatible Computers" *Consumer Reports*, October 1985, pgs 576–580.

Call, Barbara. "XT Compatibles," *PC Week*, July 15, 1986, pgs 57–67, 73–78.

Stafford, Paul M. "The Cheapest PCs Ever," *PC*, October 14, 1986, pgs *122–146*.

Rutch, Edwin. *The IBM XT Clone Buyers Guide*, $9.95 from Modular Information Systems.

Magazines

PC Clones, 5211 S. Washington Avenue, Titusville, Florida 32780, (305) 269-3211.

PC Resource, 80 Elm Street, Peterborough, New Hampshire 03458.

Addresses 80 Micro, 80 Elm Street, Peterborough, New Hampshire 03458.

Byte Magazine One Phoenix Mill Lane, Peterborough, New Hampshire 03458, (603) 924-9281.

Computer Shopper Magazine Computer Shopper, Inc., 407 South Washington Avenue, Titusville, Florida, 32796, (305) 269-3211.

DataDesk International 7650 Haskell Avenue, Van Nuys, California 91406, (818) 780-1673.

PC Magazine Ziff Davis Publishing Company, PO Box 2445, Boulder, Colorado 80322, (303) 447-9330.

PC SIG 1030-D East Duane Avenue, Sunnyvale, California 94086, (408) 730-9291 or (800) 245-6717.

Microcomputer Companies

Epson America, Inc. 2780 Lomita Boulevard, Torrance, California 90505, (213) 539-9140.

Heath Company, Benton Harbor, Michigan 49022, (616) 982-3200.

Leading Edge Hardware Products, Inc. 225 Turnpike Street, Canton, Massachusetts 02021, (617) 828-8150.

Maxi-Switch Company, 9697 East River Road, Minneapolis, Minnesota 55433, (612) 755-7660.

Modular Information Systems, 431 Ashbury Street, San Francisco, CA 94117, (415) 552-8648.

PC Source/CompuAdd, 12303-G Technology Boulevard, Austin, Texas 78727, (800) 643-0092.

Tandy Corporation, 300 One Tandy Center, Fort Worth, Texas 76102, (817) 390-3700

Zenith Data Systems, 1000 North Milwaukee Avenue, Glenview, Illinois 60025, (312) 699-4800.

Amateur Radio in National Emergencies

How to defend against EMP.

by Jerome T. Dijak W9JD

A while back Wayne devoted a bit of editorial space to lament the lack of amateur radio preparedness to deal with a major national emergency such as a nuclear war. Here are some thoughts on how to better prepare the ham community for emergency situations.

What is EMP?

Nuclear weapons produce short but intense bursts of wideband electromagnetic energy as a by-product of detonation. This phenomenon is called electromagnetic pulse (or EMP). A weapon detonated outside the atmosphere (a burst altitude of 200 km is about "optimum") produces particularly intense EMP, which could disrupt electronic equipment in one third the continental United States.

In radio equipment, antennas, and power lines, EMP produces an effect very similar to a large, near-direct lightning strike. There are many variables, but a good planning factor is to protect against an EMP pulse as one would protect against a direct lightning strike to an object a few feet from his antenna. Many areas of the country are expected to survive the initial thermal and blast effects of a nuclear laydown. Communications equipment in these areas could be usable in the post-attack period...if it can survive the EMP effects.

EMP Protection

QST ran an excellent series of articles in 1986 on EMP (see reference 1). These were based on a technical report of the National Communications System that discussed EMP testing and protection specifically for the amateur radio community (see reference 2). This report is available from Office of the Manager, National Communication System, ATTN: NCS-TS, Washington, DC 20305-2010. Request TIB 85-10. I recommend the above to anyone really interested in protecting their station from EMP.

Grossly oversimplified, my guidelines for protecting your ham station from EMP are as follows:

1. Install substantial lightning surge arrestors on all antenna and power lines entering your station.

2. Leave as much equipment as possible completely disconnected from antenna and power lines, whenever possible.

3. Keep spare radios in storage to replace destroyed units.

4. Remember to protect against low-level transients common in any severe thunderstorm. Metal oxide varistors are good for this application.

> ***"In radio equipment, antennas, and power lines, EMP produces an effect very similar to a large, near-direct lightning strike."***

It's a good idea, too, to protect against a very close strike, such as one strong enough to fire a gas-discharge lightning arrestor device. It's not feasible, however, to protect radios against a direct lightning strike. A good arrestor will help, at least, to prevent a major fire.

Be Prepared

There are several other steps one can take to better prepare to help out in a national emergency.

First, a ham should prepare himself and his station to survive and operate for several days (or better yet, weeks) in the event of a major natural disaster. Depending upon location, this may be blizzards, hurricanes, tornadoes, or earthquakes. A ham with this capability—which is not easy to attain—can be a valuable resource in a wide range of emergencies.

Second, learn how to handle third-party message traffic in the disciplined environment of the NTS (National Traffic System) (see reference 3), Military Affiliate Radio System (MARS), or other formal traffic nets. In a real time of need, people with these skills will be much more effective in passing information all over the country in an organized manner. The federal government will have a great need to send messages throughout the country in any massive emergency, and they will be glad to have them handled by amateurs (with the help of the net infrastructures), if it can get the job done.

Learn to receive and relay traffic with perfect accuracy regardless of whether or not the text makes any sense. Government messages will likely be encrypted before they are handed over to the ham community to relay, so the texts may be apparently random letter groups.

Third, learn as much as possible about nuclear weapons effects, fallout characteristics, and radiation sickness. There are a number of steps to improve survivability.

Summary

The amateur radio community is a very flexible and resourceful asset to the nation. They have long- and short-haul communications capabilities. This community has a great potential for surviving even the most severe regional or national emergencies, and providing great assistance to community, regional, and national leaders in time of crisis. 73

References

1. Bodson, Dennis W4PWF, *Electromagnetic Pulse and the Radio Amateur, QST*, Aug.–Nov. 1986, four-part series.

2. *Electromagnetic Pulse/Transient Threat Testing of Protection Devices for Amateur/Military Affiliate Radio System Equipment*, National Communications Systems, Oct. 1985.

3. *The ARRL Operating Manual*, American Radio Relay League, any recent year.

Jerome W9JD is a PhD electrical engineer, and has previously done research for the US Air Force in the field of lightning and EMP effects on aircraft. He is currently a Lieutenant Colonel and serving as Chief Engineer for Communications-Electronics at the National Emergency Airborne Command Post. He's been an amateur for 23 years.

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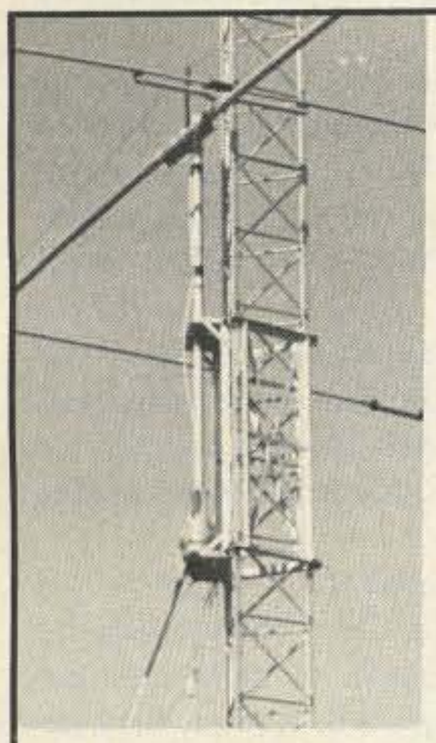

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73 Review *reviewed by Bill Clarke WA4BLC*

Finger Tip Frequency Control

Photo A. The keyboard used for frequency entry on the Yeasu FT-980.

Photo B. The ICOM-761's keypad is responsible for my interest in direct keyboard frequency entry.

Frequency determination of transmitters and receivers are always a problem for the ham. In particular, the accuracy of tuning dials are always questionable.

In the fifties, Collins radios had 1 kHz markings on the dial. That was accuracy! It was also state of the art, and considering that other radios were read by estimation of marks, the readings were sometimes as far apart as 10 kHz. In the seventies the range turned to digital readout, with its inherent accuracy. Of course the common link between these radios was the tuning knob. The interest now is to replace the great round knob and turn toward direct keyboard frequency entry, via a keyboard.

My first experience with digital frequency selection came last summer when I was asked to review the ICOM IC-761. That was the first experience of direct keyboard frequency entry on that radio. I have since become a proponent of its convenience.

What Is It?

Digital frequency entry means controlling the transceiver's frequency from a key pad. The key pad may be similar to that found on a fancy HT. Its use is very simple, for example, if tuning the rig to 7.255 kHz, the appropriate buttons on the key pad would be pressed. Immediately the rig displays the input frequency and is ready to operate.

Where Is It?

In the accompanying photographs, look at the panel mounted key pads found on top of the line HF transceivers. Additionally, there is a remote key pad by ICOM for use on the 751 and 751A. Well, how about the ham owning some late model CPU- based transceiver that does not include a digital pad on the panel or as an option?

Not to worry! A fellow way down in Georgia has come to the rescue. He is Mike Huddleston KJ4LN, of Stone Mountain Engineering. His product is the QSYer.

The QSYer

The QSYer is described in Stone Mountain's brochure as a commercial quality key pad. It is specified for one million operations, inclined to a 10 degree angle for comfort and speed. The unit contains its own 8 bit microprocessor, support circuitry, and even a small speaker for audio indication of key press.

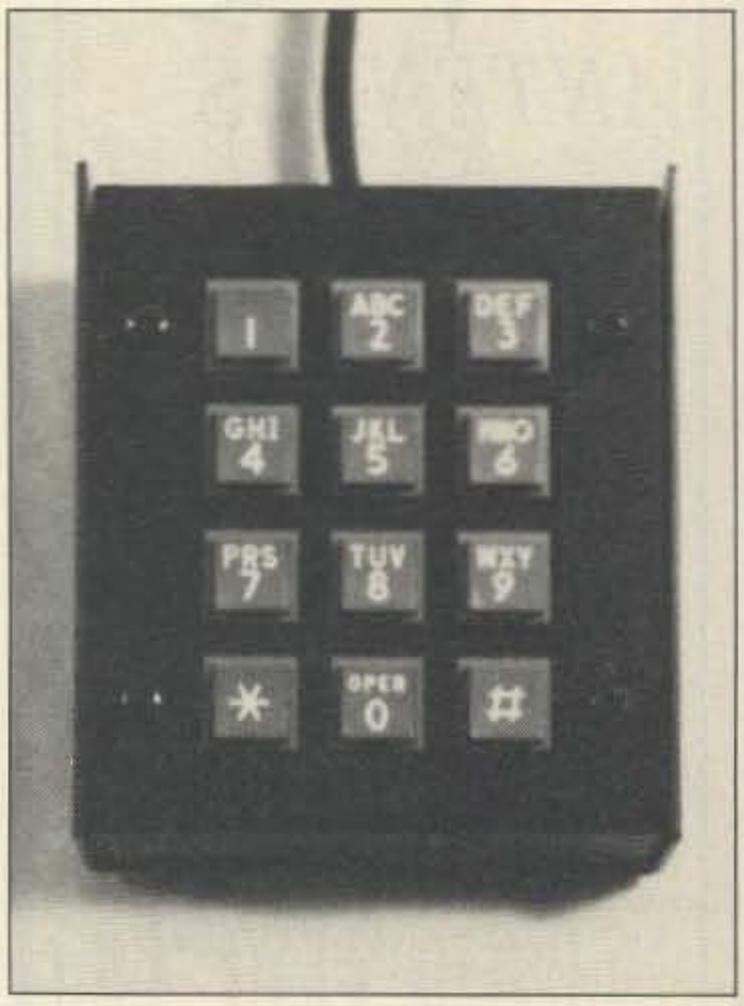

Photo C. The QSYer, available for use on most current HF transceivers.

The metal enclosure is 3.1 x 3.5 x 2 inches and has a single shielded cable running from it to the transceiver. The QSYer requires 13 VDC to operate. The power may be taken from a transceiver or from an external DC power supply.

What does the QSYer do? It allows the user to let his fingers take control of the late model transceiver. Just punch the buttons for the frequency desired to operate on. Instantly, the user will be there.

Band to band, frequency to frequency. It is all possible with the QSYer. Best of all, the QSYer does not replace, or even interfere with, the main tuning knob. Rather, they accent one another. The main tuning knob is still there for roaming around and for fine tuning.

If the rig is connected to an automatic antenna tuner, that will be controlled from the key pad, too. Mode is also automatically selected, if the particular transceiver offers this feature. For example: The ICOM 735 selects USB, LSB, and FM, depending upon what frequency is selected. Thus, when a frequency is selected, the radio will assign the mode. QSYing has never been easier. 73

The QSYer is available for the following HF transceivers:

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Table 1.

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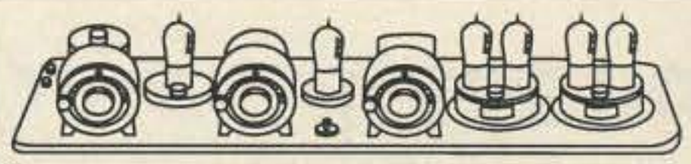

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6	Antenna Suggestions	Dec 77
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9	How about SSB Conversions?	Jul 78
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11	Radio Shack Realistic Mini 23	Sep 78
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15	Radio Shack Realistic TRC-452	Nov 78
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18	SBE Sidebander III and Pace 123A	Jan 79
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33	Put That Hy-Gain CB Board to Use	Sep 80
34	Peaking and Tweaking Hy-Gain Boards	Mar 82
35	CB to CW? (Hy-Gain)	Jul 82
36	Maximum Modulation for CB Conversions	Dec 82
37	Beef Up Your CB-to-CW Conversion	Feb 83
38	Add a Digital Readout to Your CB Conversion	Feb 83

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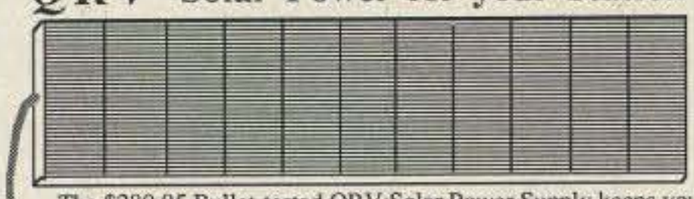

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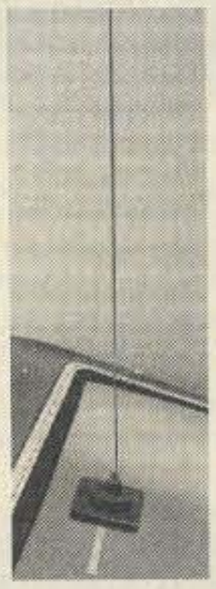

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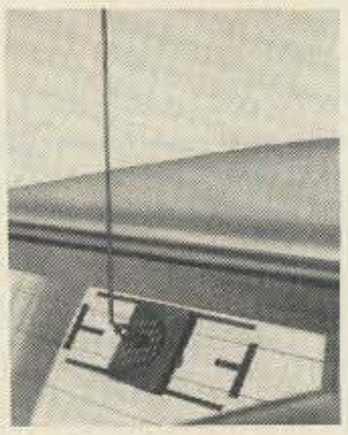

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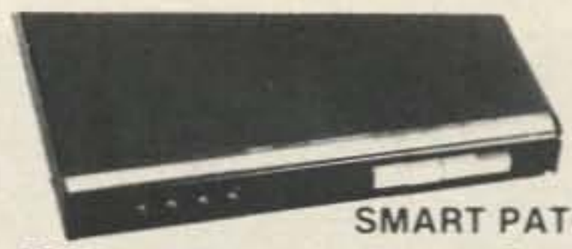

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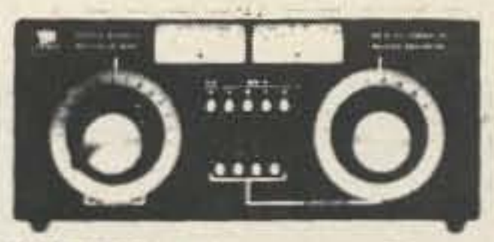

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IC-761 Xcvr/Rcvr/ps/tuner	2699.00	**2369**
HM-36 Scanning hand microphone	47.00	
SP-20 Ext. speaker w/audio filter ..	149.00	**139.95**
FL-101 250 Hz 1st IF CW filter	73.50	
FL-53A 250 Hz 2nd IF CW filter	115.00	**109.95**
FL-102 6 kHz AM filter	59.00	
EX-310 Voice synthesizer.....	59.00	

IC-751A 9-band xcvr/.1-30 MHz rcvr	1699.00	**1449**
PS-35 Internal power supply	219.00	**199.95**
FL-32A 500 Hz CW filter (1st IF)....	69.00	
FL-63A 250 Hz CW filter (1st IF)....	59.00	
FL-52A 500 Hz CW filter (2nd IF)...	115.00	**109.95**
FL-53A 250 Hz CW filter (2nd IF)...	115.00	**109.95**
FL-33 AM filter.....	49.00	
FL-70 2.8 kHz wide SSB filter	59.00	
RC-10 External frequency controller	49.00	

IC-735 HF transceiver/SW rcvr/mic	1099.00	**959.95**
PS-55 External power supply.....	219.00	**199.95**
AT-150 Automatic antenna tuner	445.00	**389.95**
FL-32A 500 Hz CW filter	69.00	
EX-243 Electronic keyer unit	64.50	
UT-30 Tone encoder	18.50	

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PS-15 20A external power supply.....	175.00	**159.95**
PS-30 Systems p/s w/cord, 6-pin plug	349.00	**319.95**
MB Mobile mount, 735/751A/761A...	25.99	
SP-3 External speaker	65.00	
SP-7 Small external speaker	51.99	
CR-64 High stab. ref. xtal for 751A....	79.00	
PP-1 Speaker/patch.....	179.00	**164.95**
SM-6 Desk microphone	47.95	
SM-8 Desk mic - two cables, Scan.....	89.00	
SM-10 Compressor/graph EQ, 8 pin mic	149.00	**139.95**
AT-100 100W 8-band auto. antenna tuner	445.00	**389.95**
AT-500 500W 9-band auto. antenna tuner	589.00	**519.95**
AH-2 8-band tuner w/mount & whip	659.00	**589.95**
AH-2A Antenna tuner system, only....	519.00	**449.95**
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IC-475H 75W 440 FM/SSB/CW.....	1599.00	**1429**
IC-575A 25W 6/10m xcvr w/ps	1399.00	**1249**

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AG-35 (Purchased with IC-471H)		99.95	**9.95**
SM-6 Desk microphone		47.95	
EX-310 Voice synthesizer		59.00	
TS-32 CommSpec encode/decoder....		59.95	
UT-15 Encoder/decoder interface...		34.00	
UT-15S UT-15S w/TS-32 installed.....		96.00	

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IC-290H 25W 2m SSB/FM	**Closeout**	639.00	**549.95**
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IC-37A 25w 220 FM/TTP mic	**Closeout**	499.00	**399.95**
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PS-45 Compact 8A power supply...		145.00	**134.95**
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IC-28A 25W 2m FM, regular mic.....		429.00	**349.95**
IC-28A 25W 2m FM, **TTP** mic		469.00	**409.95**
IC-28H 45W 2m FM, **TTP** mic		499.00	**439.95**
IC-38A 25W 220 FM, regular mic		459.00	**369.95**
IC-38A 25W 220 FM, **TTP** mic		489.00	**429.95**
IC-48A 25W 440-450 FM, regular mic		459.00	**369.95**
IC-48A 25W 440-450 FM, **TTP** mic....		509.00	**449.95**
HM-14 Extra TTP microphone		59.00	
UT-28 Digital code squelch.....		39.50	
UT-29 Tone squelch decoder		46.00	
HM-16 Speaker/microphone		34.00	
IC-228A 25W 2m FM/TTP scan mic...		509.00	**449.95**
IC-228H 45W 2m FM/TTP scan mic...		539.00	**479.95**
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IC-900A Transceiver controller.....		639.00	**569.95**
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UX-29A 2m 25W band unit.....		299.00	**269.95**
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IC-u4AT 440 MHz, TTP	369.00	**329.95**
IC-2GAT for 2m, TTP	429.00	**379.95**
IC-4GAT 440MHz, TTP	449.00	**399.95**
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BC-16U Wall charger for BP7/BP8.....	21.25
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LC-14 Vinyl case for Dlx using BP-7/8	20.50
LC-02AT Leather case for Dlx models w/BP-7/8	54.50

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BP-3 Extra Std. 250 mah/8.4V Nicad Pak	39.50
BP-4 Alkaline battery case.....	16.00
BP-5 425mah/10.8V Nicad Pak - use BC35	65.00
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HS-10 Boom microphone/headset.....	24.50
HS-10SA Vox unit for HS-10 & Deluxe only	24.50
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EX-310 Voice synthesizer	59.00	
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15 min. from O'Hare!

minute as it is five—or, for that matter, twenty. Indeed, I don't think it takes much longer to learn to copy the code at 50 wpm. One of the worst known ways to try and learn the code is to start slow and gradually build up your speed. This system works against the basic way our mind operates, so this stupid system has lost amateur radio hundreds of thousands of potential hams. I can hear you muttering "good riddance." Why spend weeks struggling with something that can be done in hours?

I mentioned the *73 Magazine* code practice tapes that I fiendishly designed to be ball breakers. When you're able to copy my tapes, you'll float happily through any license test. I have one at 6 wpm, one at 14 wpm, and one at 21 wpm, all so rotten that you'll never forgive me. I suggest you start with the 21 and forget the others. Why bother to learn the code two or three times when you can do it once and have it done with?

At the higher speeds you get used to the sound pattern of words more than characters. You'll get to know how the more commonly used words sound. And, since most ham contacts are almost totally rubber-stamp, about all you'll have to decipher is the call, name, and location. If you aren't too cheap to spring for a callbook, you won't even have to copy the name and location, just the call.

But, golly gee, wouldn't a no-code license make ham radio like CB? Not if we do it my way, with a tougher technical exam. Of course, the whole license exam thing is a sham in many areas. Extra Class licenses are going for about $150 now, with no bother about the code or even having to know an ohm from a volt. Several of my Puerto Rican friends collared me, saying that several thousand licenses had been sold there. And I've solid evidence that this is happening elsewhere, with the local amateurs hushing up the scandal. Hmmm, 5,000 licenses at $100 each is a half a million bucks! These VEs may be about the only ones making money in our hobby.

As much as I hate what they're doing, imagine how bad our drop in ham growth would be if we didn't have VEs selling licenses! The FCC figures showed a drop of 35% in new licenses in the last three years—check it out in the *W5YI Report*.

NIAC

I also mentioned my proposal to the ham industry that we form a new National Industry Advisory Committee to work with the FCC toward amateur growth and the preservation of our bands. I'd contacted the FCC and had a letter expressing their interest and cooperation. We sure could use some extra input to the Commission these days.

"The Hamvention people tell me I pull the biggest crowd of all at my talks."

Having been a member of an earlier NIAC for many years, I know how important such an organization is, both for amateur radio, the Commission staffers, and the Commissioners. The last thing we need is the FCC working in an information vacuum.

I'll let you know as the new NIAC develops. At the Dayton ham industry meeting, I got an enthusiastic response to the idea, and offers from many key ham industry people to help. To fund the project, I proposed asking all ham industry firms to contribute $100 a year. I got dozens of positive responses to this idea and only two negative.

I proposed that the NIAC group meet at the Orlando hamfest in the winter, at Dayton in the spring, Atlanta in the summer, and in Washington, where we could get together with the FCC, in the fall.

Digital Audio

Then I got to talking about some of the newer technologies I see coming along. One that has great promise is Digital Tape (DT... as in DAT, where the data is translated into digital audio). I see markets for a wide variety of hardware, software, and information products for this technology. I predict this will grow from zero into a $10 billion industry within ten years.

DT should be great for amateur radio applications. For instance, if one wanted to send music, 3D high definition photos or a data base over a 20 meter phone channel, all one would have to do is slow down the DT by a factor of 20 and send away. This is simple—you can dump 640K of data from DT into RAM in 3.5 seconds, and then send it at any rate you want over the air. You put it back on DT and then play it at normal speed. With a packet system this would all be automatic. Even movies can be sent this way, substituting time for bandwidth.

Since it's unlikely the old men who make up most of our ranks today even have a working soldering iron, this brings us back to the need for youngsters in the hobby. It was mentioned at the industry meeting that 63% of all scientists made their decision for science by the time they were in the 6th grade. This was right in line with my proposal to get courses started in every school in America, grades 5–12, teaching the fundamentals of electronics, communications, and computers.

Just a couple days before Dayton, I had an opportunity to talk at length with the chairman of the National Science Board (NSB), the group that runs the National Science Foundation (NSF), a government group that doles out something over $220 million a year promoting science. Yes, of course I explained my idea. I'll let you know what develops from this.

Ham Radio In Schools

I'm also angling for a meeting with Secretary of Education Bill Bennett to talk over this and a few other ideas with him. If I can get some basic courses in communications into the American schools, we'll have the kids we need to get amateur radio growing again—and perhaps, even our American electronic industries.

Is it really possible that we might have as many as a million new hams a year? I think so.

Get Our Elected Where It Counts

You know, if you'd help, we might have a whack at it. It costs about $100 to get the undivided attention of a congressman. Oh, it probably isn't the $100 that gets the attention as much as the perceived potential for more. Congressmen tend to have three major priorities. 1. Get re-elected. 2. Get re-elected. 3. Get re-elected. Beyond that, the priorities get fuzzy, often tending to bow to the breezes from lobbyists. Thus, if you send along a little donation toward the next re-election campaign, you could use the attention this generates to get my ideas read. But please hold your money until we're set to go.

I brought up the new communications technologies that we amateurs should be developing. We've the potential right now for setting up a system that has a throughput of 500 pages per second. No, you can't read that fast, but that means you can send one page in two milliseconds. With that kind of throughput, twenty thousand ops could use one single channel without any problems. It's almost enough to make one think. Well, if we don't get some youngsters into our hobby and turn them loose on pioneering like this, we'll have to read the Japanese ham magazines to find out how to do it. That what you want?

More Building!

Oh, yes, Dayton. I mentioned that I'm very interested in getting as many articles as I can for *73* on home construction projects. With the rising interest in QRP, how about some simple rigs and transceivers? Also, I'm interested in articles on transmitter hunting—equipment, techniques. How about some articles on using the new SSTV telephone units from Mitsubishi and Sony? They should be fantastic for amateur radio. And with FAX going into offices everywhere, how about more articles on the ham use of FAX?

If you get a new piece of ham gear and think it's worth telling others about, you might see if we're interested. I'd rather read about real ham opinions of new gear than most of the technical reviews I'm seeing in the other magazines. How is it to use? I don't want to know how to build a watch as much as I want to know what time it is.

Love and Hate

Since I've heard there are a bunch of Wayne Green haters out there, I thought I'd take advantage of this and have stickers available at Dayton. Half said "I Love Wayne"—the other half said "I Hate Wayne." How anyone can hate someone as lovable beats me, but I've heard ugly rumors. I keep hoping a hater will come to one of my talks and speak up.

The stickers were popular. I wonder how much they'll go for in a few years? People collect the darndest things. Good collector's item.

If you missed me at Dayton this year, let's try it next year. Let's pack that room until the fire marshals complain. 73

73 Review *by Jozef Hand-Boniakowski WB2MIC*

Pac-Comm Micro Power TNC

Go Packet Portable with the µ2AT and Tandy T-100!

Pac-Comm
3652 W. Cypress St.
Tampa, FL 33607
Price: $160

A little over a year ago, I wrote a review for *73 Magazine* on the ICOM µ2AT, 2-meter hand-held transceiver, a unit by which I was, and am still, impressed. As I finished putting together that review, I began to think: How soon will hams see a packet station using the low power consumption of a rig like the µ2AT? Well, that time has come already—read on to find out about such a *small*, versatile, and easy to operate station.

Pac-Comm's Micro TNC. Ideal for any station, portable or fixed.

The Need

I have been involved with packet radio for over three years. I have set up an educational network called COSIN, the COmputer Student Information Network. This revolves around WB2MIC-7, a fully windmill-powered, 130-watt output digipeater atop Northeast Mountain, Vermont (2,400 ft ASL), and WB2MIC-4, a dual-ported educational bulletin board system. The BBS runs KA2BQE PRMBS code in "C," a spectacular bit of software. I needed a portable demonstration station I could bring to schools, science exhibits, demonstrations and, of course, for emergency operation, fun and recreation.

COSIN uses three AEA PK-87s. They work flawlessly, but were too big and power-hungry for portable packet. I tried the GLB PK-1L, but, not having the standard TAPR TNC-2 command set, I was quickly disappointed.

Finally, I noticed the ad for the Pac-Comm Tiny-2 and Micro TNCs. The Micro is as small as its Tiny brother, but rated at very low power draw. Having good luck with Pac-Comm's DR-100 and DR-200 dedicated digipeaters, I didn't hesitate to buy a Micro TNC.

Description and Specs

The Micro is smaller than most TNCs, though—at 5″ x 7″ x 1⅜″ and 22 ounces—bigger than GLB's PK-1L. The Pac-Comm Micro has a nice gray extruded aluminum cabinet with a wrinkle finish. The front panel is a thin, flexible plastic plate. On it are five LED indicators, labelled DCD (Data Carrier Detect), PTT (Push-to-Talk line), STA, CON (Connect), POWER, and the power pushbutton. The rear panel has a 9–12 VDC jack, 5-pin DIN connector for radio hookup, TTL level connector for hookup to computers such as the C-64, and DE-9P nine-pin connector for standard RS-232C levels.

The Micro has several improvements over previous models. Just above the opening for the TTL level connector, there is easy access to the trim pots that adjust the radio drive and modem bias levels. This is a welcome change from Pac-Comm's previous designs, where the entire TNC circuit board had to be removed from the cabinet to make the TX audio level adjustment!

Another improvement was the method of removing the circuit board from the cabinet. In the DR-100/200/TNC-220 series, the regulator transistor was fastened to the extruded aluminum cabinet with a self-tapping screw. The user has to loosen this screw to remove the board from the cabinet. Many regulators fry because users forget, or don't realize, that the cabinet serves as the heat sink for the regulator.

". . . there's easy access to the trim pots that adjust the radio drive and modem bias levels."

This isn't the case with the Micro. The packeteer just needs to loosen two screws, and the back panel (also made of plastic lined on the inside with a metallic shield) comes off. The board slides out easily, exposing all DIP switches that set the radio, and computer, baud rate. Newer models have metal back panels, and in July Pac-Comm began shipping units with metal front panels, too.

All the microchips, thank goodness, are socketed. The components are high quality and the workmanship is excellent. The only shortcoming is the fuzziness of the silk screening identifying the components and jumpers. (Pac-Comm has since corrected the silk screen problem, which only occured on a run of 300 boards.) I had to look very carefully to make certain the jumper I was looking for was the correct one for the lithium battery backup. This battery is for maintaining parameters that are entered into the TNC and such things as the beacon and connect texts.

Micro TNC To The Task

I hooked up the Micro to my wife's ICOM µ2AT and Tandy Model 100 computer. I used two 6-volt 2.6 amp-hour gel-cells in series supplying power to the TNC and tapping in the middle for power to the computer. I made up the cables per the manual instructions (more on this document later) and placed everything strategically inside a Radio Shack carrying case for the Model 100. All fit very easily with room to spare for a log book, spare connectors, AEA Hot-Rod collapsible ⅝-wave antennas, and electrical tape.

From the first power up, everything performed flawlessly. The very first contact was through COSIN's ten-meter gateway from 145.07 to 28.105 MHz. I was sitting on my porch having a QSO with a ham in South America on packet radio running 100mW!

The Micro draws about 38 mA, within the published specifications of 40 mA. It's a sheer pleasure to use and does everything a packet radio terminal node controller is supposed to do, and more.

A Little RFI

My only complaint is that my unit is a bit "noisy"—RFI from the Micro showed on the LCD S-meter read-out of the µ2AT. This, however, didn't affect operation. My guess is that RFI was getting into the handheld at the radio's IF frequency. Nonetheless, I could minimize RFI by moving the HT further away from the TNC and working up a better shielded cable. Later models have an RF choke in the power input circuit to reduce RFI from the units. Pac-Comm offers owners of older units free upgrade kits.

Watch also the shielding when configuring the Micro to use with the ICOM AT/0AT/µAT-series HTs. These HTs use one electrical line for both TX audio and PTT, so a small circuit is needed to separate the two signals from the HT.

One lead of a .01µF ceramic disk capacitor was soldered to one end of a 27k⅛-watt resistor. This common lead was connected to the HT's external microphone jack at the tip. The free end of the resistor went to the TNC's PTT line while the free end of the capacitor went to TNC's TX audio line. I placed these components originally on a vector board mounted close to the HT and soon realized that this break in the shielded cable was a major source of RFI. Mounting the components inside the shell of the 5-pin DIN plug greatly reduced RFI.

One-Time Mystery

The only initial problem with the operation of my Micro was the loss of anything other than ROM default parameters at power down. MY CALL WB2MIC-6, the beacon, and connect text, was lost as well as any other keyboard changes. This prompted me to look inside the Micro for the jumper to the lithium BBRAM (battery backup random access memory) battery jumper. Upon removal of the jumper, and replacement, this condition disappeared. This was apparently an anomaly with my unit. Pac-Comm has not reported this problem elsewhere, and BBRAM reset is not normally required.

Extras

The Micro functions are similar to other TNC-2 type TNCs, so I'll discuss just the added features. The Micro allows for "HEALTH" features. By using the command HEALLED ON, the CON and STA LEDs give up their normal functions and take on the role of indicators for the condition of the processor in the packet controller. The two LEDs blink on and off in a random pattern when all is well and the processor is executing the software properly. The command HEALLED OFF is used to bring the CON and STA LEDs back to their normal function. In addition, a packeteer can monitor numerous parameters by looking at the 17 available counters, each 16 bits wide. The command DISPLAY HEALTH causes the Micro to reveal the counter names and their settings. One of the more interesting counters is BBFAILED which counts the times that the BBRAM checksum was in error. Other examples of counters include ASYRXOVR (indicating data from user being lost), and DIGISENT (keeps track of the total frames digipeated).

Manual

Pac-Comm has come a long way from the days of TNC 200 and 220—and the manual is no exception. No longer does a newcomer (or experienced forgetful user) have to second-guess the tech writer's intent. The two-part manual—for operation and hardware reference—is concise, well written, and well organized. It clearly explains all commands, features, interfacing wiring and usage instructions, with illustrations where appropriate. It's obvious the manual is a dedicated guide to non-frustrating packet setup and operation. There's even a section explaining the physical and link layer protocols for those inclined to learn. Also included is a detailed circuit description and a troubleshooting section. There is a full-size circuit schematic and detailed diagrams of all connectors, pin-outs, and wiring to various system configurations at the end of the manual, which is spiral bound and small enough to fit into the Model 100 carrying case. A pull-out summary sheet of all TNC commands is supplied.

Conclusions

The Micro is fully compatible with the latest version of NETROM software for level 3 use and is readily adaptable for use with high speed modems like the 19.2kB AEA backbone tracking modem/radio combination.

I am very favorably impressed by the Micro. To date, three local members of COSIN have purchased the Pac-Comm Micro and are completely satisfied. I highly recommend this Pac-Comm unit for home use, as a low powered dedicated digipeater, NETROM switch or BBS controller to use with a host computer. The unit performed flawlessly in each capacity. Pac-Comm has a winner. Now, how do I convince my wife, Jeanne KA1PMS, to trade my big IC-02AT for her µ2AT? Instead of the swap, I may well set up another portable packet station and buy another one of these little wonders. 73

Modernizing the SB-200

Necessity is the theme and the inventress, the eternal curb and law of nature.
—Leonardo Da Vinci.

by Bill Clarke WA4BLC

Heathkit for many years sold an amplifier kit called the SB-200. It was a 1200-watt PEP unit that used two 572B tubes. Although these amplifiers now have some age on them and are no longer produced, it is by no means the end of them.

A ham can usually find used a SB-200 for about $300. Its true value depends upon how well the kit-builder put it together, and cared for it and its final tubes. The careful shopper can find a solid unit at a large cost savings over the purchase of a new amplifier using the 3-500Z tube (also a 1200 watt PEP amplifier).

Of course, many types of older equipment need improvements and modernization to function in today's stations. The SB-200 is no different.

The operator must modify the SB-200's keying circuit to use with modern solid state transceivers. The problem is that the voltage present on the relay jack exceeds that allowed by the amplifier keying circuits of most new transceivers. Trying to key the SB-200 with a new transceiver will most likely damage the internal relay. Repair costs are *at least* $50.

Update It!

This article outlines the procedure to update the keying circuit and adding status lights. The result is a more modern-appearing amplifier that one can key with any solid state rig. The cost for the parts is about $20, and the time spent should be less than two hours.

275-213	Relay	$3.99
275-663	Switch	2.89
272-332	Red lamps	1.69
272-335	Blue lamps	1.69
276-1180	Rectifier	2.19
273-1352	Transformer	4.99
272-1048	Capacitor	3.49

Table 1.

"A ham can usually find a used SB-200 for about $300."

Parts List

The modification is completed with parts from Radio Shack. Part numbers are given in Table 1.

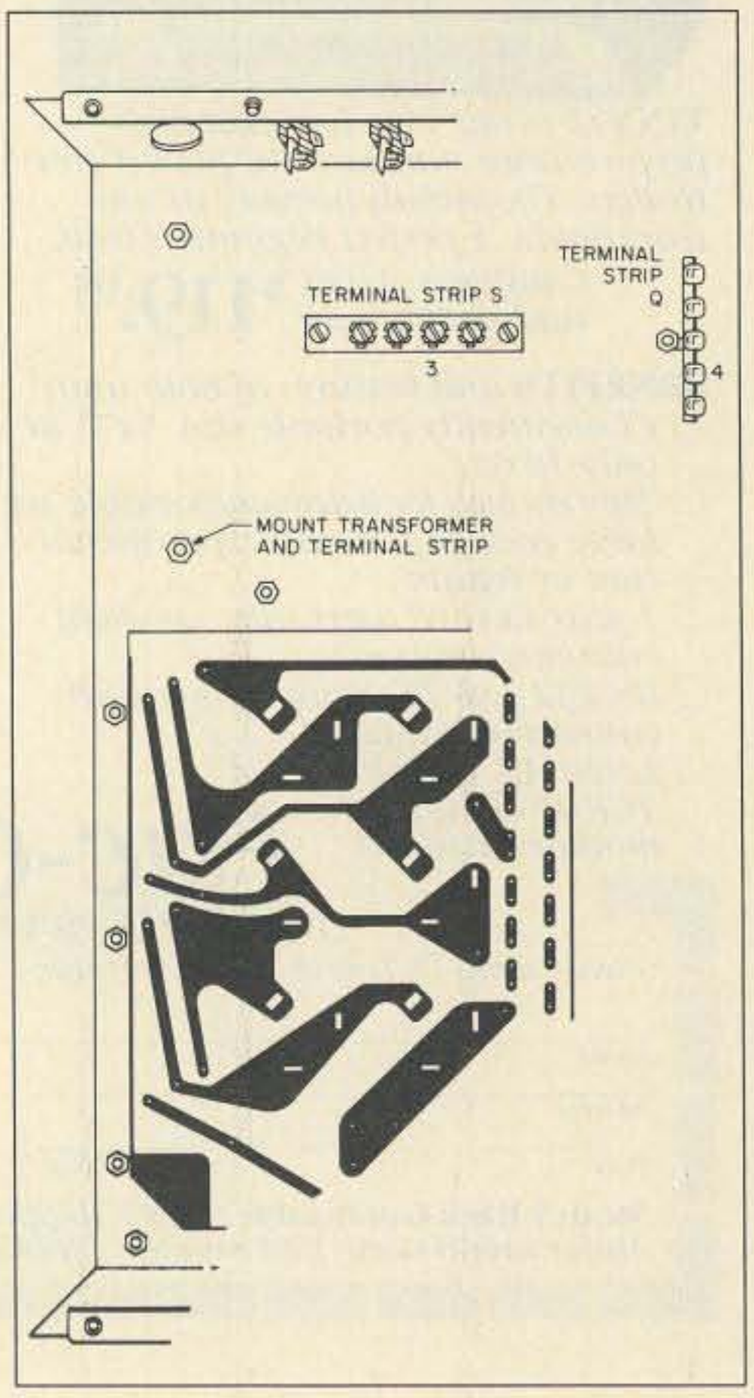

Figure 1. Diagram of the inside bottom of the Heathkit SB-200 linear amp.

Instructions

Just a few short steps will modernize the SB200. Before proceeding, make sure the amplifier is unplugged! Then remove the case.

First mount the new transformer to the transformer mounting bolt on the bottom of the chassis as shown in Figure 1. Then install a 5-lug terminal strip (TS) on the same bolt as the new transformer. This terminal strip will be referred to as TS. Glue the relay to the chassis (terminal legs up) near the new transformer.

Now solder the rectifier's AC legs to TS lugs #1 and #2. Solder the rectifier's positive (+) leg to TS lug #4, the rectifier's negative (–) leg to TS lug #3, and the new transformer's secondary leads to TS lugs #1 and #2.

Isolate the new transformer's secondary center tap lead. It won't be used.

Then solder the new transformer's primary leads to terminal strip S lug #3 and terminal strip Q lug #4 as shown in Fig. 1.

Solder the positive (+) lead of the filter capacitor to TS lug #4 and the cap's negative (–) lead to TS lug #3.

Drill a ¼-inch hole about two inches left of the meter function selector knob (on the front panel), and mount the DPDT switch. Then run a wire from relay terminal #1 to TS lug #4 (see Fig. 3) and solder.

Run a wire from relay terminal #5 to switch terminal #2 (see Fig. 2 and 3) and solder. Unsolder the leg of R16 that is attached to the center conductor of the relay jack on the rear panel. Then solder R16's leg to relay terminal #4 (see Fig. 3). Run a wire from relay terminal #2 to TS lug #3 and solder. Run a wire from switch terminal #1 to the center of the relay jack on the rear panel (see Fig. 2) and solder.

Now drill a ½-inch hole about 1-½ inches to the left of the DPDT switch and install the red lamp. Drill a ½ inch hole about one inch to the left of the red lamp and install the blue lamp.

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List price $189.95/**CE price $98.95/SPECIAL**
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Bands: 29-54, 136-174, 406-512 MHz.
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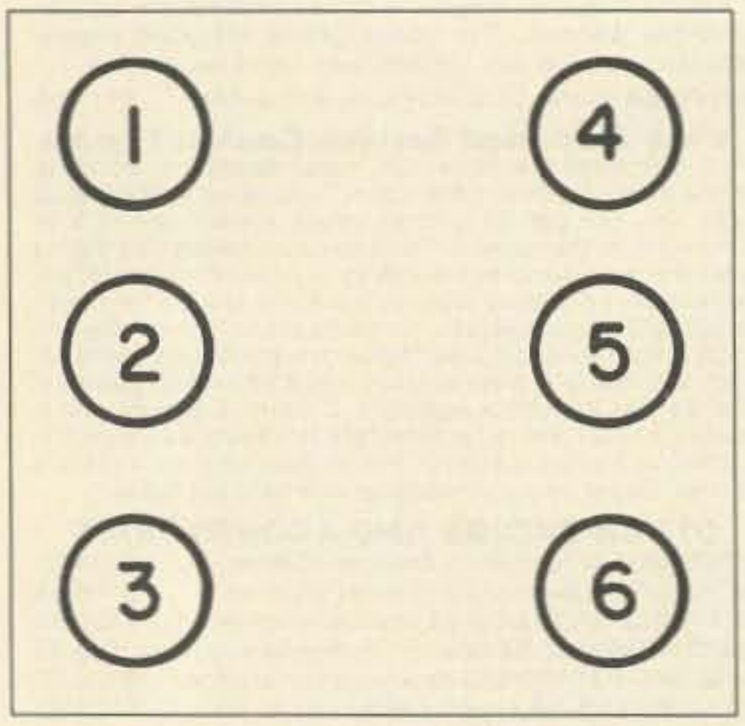

Figure 2. DPDT switch terminals.

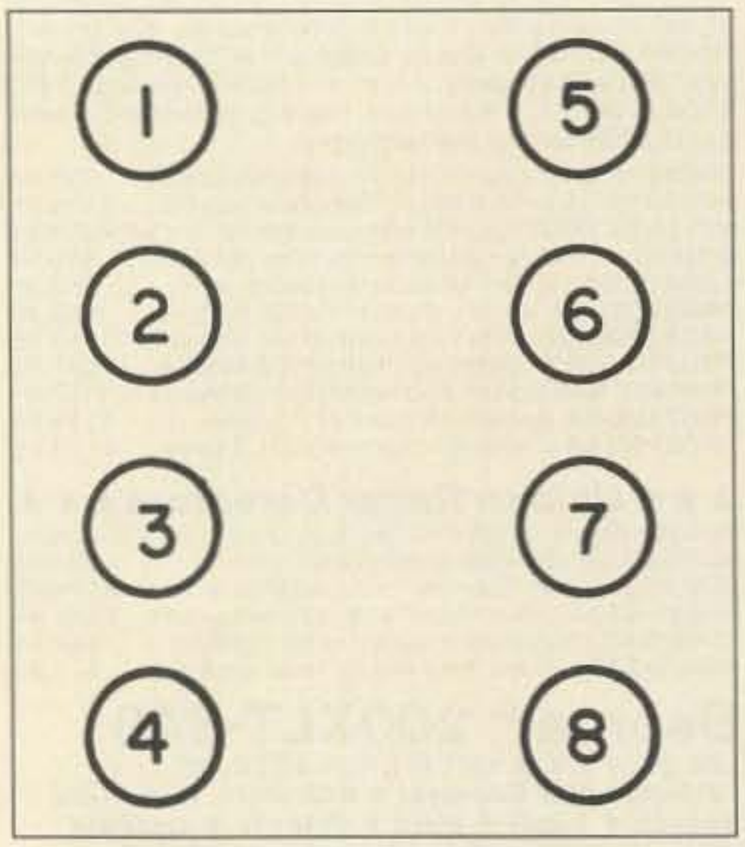

Figure 3. Relay terminals.

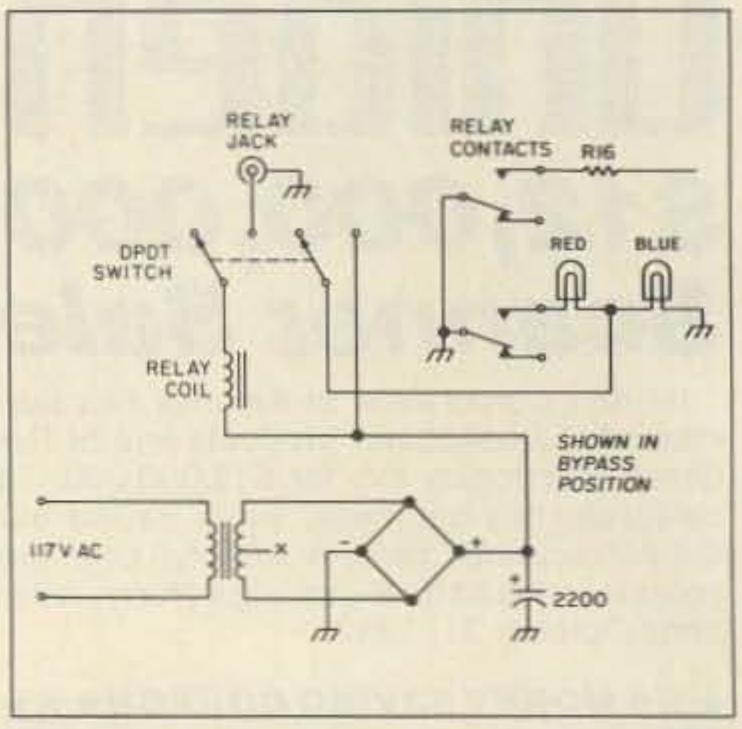

Figure 4. Schematic of SB-200 modification. It brings amp key relay terminal voltage down to a level acceptable to most current solid-state drivers. It also installs an amplifier by-pass switch.

Solder a lead from the red lamp to switch terminal #5 (see Fig. 2) and solder the remaining red lamp lead to relay terminal #8 (see Fig. 3). Next run a wire from relay terminal #6 to TS lug #3 and solder.

Run a wire from switch terminal #5 to TS lug #4 (see Fig. 2) and solder. Also solder a lead from the blue lamp to switch terminal #5. Then solder the remaining blue lamp lead to TS lug #3.

This completes the installation steps. Double and triple check the work.

Use of the Mods

The newly installed switch allows instant amplifier by-pass. Heath's original thinking was that since the 572B tubes are instant heating, the user can switch them off during any amp inactivity. I don't subscribe, however, to the policy of turning off electrical equipment on and off at every moment when it's not needed. The power up/down action is very stressing to equipment and causes excess wear.

When the new switch is in the OFF position, it's not possible to key the amplifier, and the new pilot lamps will be off. Only the SB-200's meter lights will be on.

Place the switch in the ON position and the blue lamp will come on indicating the amplifier is now ready to use. When the transmitter is keyed, the new relay will close (activating the amplifier keying circuit) and the red lamp will light.

Other Mods Are Possible

I suppose the list is endless of what one might do to an older piece of equipment to make it suit their tastes. Here are a few ideas:

- The addition of a better cooling fan, such as a 4-inch muffin fan.
- Operation on the 160-meter band.
- Vernier turns reducers for the knobs.
- An improved meter function switch.

The moral is this: Those willing to take the time to check out older equipment carefully and spend a little soldering time will most often get a fine piece of equipment at a huge savings.

Who can balk at a 1200W amp, usable with today's HF drivers, for $350 and a few hours worth of their time?

Good luck! 73

Soldering Sidebar

Tips to master soldering techniques

by Larry Antonuk WB9RRT

Once you've mastered basic soldering techniques (you did read that booklet from Heathkit, didn't you?), keep the following tips in mind:

1. Use enough heat. For most PC board work, this means a 45-watt pencil. Use a big enough iron, and regulate the amount of heat by controlling the time that the iron is in contact with the joint. If you have to wait more than two seconds to heat a PC board connection, more wattage is needed. For a UHF connector the large-tipped 40 watt pencils (similar to Weller WP-40) work fine.

2. Be clean. Wipe your soldering iron tip on a damp sponge. Make sure your wires, PC pads, etc., are spotless. If you're resoldering burned wiring, strip the wires back to clean copper. On a PL-259, scrape the area around the holes with a small file or pocket knife. Don't count on the flux to do your cleaning for you.

3. Use the proper solder for the job. For most electronic work, use 63.37, or "eutectic" solder. Eutectic solder has a very small "plastic" range, which helps prevent cold solder joints. Heavy current or high temperature connections require a high melting-point solder–usually a tin/lead/silver alloy. Use ONLY rosin core solder.

4. Clean the flux from the PC board when finished. Use alcohol and a trimmed plumber's flux brush. (The use of flux removers on boards containing surface-mounted devices is not recommended.)

5. Know what you're soldering. If you have enough heat and a clean connection, and things still aren't working–check your materials. Some of those stainless steel straps on some battery packs will not accept rosin core solder. To solder stainless steel, you'll need some "tinner's flux," available at most hardware stores. A drop will allow proper wetting on stainless. (Tinner's flux is highly corrosive–exercise caution when using it, and thoroughly clean all connections once you're finished.)

6. Yes, Virginia, you can solder wires to aluminum. The reason that you normally can't is that aluminum forms a thin layer of oxidation whenever it's exposed to air, which prevents proper wetting action. To overcome this, thoroughly clean the area to be soldered. Place a few drops of motor oil on the cleaned spot, and scrape the cleaned area with a screwdriver blade. The oil prevents the oxidation layer from forming. Using a LARGE iron, solder the wire to the aluminum in the normal fashion. While somewhat of a mess, this procedure might allow you to save an otherwise unusable antenna element, etc. 73

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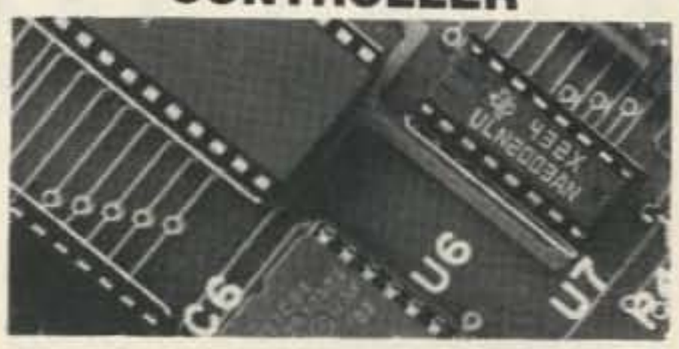

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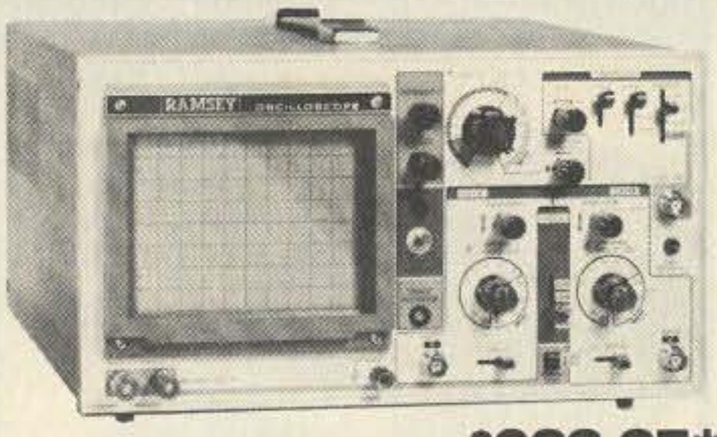

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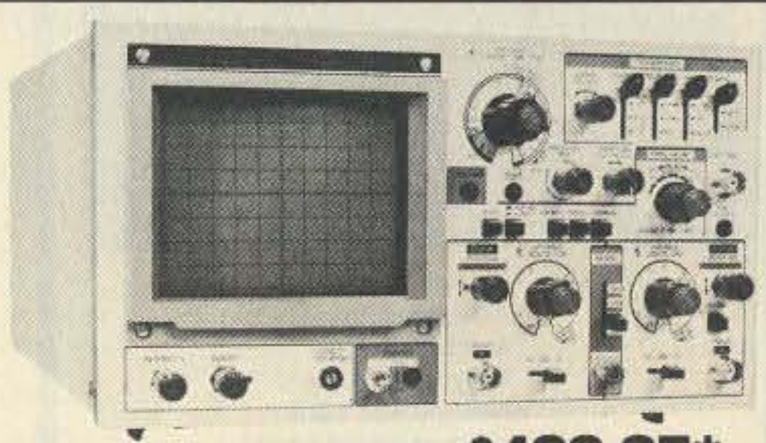

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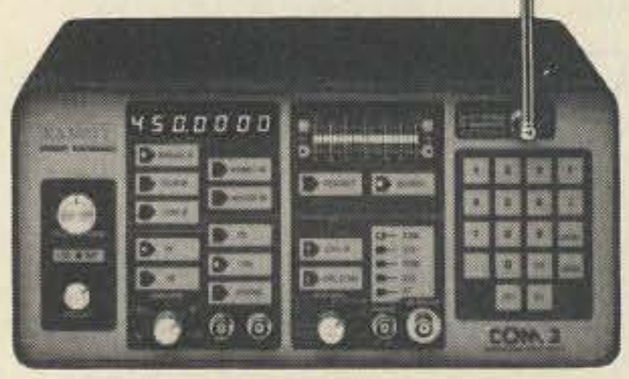

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CIRCLE 34 ON READER SERVICE CARD

Oscilloscope Preamplifier

A little about op amps and video amps

by Frank C. Pugh

This article details the basic theory of operation of a video amplifier and the construction of a practical video amplifier project. I built this project to expand the sensitivity of an older oscilloscope. Before I begin a discussion on "video amplifier theory," a short review of operational amplifiers (op amps) is useful.

Basic Amplifiers

An amplifier is an electronic circuit containing Bipolar Junction Transistor (BJT) and/or Field Effect Transistor (FET) devices. These types of amplifier circuits usually come packaged as ICs. These IC amplifiers generally provide voltage or current gain. They may also provide power gain or allow for desired impedance matching.

Amplifiers have many classifications. There are low-frequency amplifiers, audio amplifiers, ultrasonic amplifiers, radio frequency (RF) amplifiers, wideband amplifiers, op amps, and video amplifiers, each type operating within a prescribed frequency range or in a predetermined fashion.

Op Amps

An operational amplifier is a highly sophisticated linear integrated circuit, a direct current amplifier demonstrating high gain, high input impedance, and low output impedance. Originally the term referred to high gain, high performance, vacuum tube direct current amplifiers. It was designed to perform mathematical operations with predetermined voltage levels. Op amps were the basic building blocks of analog computers, because they could perform the mathematical operations of multiplication, addition, subtraction, integration, and differentiation. The op amp used today can still be used to perform these operations, and now also work in other useful circuit designs. In combination with nonlinear elements such as diodes, they may be used as limiters, level detectors, and nonlinear function generators. By designing op-amp circuits that include other active components, such as transistors, it's even possible to multiply and divide analog voltages by taking the logarithms and anti-logarithms of input voltages.

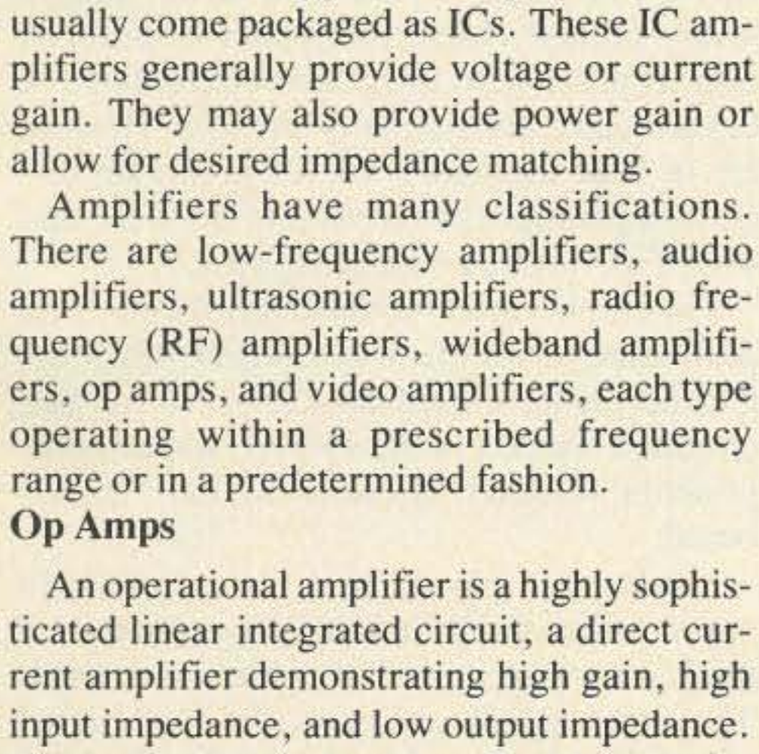


Figure 1. Schematic symbol of a typical op-amp.

"The op-amp is the most commonly used integrated circuit in the industry today."

The modern day device tends to operate at lower voltages and does not have any of the common problems associated with vacuum tubes. Today's op amps are in integrated circuit formats and still resemble the high gain direct current amplifier which uses external feedback for controlled responses. Users working with op amps see that they adapt well to a variety of industrial applications. They can be designed to function as filters, oscillators, pulse modulators, peak detectors, signal-function generators, small signal rectifiers, instrumentation amplifiers, and a seemingly endless variety of specialized circuit applications. The op amp is the most commonly used integrated circuit in the industry today.

The op amp schematic diagram looks like a triangle. (See Figure 1). There are two input terminals used to correctly address input signal information to the op amp. They are traditionally drawn on the left-hand side of the schematic symbol as represented in Figure 1. The input terminals are connected internally to a differential amplifier located inside the integrated circuit package. These terminals are the inverting and noninverting inputs and carry the symbols − and + respectively. The device also has one output terminal, located at the apex of the triangle, on the right-hand side of the schematic symbol.

Under normal operating conditions, an AC signal applied to the inverting terminal (−) with reference to ground is 180 degrees out of phase with the output signal. This inversion may be difficult to see with a single trace scope. A dual-trace oscilloscope, however, compares the input with the output signal, making the phase shift easy to see. An AC signal applied to the noninverting terminal (+) with reference to ground is in the same phase as the output signal.

Of course, the op amp needs supply voltages and external components added to operate correctly.

Circuit Configurations

Circuits using op amps commonly display properties radically different from those of the individual devices themselves. For example, the circuit's closed loop gain, A_{CL}, is only a fraction of the device's internal open loop gain, A_{OL}. In addition, the circuit input impedance is often much different than the operational amplifier's internal input impedance (although for some circuits it will be the same magnitude). Output impedance of the op-amp circuit is usually less than the op-amp device, but the bandwidth is usually greater in op-amp circuits. It's best then to make the first analysis of this circuit assuming an ideal op-amp situation, and then to modify the analysis for the imperfections in the real world of circuit design.

The ideal op-amp has the following five characteristics:

Infinite open loop gain	A_{OL} = infinite
Infinite input impedance	Z_{IN} = infinite
Zero output impedance	$Z_O = 0$
Zero offset voltage	$V_{OS} = 0$
Zero bias current	$I_{IB} = 0$

The previous assumptions are by no means complete. They are, however, the values which influence most other characteristics. The approximations simplify the analysis of operational circuitry. For example, the assumption of an infinite input impedance allows the experimenter to ignore the loss of any signal current into the amplifier's input terminal. The lack of bias current enables him to neglect the effect of this variable. Designers can apply these assumptions to many circuits.

Video Amplifiers

The video amplifier's characteristics are similar to those of the garden variety op-amp. Typical performance differences between the op amp and video amplifier are superior bandwidth and gain characteristics. Whereas both devices share "ideal" characteristics of infinite gain, zero output impedance, infinite input impedance, and an offset of zero, the video amplifier averages a typical bandwidth between 50 and 90 MHz. This compares very favorably with the bandwidth average of 100 kHz for typical op amps. Some video amplifiers have bandwidths as high as 100 MHz.

The gain of a video amplifier is usually adjustable between 0 and 400, which translates to 50 dB. This compares to 100 dB for op-amps. The internal phase shift of the video

"Some video amplifiers have bandwidths as high as 100 MHz."

amplifier doesn't allow the use of negative feedback to control gain. Therefore, most video amplifiers display a limited output voltage swing. For high-frequency operation, the output voltage swing is typically limited to just a few volts.

Input stages of common video amplifiers are designed so that, with the addition of a few external reactive components between the gain select terminals, the gain is easily varied. The video amplifier IC can be made to function as a high-pass, low-pass, or bandpass filter by altering the external reactive elements between the gain select terminals. If a potentiometer is placed between these terminals, the gain can easily be adjusted.

This project's differential video amplifier is the SK9017. Another integrated circuit is the NE592, manufactured by Texas Instruments. The SK9017 and the NE592 are similar video amplifiers that provide selectable amplification. Most video amplifiers have selectable gains of 10, 100, or 400. In addition, most video amplifiers have adjustable passbands. Study the manufacturer's specifications when planning to substitute another integrated circuit for the specified one. Specification sheets are readily available from the manufacturer or component dealer from whom the builder bought his op amp.

When reviewing the manufacturer's specification sheet, the designer sees that the input stage of the video amplifier consists of a basic emitter-coupled differential transistor pair connected to a constant-current-source transistor configuration. This arrangement is typical of video amplifiers available today.

Oscilloscope Preamplifier

A circuit containing a single SK9017 video amplifier, which is the only active component, can be used to increase the sensitivity of an older oscilloscope or frequency counter. The circuit in Figure 2 shows a circuit which provides about 20 dB voltage gain with a frequency range from 0.5 to 50 MHz.

The builder can extend the low-frequency response of this circuit by increasing the value of the 0.05 µF capacitor (or try removing the capacitor). This capacitor connects in series with the input terminal. Another advantage of this circuit is that it delivers a particularly small level of input noise, measured at approximately 20 µV over a bandwidth range of 15 MHz.

The gain is calibrated by adjusting the gain potentiometer connected between pins 3 and 10, as shown in Figure 2. One can adjust the 1 kΩ trimmer potentiometer for an exact voltage gain of 10, which helps preserve the scale factor of the oscilloscope.

Wiring Precautions

The mechanical layout of this oscilloscope preamplifier is very important. Keep all leads as short as possible. When using a PC board for this project, keep all foil conductors as wide and short as practical. This PC board technique helps provide a low resistance and low inductance signal path. It also minimizes stray signal feedback.

Adequate grounding is the most important wiring precaution in this construction. As with all high frequency circuits, use a ground plane and good grounding techniques. At higher frequencies, device capacitances between IC terminals reduce voltage gain in the preamplifier due to decreased capacitive reactance from an increase in frequency.

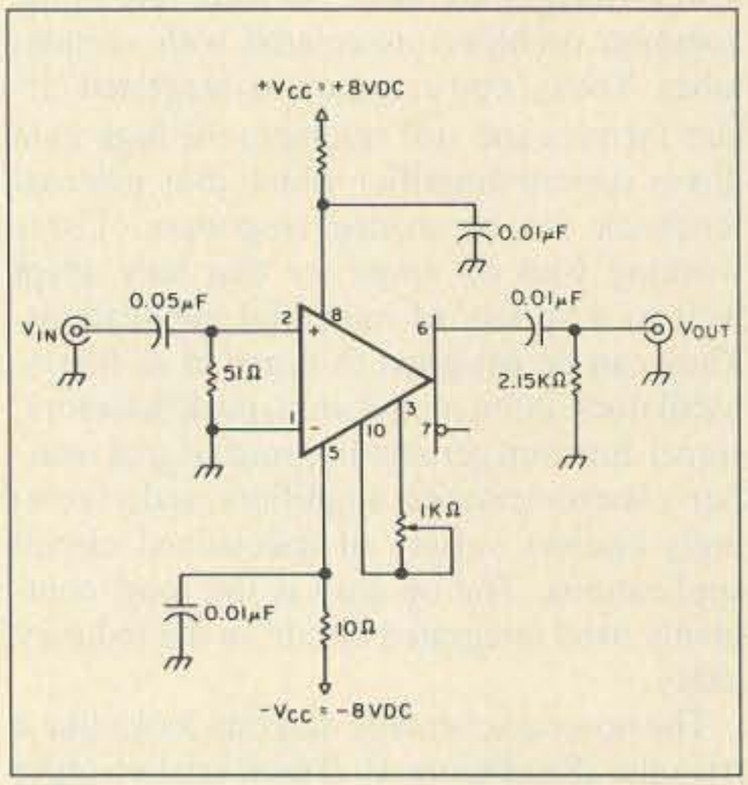


Figure 2. Schematic diagram of the oscilloscope preamplifier using an SK9017 integrated circuit. (Note that the IC pins are numbered differently for the Texas Instrument's NE592.)

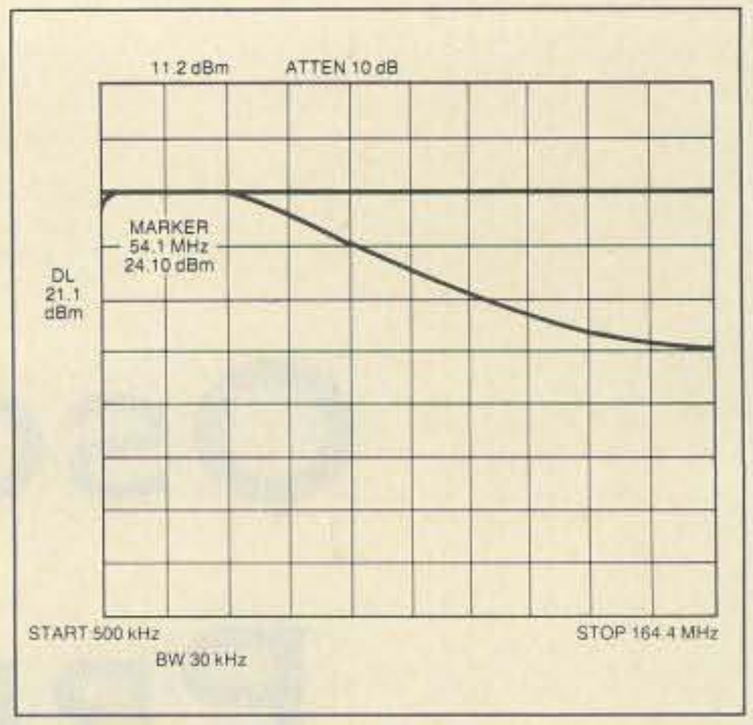


Figure 3. Swept frequency response of the oscilloscope preamplifier. (Note: the marker was set at the half power point, or −3 dB.)

While device capacitance between terminals affects the overall amplifier gain, the capacitance that exists between input and output terminals has the greatest effect. This condition is known as the "Miller Effect," and results in the effective capacitance being magnified by the voltage gain of the amplifier.

In summary, the ground plane should connect all unused areas of the pattern side of the printed circuit board. The ground plane then provides a low resistance, low inductance common return path for all signal and power returns, and reduces stray signal pick up.

Other Considerations

This circuit uses positive and negative DC voltages. To keep the supply voltage free of ripple and noise, bypass each power supply lead to ground. Solder the bypass capacitor as near as possible to integrated circuit pins. A 0.1 µF capacitor normally suffices. However, in high frequency and/or high gain circuits, a parallel combination of a 1.0 µF and 470 pF performs a suitable bypass.

The circuit easily mounted on a 4 cm x 5 cm perforated board that had a sufficiently large ground plane. I used no enclosure for this circuit. There are no IC sockets, and all components soldered directly to the "perf" board.

Single-point grounding is recommended in cases where point-to-point connections are used, or where a ground plane is not used. The input signal common, the load signal common, and the power supply common should be connected to the same physical point. This eliminates ground loops or common current paths which may cause signal modulation, distortion, or unwanted feedback.

Preamp Performance

I tested the oscilloscope preamplifier with a sweep generator and spectrum analyzer over a frequency range of 0.5 MHz to 164.4 MHz. Figure 3 shows the results.

As designed, the oscilloscope preamplifier provided a voltage gain of approximately 10 (±0.1 dB) from 0.5 MHz to 50 MHz. It actually only rolled off −3 dB at 54.10 MHz, and so exceeded specifications as shown in Figure 3. 73

Number 17 on your Feedback card

PROPAGATION

by Jim Gray W1XU

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

Ionospheric Propagation

Although there will be some good days, the month of August is NOT expected to provide exceptional HF propagation. The worst conditions happen sometime between the 12th or 13th and the 16th or 17th. On these days the magnetic field may be unsettled to active (A=10 to 30) and the possibility of a solar flare is likely. In this period the 14th, 15th, and 16th are likely to be the poorest days. The rest of the month is expected to exhibit Fair to Good conditions for propagation. The fall equinox, which will occur in September, continues to increase solar flux values and the usually good DX conditions surrounding.

For those interested in astronomical events, there will be a partial eclipse of the moon for North America. It can be seen best in the western part of the United States, on August 27th. Propagation conditions will not be affected in any way by the eclipse. Keep checking the daily chart for F=Fair; P=Poor; and G=Good propagation. Trends are shown by Double letters F–G, for example.

Permanent records of sunspot activity begin in 1611, only one year after Galileo invented the telescope. Until recently, observers didn't begin to unravel the secrets of the causes of sunspots. Galileo noted that the spots appeared close to the sun's surface, and that they seemed to rotate with the sun. He noted that the sun itself rotated on its axis once every 27 days or so (the lunar month).

AUGUST						
SUN	MON	TUE	WED	THU	FRI	SAT
	1 G	2 G	3 G-F	4 F	5 F	6 F
7 F-G	8 F-G	9 F-G	10 G	11 G-F	12 F-P	13 P
14 P	15 P	16 P	17 P-F	18 F	19 F	20 F
21 F–G	22 G	23 G	24 G	25 G-E	26 F	27 F
28 F-G	29 G-F	30 F	31 F-G			

F—Fair G—Good P—Poor

In the mid-1700s, after a 100 years or so of accumulated data, observers first noted the more or less regular pattern, with sunspot numbers increasing, decreasing, and disappearing, over approximately 11-year periods. Cycle periods so far have ranged between 9–12 years, the average being 11.2 yrs. No two sunspot cycles are exactly alike.

In 1908, special photographs of the sun, taken by Dr. Hale of California's Mt. Wilson observatory showed that large sunspots are surrounded by whirling masses of luminous gas. Six years later, Dr. Hale discovered that sunspots are the centers of extremely powerful magnetic fields. Scientists have since developed detailed theories about the origin and behavior of sunspots.

Some sources are predicting that Cycle 22 may well be the most active cycle ever. They expect peaking early, perhaps as early as 1989 or 1990, with extremely high solar flux values and frequent large solar/terrestrial disturbances. Cycle 22 will be a DXer's Delight. 73

73 Review *reviewed by Larry Ledlow, Jr. NA5E*

Radio Shack PRO-2004 Scanner

Top Performance at a Realistic Price

Radio Shack
Tandy Center
Fort Worth, TX 76102
Price: $420

The PRO-2004 scanner brings new life to reception of VHF and UHF signals. Radio Shack's latest entry in the wide coverage receiver market will knock the socks off just about any scanner enthusiast. This receiver boasts an abundance of features listeners only dreamed about a few years ago. Anyone who needs or wants serious scanning power between 25 and 1300 MHz should take a long, hard look at the PRO-2004.

The receiver is truly wideband, covering 25–520, 760–823.945, 851–868.945, and 896–1300 MHz. Note the conspicuous absence of the 800 MHz cellular telephone band. This coverage is easily restored with a simple modification (see the sidebar). The PRO-2004 features AM, narrowband FM (NFM), and wideband FM (WFM) demodulation, which are user-selectable on any frequency. The receiver also has the smarts to automatically select reception mode according to frequency.

With 300 memories in ten banks, listeners can customize their scanning by selecting any or all banks for reception. (Note that a simple modification will increase the memory to 400 channels!) Users can also lock out specific channels. To aid in searching such a broad frequency range, the receiver will memorize up to ten search ranges. Also, it will search in 5, 12.5 and 50 kHz steps at either eight or 16 steps per second (up to 20 steps or channels per second with modification). Now *that's* versatility.

A Closer Look

The PRO-2004 measures 2-⅞ × 10-¼ × 9 inches and weighs 7 pounds. Its front panel features 29 color-coded function and programming keys, volume and squelch knobs, dimmer and "sound squelch" buttons, a miniature headphone jack, and a multifunction green liquid crystal display. The LCD shows channel number, frequency, operation mode (SCAN, MANUAL, SEARCH, PRIORITY, PROGRAM), delay status, reception mode (AM, FM, WFM), step size, lock-out status, monitor channel/memory bank number, battery condition, and error status. The rear panel features external speaker and recording jacks, an input jack for 13.8VDC, memory backup battery compartment access panel, a sensible BNC antenna connector, a 10 dB attenuator switch, the AC power cord, and the CPU reset switch.

"Of course, a simple touch of the SCAN button initiates scanning across all 300 memories."

The 24-page operating manual is fairly complete with detailed function descriptions and operating instructions. It also lists a number of frequency ranges of interest, listening pointers, and troubleshooting tips. A schematic would have been nice. The block diagram printed in the manual is relatively uninformative, since it lacks information about the three intermediate frequencies, the sound squelch circuit (more on that below), and a few other items of interest. The manual does, however, recommend contacting Radio Shack's National Parts Department for the most accurate schematic and parts lists.

Getting started is straightforward. Programming a frequency into a memory requires only three steps: channel selection, PROGRAM mode selection, and frequency entry from the keypad. The scanner will accept any frequency within the bands listed above, but it will round off frequency values to the nearest 5 or 12.5 kHz depending on the band. For example, 101.143 MHz entered from the keypad will become 101.140 MHz in the memory.

Of course, a simple touch of the SCAN button initiates scanning across all 300 memories. Users can select the two second delay feature to cause the receiver to resume scanning two seconds after a transmission ceases. This is often adequate to catch both sides of a conversation, but I would prefer an adjustable

delay time, perhaps up to five or more seconds. Without the delay selected, scanning will resume as soon as the received signal drops. Listeners can force scanning to resume by hitting the SCAN button again.

The user can lock out unwanted channels by selecting them manually and hitting LOCK OUT. The LOCK OUT REVIEW button will display all locked out channels for easy review. Entire memory banks can be locked out by pressing the appropriate numbers in the scan mode. The receiver only allows one priority channel, but any of the 300 memories can serve as the priority channel. In scan or manual modes, this function will check the priority channel for activity every two seconds.

I strongly advise buyers to read the manual first and follow its step-by-step instructions. Listeners experienced with only Uniden or Regency scanners will find a number of mysterious functions on the PRO-2004 keyboard. They must also understand the importance and uses of the memory banks to best use the scanner's features.

Harnessing the Features

With such a wide frequency coverage, the PRO-2004 would be almost useless without its sophisticated search functions. An eleventh bank of ten memories serves as a temporary storage location during frequency searches. Further, the scanner will retain up to ten different search ranges, a handy feature that allows the listener to search for specific services with- out constantly reprogramming search limits.

"Best of all it's affordable!"

Suppose an operator wants to scan the two meter and 70 centimeter bands for repeater activity. He first selects the program mode, chooses the first search range with 1 LIMIT, enters 145 MHz (lower limit #1), hits the LIMIT key again, and enters 148 MHz (upper limit #1). He then chooses the second search range in a similar manner and enters 440 and 450 MHz upper and lower limits. These search ranges are retained, and the listener can select either one with two key strokes.

The DIRECT button will begin a search in a selected direction and without specific limits. Up or down arrows initiate search in their respective directions for both limit and direct modes.

When the listener hears a signal of interest, he can hit the MONITOR button to store it in one of ten temporary memories. These temporary memories are highlighted at the top of the LCD, and the selected one blinks on and off. To move a frequency from temporary to permanent storage, the user needs only to execute as few as three key strokes.

The Hidden Secrets of the PRO-2004

by Michael J. Senff KB6LCN

The PRO-2004 scanner was made to scan 25 MHz to 520 MHz and 760 MHz to 1300 MHz. The receiver had been modified so that it would not scan parts of the 800 MHz band. These frequencies are the cellular phone frequencies. When trying to program in a 800 MHz frequency, the unit will give an error message on the diplay.

After programming in all of the cellular, police, and air navigation frequencies, I found that I only had 90 channels left. I ordered the service manual and modified the unit to 400 channels.

The tools needed to modify the unit are: soldering gun (25-40 watts), solder and a phillips screw driver. A cloth or newspaper should be placed on the work area.

The unit should be unplugged from the wall outlet. Remove the four screws on the back of the scanner and slide the casing off. Turn the unit upside down so that the faceplate is closest to the constructor. Locate PC-3. This is the central processing unit or CPU printed circuit board. Remove the five connectors labeled cn 501, cn 502, cn 503, cn 504, and cn 505. Remove the seven screws on the edge of the circuit board and remove the board from the scanner. Turn the board over. Note the location of diodes D-502–D-515. D-513 *may* be on the underside of the board. There should be a diode close to the edge of the circuit board about one inch away. Remove diode 513-(D513). This enables the scanner to scan all of the 800 MHz band!!!

Take the removed diode and solder it to the position for D-510. This tells the CPU's ROM to access more memory in order to have 400 channels. A diode installed at D-514 will increase the scan rate to 20 ch/sec. Reassemble the scanner in reverse order. Make sure that all connections are made.

I hope these modifications were enjoyable. Remember that what is heard cannot be repeated to anyone or used for personal gain. It is for enjoyment only.

Diode Functions

d-510 In circuit, scanner will have 400 memories.
d-512 In circuit, it will step 30 kHz from 825-844.995 and 870-889.995 MHz.
d-512 Removed, it will step 12.5 kHz from 825-844.995 and 870-889.995 MHz.
d-513 In circuit, it will not scan 825.844.995 MHz or 870-889.995 MHz.
d-513 Out of circuit, it will scan all of the 800 MHz band.
d-514 In circuit, scanning rate increases to 20 channels per second.

(Ed note: These modifications are made at your own risk.)

Smart Squelch

The PRO-2004 has two squelches. One operates in a normal fashion, but the "sound squelch" feature is special. When the scanner stops at a frequency during scan, search or priority modes, the sound squelch checks for audio modulating the carrier. If the carrier is truly dead (unmodulated), then scanning will resume 0.5 seconds later with the sound squelch turned on. Noisy signals or those with low-level modulation may not be received properly with the sound squelch turned on. I did not find this feature very useful, but listeners in RF-congested areas may discover the sound squelch is essential.

The top-mounted, three-inch speaker provides plenty of audio for most environments, including my truck bouncing down some of the roughest mountain roads in this part of New Hampshire. Though obviously not designed as a mobile scanner, since it lacks a mounting bracket or holes to accommodate one, it worked quite satisfactorily sitting on the truck's floor or passenger seat. Speaking of audio, the tape output provides approximately 600mV into 10kΩ, which will easily drive most properly functioning recorders.

Tops!

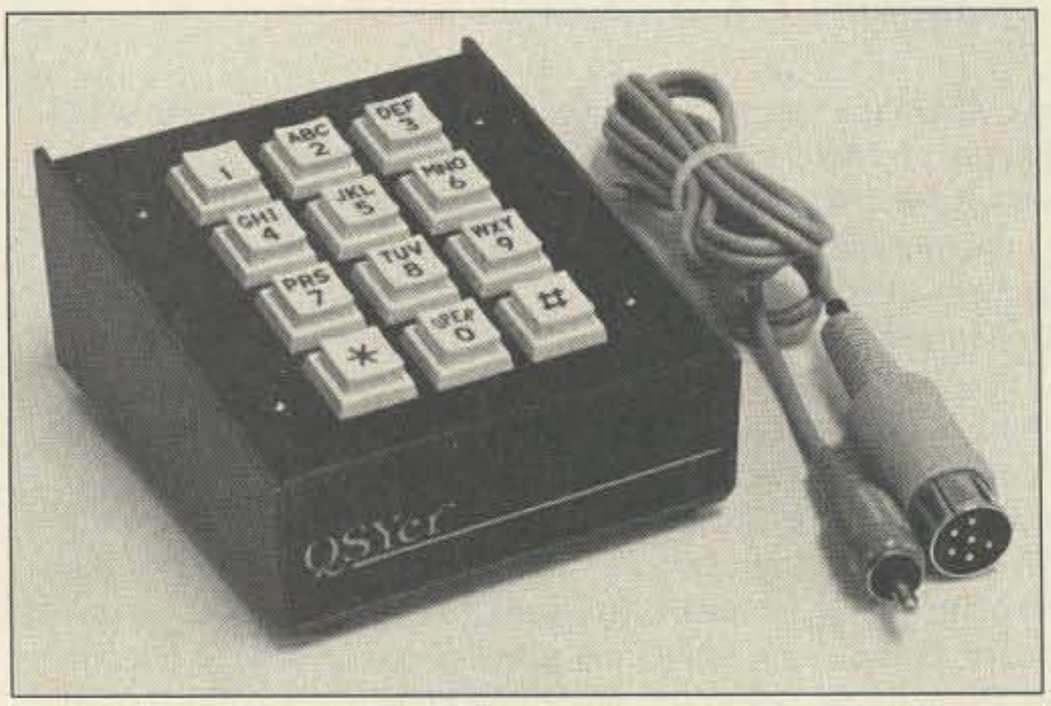
In short, I'm impressed. After more than three months in nearly round-the-clock use, my PRO-2004 scanner performed flawlessly. I hardly missed a cosmonaut's comments or a volunteer fire call. I've been a scanner buff for more than a decade, and the 2004 gave me almost everything I could want in a VHF receiver. I would have liked a signal strength meter, automatic frequency entry into memories during search, perhaps a video demodulator option, and even computer control facilities, but this little radio has a heck of a lot going for it. Best of all, it's affordable!

Radio Shack gives us listeners something to cheer about—the PRO-2004! 73

Number 19 on your Feedback card

NEW PRODUCTS

Compiled by Linda Reneau



PRODUCT OF THE MONTH

STONE MOUNTAIN ENGINEERING

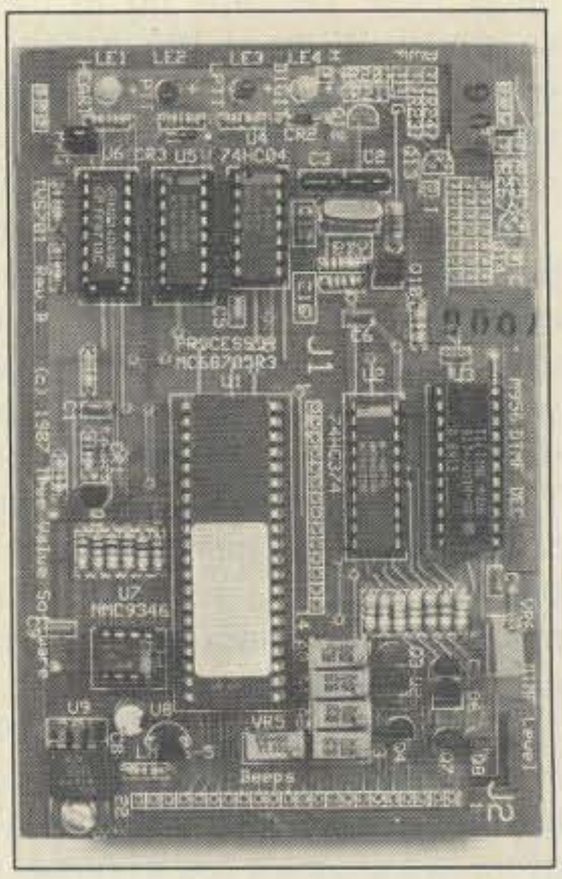
Stone Mountain's KW-QSYer for Kenwood rigs provides high speed keying and easy frequency selection. Its full-size keypad is inclined at a ten degree angle for comfort as well as speed. Popular with contesters and blind operators. The QSYer is a tiny computer terminal in an all-metal housing, measuring 3.1 x 3.5 x 2 inches. It has an internal speaker that sounds a different tone for each key. The KW-QSYer works with the TS-940 series (with the Kenwood IF-10B interface), the TS-440 series (with the IC-10 interface), the TS-140 series (with the IF-10C interface), the TS-711/811 series (with the IF-10A interface), and requires an 8–16 V, 100 mA, external DC supply. The sister models are available for the 757GX, 757GX-II, 767GX, and the IC-735. Priced at $89.50 plus $2.50 shipping. A companion 12-volt DC wall supply for the KW-QSYer is $10. For more information contact *Stone Mountain Engineering Company, Box 1573, Stone Mountain GA 30086; 404-879-0241.* Or circle Reader Service number 201.

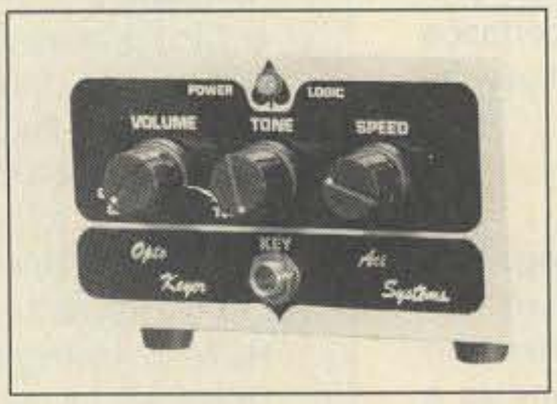
ELECTRONIC PROCESSING, INC.

The MRA-3 Multiple Receiver Adapter from Electronic Processing, provides SWL listeners and scanner owners with a way of connecting more than one receiver to an antenna. Using BNC jacks, the MRA-3 will connect up to three receivers to one antenna. With an internal amplification stage, the MRA-3 assures equal or better signal strengths than with the antenna connected to only one receiver. The MRA-3 is powered by 115 VAC at less than 5 watts. 12 volt DC models are also available on special order. Pricing starts at $69.95 and quantity discounts are available. Order from *Electronic Processing, Inc., Sales Department, PO Box 708, Medford NY 11763; 516-764-9798.* Or circle Reader Service number 210 for more information.

TRUE VALUE SOFTWARE

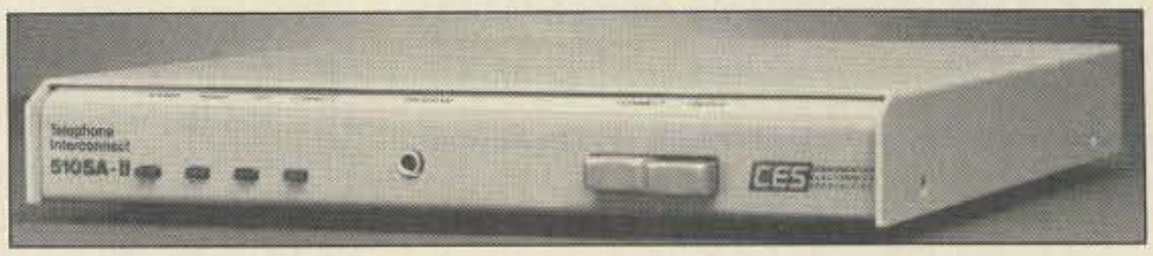
The True Value Software TVS701B repeater controller can be remotely configured without ROMS or jumpers. The unit offers voltage telemetry and alarms to monitor batteries and power levels. A watchdog timer and EEPROM protect the unit from power failure. TVS701B has 74 functions, four levels of control security, digital inputs and outputs for auxiliary control, and alarms. **Assembled and tested: $190.** For more information contact *True Value Software, 2805 E. Sherran Lane, Phoenix AZ 85016; 602-956-4259.* Or circle Reader Service number 202.





ACE SYSTEMS

Ace Systems offers the battery-operated Opto Keyer with a built-in speaker, isolated output with no mechanical T/R switching, reverse polarity protection, self-completing dots and dashes, LED status indicator for keying and battery. Price is $39.99 plus $3 shipping. All products are guaranteed for one year. Call or write for more information to *Ace Systems, RD 1 Box 83, Wilcox PA 15870; 814-965-5937.* Or circle Reader Service number 203.

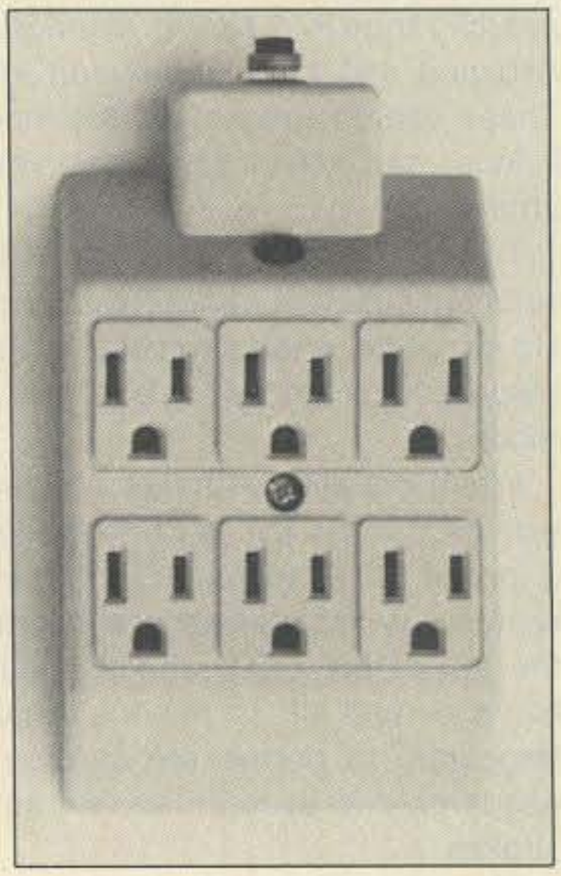


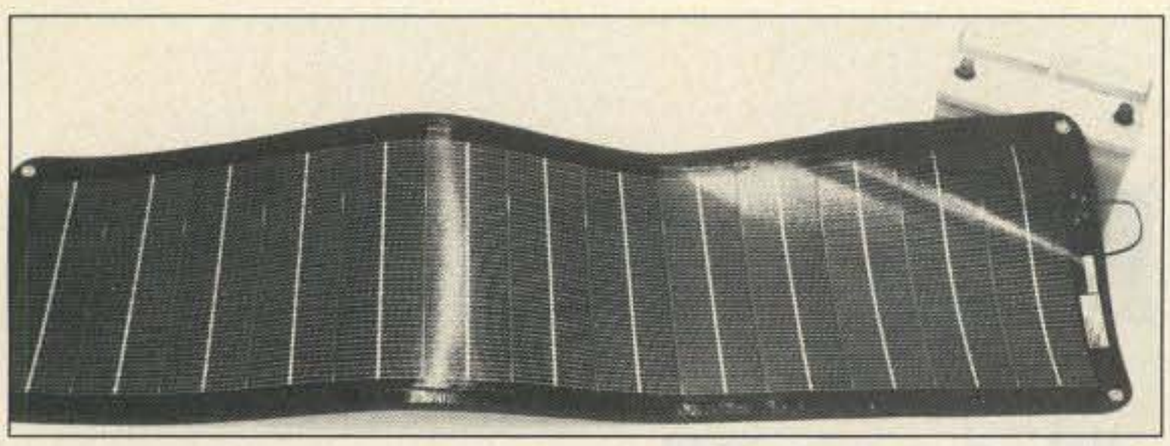
COMMUNICATIONS ELECTRONICS SPECIALISTS, INC.

CES has a new model 510SA-II telephone autopatch for fixed station and repeater applications. The 510SA-II has multi-digit DTMF connect code, activity timers, CW ID, toll restrict, and disconnect override code programmable with any DTMF telephone with security code access. Also, it has remote operation by security code, repeater logic control, reverse patch capability with automatic ringout on inbound calls. Accessories are also available. The list price is $583.33. Contact *CES, 931 S. Semoran Blvd., Suite 218, Winter Park FL 32792.* For more information circle Reader Service number 209.

SPI-RO MANUFACTURING, INC.

Spi-Ro Manufacturing's SP-6-CB surge protector, rated at 15 amps, 125 V, 60 Hz, is equipped with an EMI/RFI filter and UL-listed surge suppressor. It has 6 outlets and a resettable circuit breaker. Protects electronic equipment from voltage surges and spikes on the incoming power line. The maximum spike current is 4,500 amps. Priced at $29.95. Contact *Spi-Ro Manufacturing, Inc., PO Box 1538, Dept. S, Hendersonville NC 28793.* For more information circle Reader Service number 204.



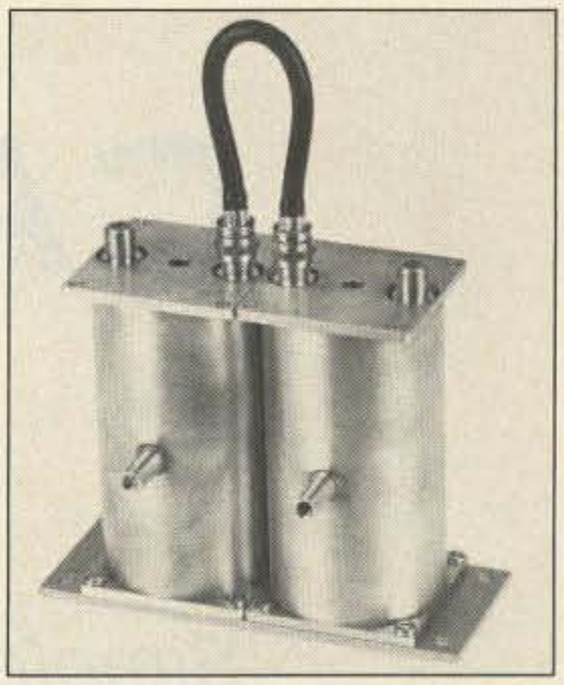


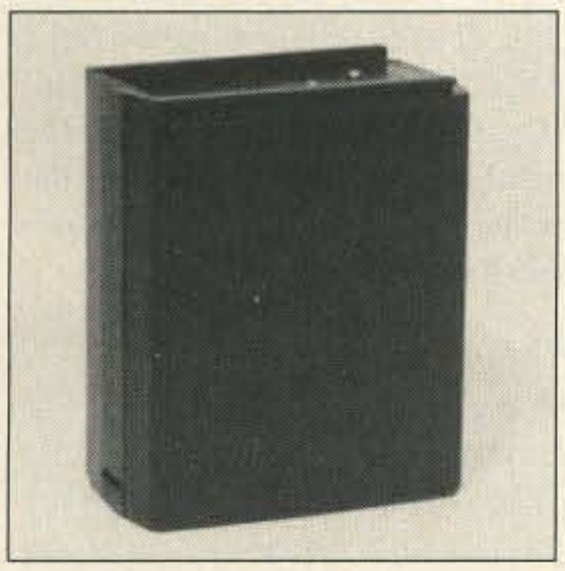
HAL-TRONIX and ANTENNAS WEST

SunFlex, a lightweight, durable, and flexible Sovonics solar battery charger, is available from Hal-Tronix. SunFlex is equipped with blocking diodes to prevent discharge of the battery at night or on cloudy days. MA-2, the most compact generator, can be plugged into a cigarette lighter. MA-3 maintains boat or RV batteries. The MA-5 can power portable radios. MA-10 gives standby power for deep discharge batteries. MA-20 is useful for versatile mounting applications, and MA-30 may be used for single applications or arraying. The price range for these product is $80 to $475. Contact *Hal-Tronix, 12671 Dix-Toledo Hwy., Southgate MI 48195. Antennas West address is 1971 N. Oak Lane 1300 E., Provo UT 84604; 801-374-1084.* Circle Reader Service number 208 for more information.

MICROWAVE FILTER COMPANY, INC.

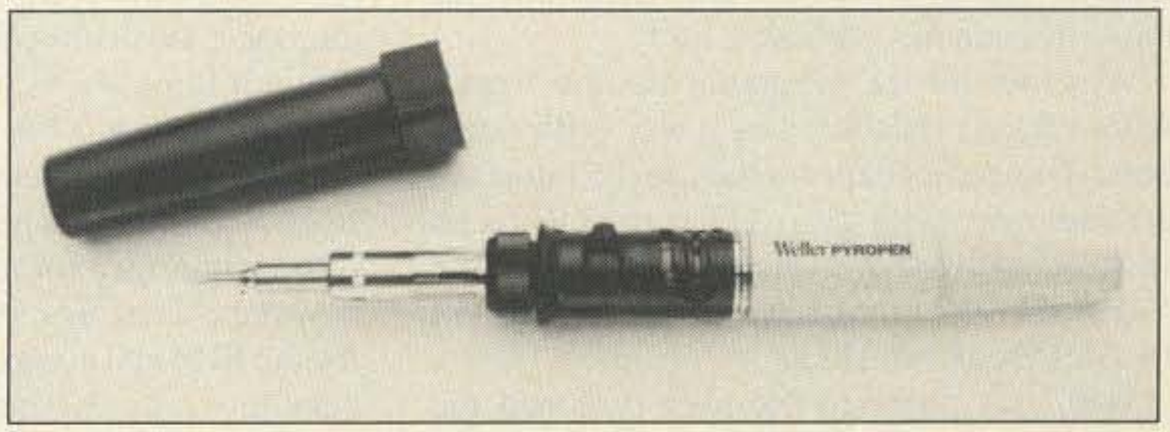
Microwave Filter Company has a series of 6556 notch filters. Installed in the filters is a block band to eliminate strong terrestrial interference and to clear a dedicated service channel. These filters are pretuned, but are adjustable in frequency and bandwidth. Model S6556 is a single notch filter. While Model D6556 has two notches with 10 MHz below and above channel center. Notch loss is 16 dB minimum at the factory set bandwidth of 3 MHz. The units may be retuned +/− 25 MHz minimum. They have type F connectors and an impedance of 75Ω. The price of the S6556 is $139, and the D6556 is $249. Contact Linda DeCoursey for a copy of Bulletin 09, which describes this series of filters. For technical information, contact *Steve Shafer, Microwave Filter Company, Inc., 6743 Kinne St., East Syracuse NY 13057; 800-448-1666 or call collect 315-437-3953 for New York, Hawaii, Alaska, and Canadian residents.* For more information circle Reader Service number 212.





PERIPHEX, INC.

Periphex has a new battery pack for the Kenwood TR-2500/3500 and the TR-2600A/3600A. The PB-25S/26S, 8.4 V/900 mA battery pack has double the capacity of the original PB-25 or -26 packs. It is compatible with the Kenwood ST-2 base charger, MS-1 mobile charger, and the trickle wall charger. The PB-25S/26S includes overcharge, over temperature, and short circuit protection. Priced at $65 plus $3 shipping. Contact *Periphex, Inc., 149 Palmer Road, Southbury CT 06488; 800-634-8132. In CT, 203-264-3985.* For more information circle Reader Service number 206.

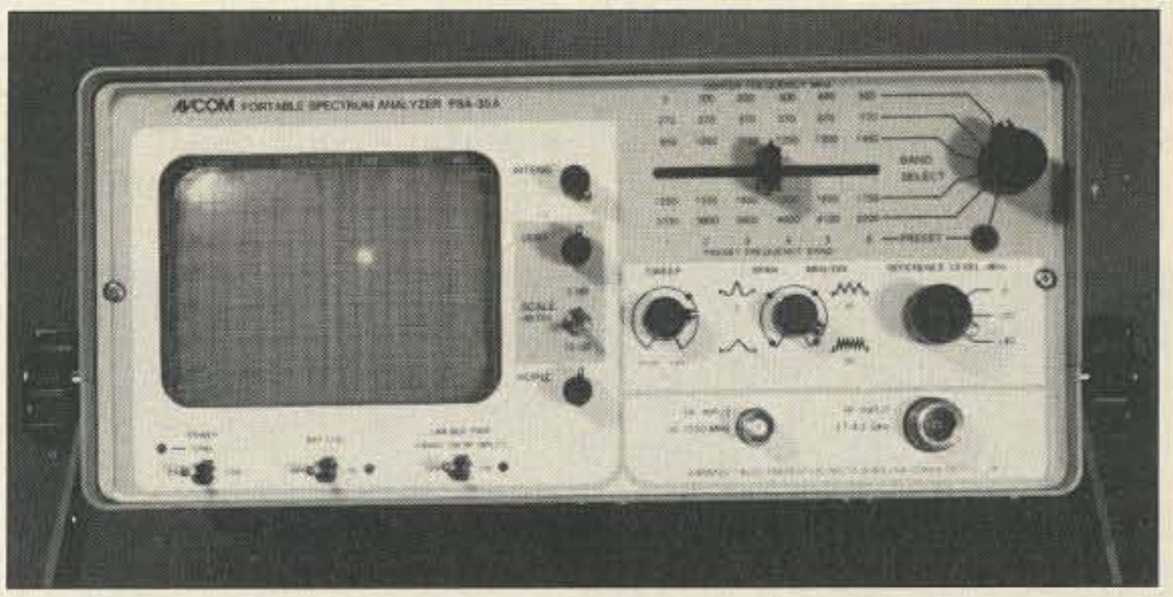


CooperTools™

The Weller® Pyropen from CooperTools™ may be used as a soldering iron or hot air gun. With push-button ignition, it's useful for single-handed and field operation. The 4.4-ounce cordless Pyropen has about three hours burning time before it needs refilling. The price is $76.40 and it is available from *CooperTools™, PO Box 728, Apex NC 27502.* For more information circle Reader Service number 205.

BRADLEY & ASSOCIATES MARKETING

Available from Bradley & Associates is the 13 ½lb LVM-3 Wind Generator, made by L.V. Motors, for charging 12/24 V lead acid batteries. It incorporates a 12-pole, 3-phase permanent magnet alternator, 30-inch diameter fan, an aluminum tail fin, and requires no special installation. The LVM-3 generates high output at moderate wind speeds. It is thermally protected from overloading during periods of constant high winds. An optional shunt regulator to prevent battery overcharge at an unattended installation is also available. The suggested retail price is $1,098. *LVM/Bradley & Associates Marketing, 5147 South Harvard, Suite 123, Tulsa OK 74135.* Circle Reader Service number 207 for more information.



AVCOM

Avcom introduces the PSA-35A Portable Spectrum Analyzer with a standard center frequency band, calibrated from 1250 to 1750 MHz to cover European BDC frequencies. Also included is a switch selectable 2 dB/division or 10 dB/division sensitivity function. Avcom's PSA-35A also covers 10 to 1750 MHz and 3.7 to 4.2 GHz, a built-in DC block with +18 VDC for powering LNAs and LNBs, signal amplitude display, and rechargeable battery with charger. Priced at $1,965. For more information contact *AVCOM of Virginia Incorporated, 500 Southlake Blvd., Richmond VA 23236; 804-794-2500.* Or circle Reader Service number 211.

CAT to RS-232 Interface

Simple computer control for Yaesu Equipment

by Mike Roberts N9CLX

With the advent of today's modern radios comes the convenience of memory channels. Some rigs have a few and others have hundreds. This is a very nice feature, but how can anyone remember all those frequencies without a list?

Why not let the computer do the work? After all, the machine has a way with numbers. This project allows the user to interface a Yaesu radio with a PC. I have tried using an IBM PC with a shareware program called the Yaesu FT-757 GXII CAT Program, written by Dick Roux N1AED.

With this program the user can read the status of most front panel controls (including S-units) or change them from the keyboard. Also featured is a station directory in which the user can store names, frequencies, and modes on disk. Then, by punching a couple of keys, the station directory is loaded into the radio.

This program is available on several bulletin board systems. Dick's latest version (2.0) is no longer available as shareware. This latter version is very smooth running and allows 480 entries in the station directory. It will run on a color or monochrome system. More information on this program may be obtained from Dick for an SASE.

One-Evening Project

If using a Yaesu rig with the CAT system feature, and an IBM or compatible PC, the only additional component needed is a logic interface. Basically, this circuit converts the +5 volt logic levels in the transceiver to the RS-232 standard for connection to a serial port. The idea of controlling a transceiver from a computer is not new; after all, Yaesu sells an interface for under $100. They do not however, as of this writing, have a program for the IBM and compatibles. This project is a very low cost alternative to the commercial device. I assembled this project in one evening, although it was a late one! All parts except the mini-DIN connector are available at Radio Shack.

Circuit

This is a fairly simple project consisting of only two CMOS devices, the MC1488 transmitter chip, and its companion the MC1489 receiver. Data from the computer is taken from pin 2 (transmit) on the serial port and is routed to pin 1 of U1. U1 changes the signal level from plus and minus 10 volts to 5 volts on its pin 3, which connects to pin 3 (serial input) on the CAT jack. C1 is included to prevent false triggering on transient waveforms.

The other half of this circuit functions similarly, but in reverse. Data from pin 2 on the CAT jack (serial out) goes to pin 2 on U2. U2 changes 5 volt signals to plus and minus 10 volts on pin 3, and this connects to pin 3 (receive) on the computer's serial port. R1 is a pull down resistor on the input of the transmitter chip. It keeps the voltage on pin 2 below two volts when the data link is idle. Jumpers between pins 4–5, and 6–20 on the DB-25 connector are necessary to provide the computer's serial port with the proper handshaking signals for an online state.

Construction

Since there are only a few connections to make, I assembled this circuit on a Radio Shack dual IC board (see parts list). Just keep track of the pin numbers and solder the wires to the pads around the edges of the board. The layout is not critical, but to avoid loops, tie all signal grounds together at one point with the power supply common lead.

Sockets can be used for the IC chips for easy replacement in case of trouble in the future. The user can also use sockets for the data connectors, but since it's much easier to just drill a hole, I opted to solder the leads directly to the circuit board. First install all the components on the board and wire in jumpers where necessary. Then pass the cables through the holes drilled in the cabinet and solder the free ends to the board.

A bipolar power supply is required for this circuit. I have included a sample diagram of a typical supply of this type. The power transformer is a small plug in type. Output voltage should be somewhere between 14–18 VAC at

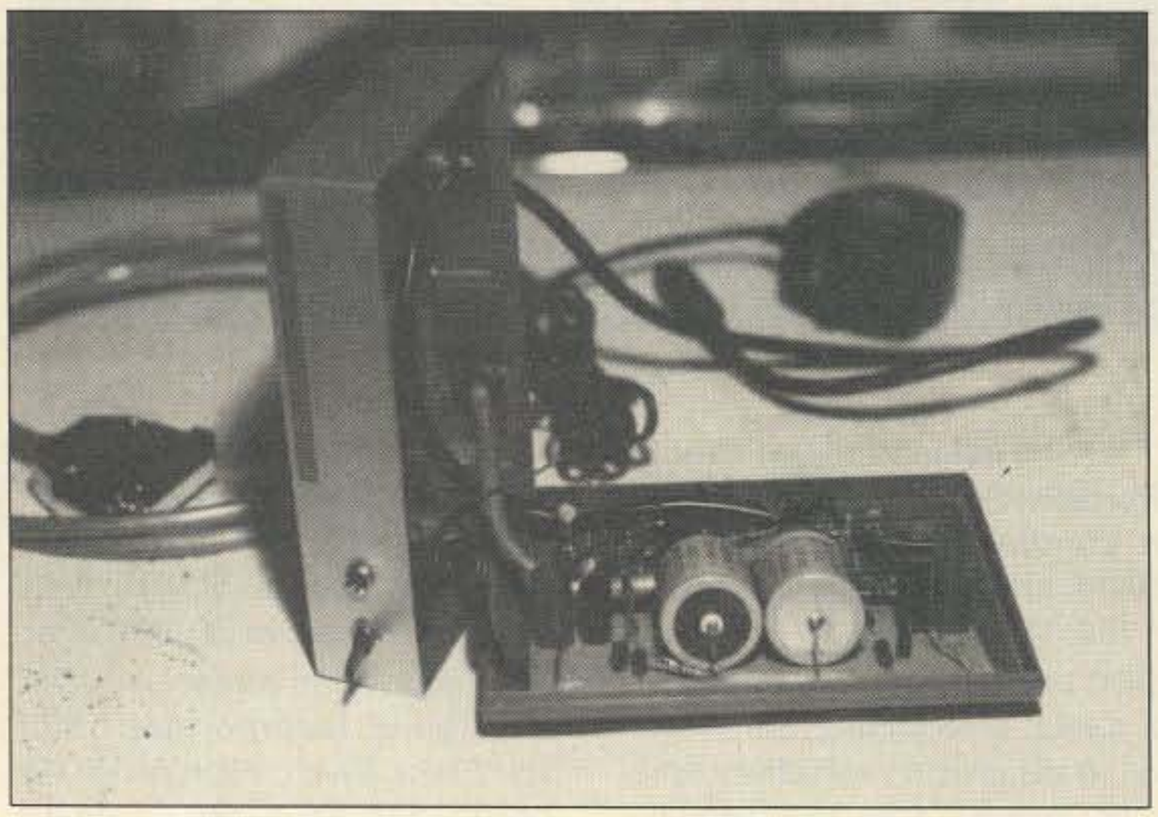


Photo A. Inside the CAT to RS-232 Interface.

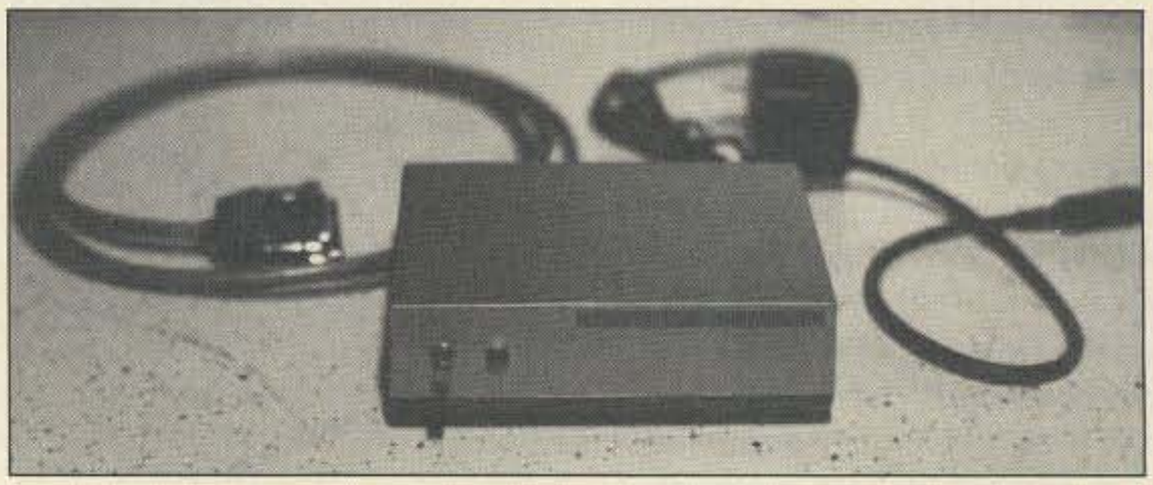


Photo B. The completed interface.

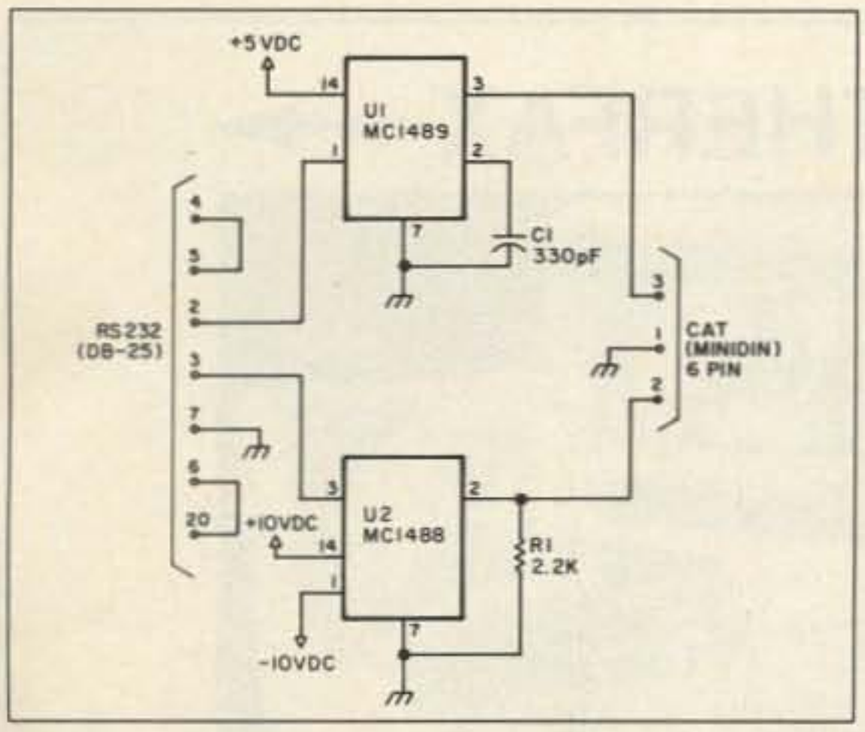


Figure 1. The circuit schematic.

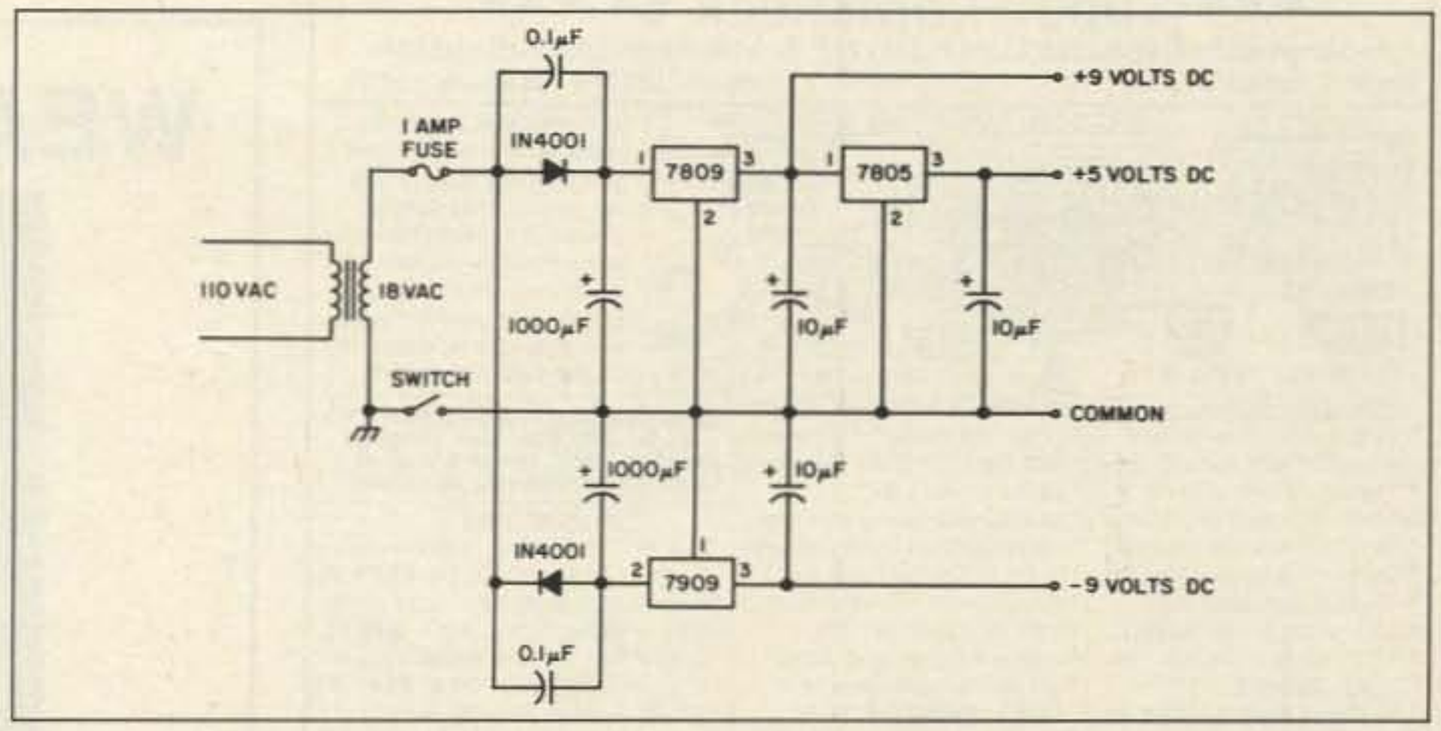


Figure 2. Typical power supply.

50 mA or better. For regulation, 78XX and 79XX series three terminal devices can be used. These can be 9 or 12 volt chips for the driver, and 5 volts for the receiver chip. The RS-232 port is not too fussy. It will work from plus and minus 7–15 volts. U2, however, requires five volts, which is its maximum source voltage. Supplies of this type are well documented in past *73* issues and ARRL handbooks.

Use twisted pair shielded cables for the signal lines. This will keep out stray RF and magnetic fields emanating from within the shack. Since the rigs and serial ports have RFI suppression built in, I did not use any additional measures. If RFI is a problem, try putting some ferrite beads on the cables.

The CAT jack on the transceiver is a six-pin mini-DIN type. If the user has an 8-pin type, it can be modified by carefully pulling out the two center pins from the back of the plug with needle nose pliers. The DB-25 connector is usually a female type, but don't tempt Murphy, eyeball the port first. Jumper the pins as shown in the diagram. This allows the port to operate in full-duplex mode without any additional control signals.

```
                    *** STATIONS DIRECTORY ***

  1  - AFRTS (15mhz)                    21  - CBC Canada (6mhz)
  2  - V. OF FREE CHINA (15mhz)         22  - Vatican Radio (6mhz)
  3  - AFRTS (6mhz)                     23  - KNLS- Alaska (6mhz)
  4  - HCJB - ECUADOR (6mhz)            24  - Radio Yugoslavia (7mhz)
  5  - R. NETHERLANDS (6mhz)            25  - Radio Kiev (9mhz)
  6  - VOICE OF TURKEY 9mhz             26  - Radio Mongolia (12mhz)
  7  - R. JAPAN (9mhz)                  27  - Radio Denmark (15mhz)
  8  - R. CAIRO (9mhz)                  28  - Radio San Gabriel (15mhz)
  9  - BRT - BELGIUM (6mhz)             29  - Radio Moscow (7mhz)
  10  - WWV (15mhz)                     30  - Voice of Greece (9mhz)
  11  - BBC-LONDON (9mhz)               31  -
  12  - CFVP-CALGARY(6mhz)              32  -
  13  - France International(9mhz       33  -
  14  - WRNO Worldwide(6mhz)            34  -
  15  - Radio Australia (15mhz)         35  -
  16  - Radio Moscow (5mhz)             36  -
  17  - Radio Moscow (9mhz)             37  -
  18  - Voice of America (6mhz)         38  -
  19  - Voice of America (9mhz)         39  -
  20  - US Armed Forces(6mhz)           40  - WLUP (chicago) 1mhz
ENTER SELECTION, <E>DIT, <Q>UIT, <L>OAD OR <ENTER> FOR NEXT PAGE?


                  *** TRANSCEIVER STATUS DISPLAY ***

SCAN MODE = OFF                          DIAL UNLOCKED
BAND = 4.0 -> 7.5 MHZ                    SPLIT OFF
SELECTED MEMORY = 6                      CLARIFIER OFF
                                         'A' VFO ACTIVE
OPERATING FREQ = 7354 KHZ                VFO OPERATION
SELECTED MODE =AM                        RECEIVE
                                         HAM BAND MODE
VFO A FREQ = 7354 KHZ
VFO A MODE =AM                           SIGNAL STRENGTH = S9

VFO B FREQ = 9979.55 KHZ
VFO B MODE =USB

CLARIFIER FREQ = 14259.67 KHZ
CLARIFIER MODE =USB

MEM #0 FREQ = 15000 KHZ ---> AM          MEM #5 FREQ = 5000.03 KHZ ---> AM
MEM #1 FREQ = 7082.95 KHZ ---> LSB       MEM #6 FREQ = 10000.09 KHZ ---> AM
MEM #2 FREQ = 29433.59 KHZ ---> USB      MEM #7 FREQ = 6230 KHZ ---> AM
MEM #3 FREQ = 21233.51 KHZ ---> USB      MEM #8 FREQ = 6020 KHZ ---> AM
MEM #4 FREQ = 29407.09 KHZ ---> USB      MEM #9 FREQ = 9600.03 KHZ ---> AM
   HIT <ENTER> TO RETURN TO MAIN MENU


          --- YAESU FT-757GX MK II CAT PROGRAM ---

                1 - STATUS DISPLAY
                2 - CONFIGURATION DISPLAY
                3 - STATIONS DIRECTORY
                4 - EXIT TO DOS
              SELECTION?
```

Operation

Now for the easy part, the adjustments. There are no pots or anything to tune. First verify that the mini-DIN plug has no more than 5 volts on any of its pins. Next comes the DB-25, which should have no more than plus or minus 15 volts on pins 2 or 3. Now plug in the connectors and power everything up.

The CAT program I mentioned earlier is configured to use COM 1, so make sure that the interface is plugged into COM 1. After starting up the program and answering the questions, the user should be at the main menu. From there just follow the prompts, and have fun!

If for some reason a problem occurs, a digital voltmeter can be used to see if data transitions are occurring on the line. Try sending a command from the keyboard while monitoring pin 2 on the DB-25. If the user gets a quick voltage swing, all is well so far. Now move to pin 3 on the mini-DIN connector and try again. Troubleshoot the U2 side of the circuit in the same manner. Problems caused by U1 will show up as inability to access the transceiver. Inability to get a status display would point to a bad U2, if the configuration portion works.

Use Your Imagination

For those fluent in programming language, there are many possibilities for this device. How about assembling a program to compensate for doppler shift during an OSCAR pass? Or maybe a small basic program that would tune in WWV at preset times, input the signal strength and store the data in a disk file. The user could then recall the data to compare notes on propagation prediction charts.

I have found the CAT-to-RS-232 interface to be a very handy device, used to enhance the operation of a modern transceiver. An excellent way to control all those bells and whistles. If the user has any problems or questions, I can be reached via the WA9UXP BBS/145.070 MHz, located in northern Indiana.

The CAT757 GX program is available from Dick Roux N1AED, 25 Greenfield Drive, Merrimack, NH 03054. 73

PARTS LIST

1. 2.2k resistor
2. MC1488 driver (276-2520)
3. MC1489 receiver (276-2521)
4. 330pF capacitor
5. Dual IC PC board (276-159)
6. DB-25 connector (female) (276-1548) & (276-1536)
7. 6 pin mini-DIN connector (cat. #N7372) Edlie Electronics
8. LED
9. SPST switch
10. Cable (twisted pair w/shield)
11. Cabinet (270-210)
12. Power Supply, +5VDC, ±15VDC (see text)

Solder Iron Auto Shut Off

A redeeming safety switch

Robert P. Krieger, Jr. KAØQHV

Hams who can begin a soldering project and run from start to finish uninterrupted are truly fortunate. This device was put together for the other 99% who must work our construction time around obstacles. Backyard dog and kid fights are common and usually go from "noisy" to "painful" quickly if not broken up. The wife's car requires constant maintenance, and friends with broken TVs, radios, CBs and other electronic goodies appear regularly to get in the way of a non-stop start-to-finish job.

Returning to the shop to find a solder iron tip burnt to a black flaky crisp, after being left on for two days, got old fast. It also happened often enough to initiate a search for a time controlled auto-shut-down circuit for the iron. Straight timing circuits are useful, but they usually wait until the wrong moment to automatically shut off without warning.

Helpful Reminder

This project will not solve all the problems around the shop, but it can help with the two previously mentioned. The heart of this device was published nearly 10 years ago as a circuit fragment.[1] It has worked well in many modified ways for a long time. Basically this circuit, when turned on, will time 15 minutes (approximately) then shut off. . .BUT. . .20 seconds before it shuts off, it will give a one second tone telling the user to reset the timer for another 15 minutes, if a hot iron is still needed.

In an attempt to maintain "quick and easy" project status, theory will be brief. Essentially we have: 1) a regulated power supply; 2) a logic and timing circuit; 3) an optically-isolated high voltage control circuit.

CMOS "NAND" gates are wired as one-shots, and a tone generator controlled by RC time constant, make up the heart of the logic circuit. Regulating the power supply will help to keep timing consistent and an optically isolated Triac handles the job of AC switch.

There are actually three RC timers here. R8 and C1 control the initial time on period (15 minutes). R6 and C3 determine how long the tone is produced (one second). R2 and C2 vary on how long the device stays on AFTER the tone (20 seconds).

The RC combinations are flexible and can be varied to the individual needs but bear in mind, an unattended soldering iron can start a fire in less than 15 minutes, so this project also has a redeeming safety value.

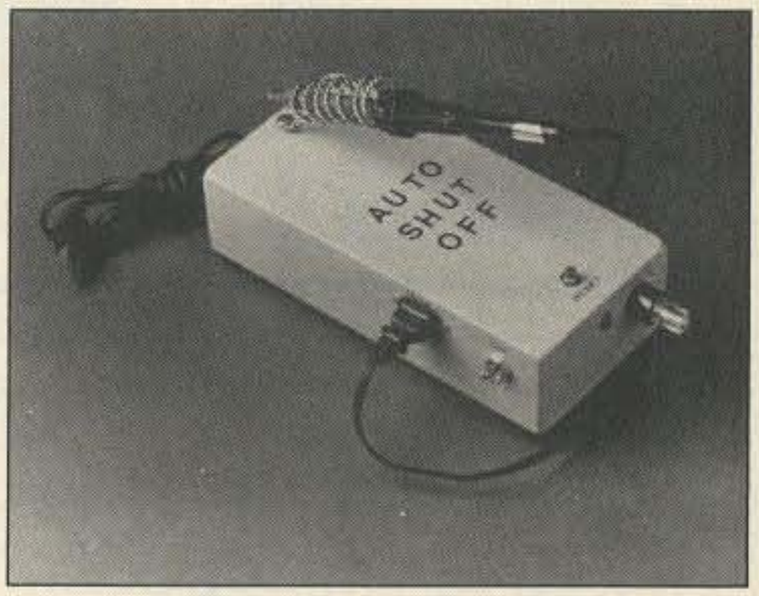


Photo A. Completed project with solder iron in holder. Fuse and LED mounted on end of the box.

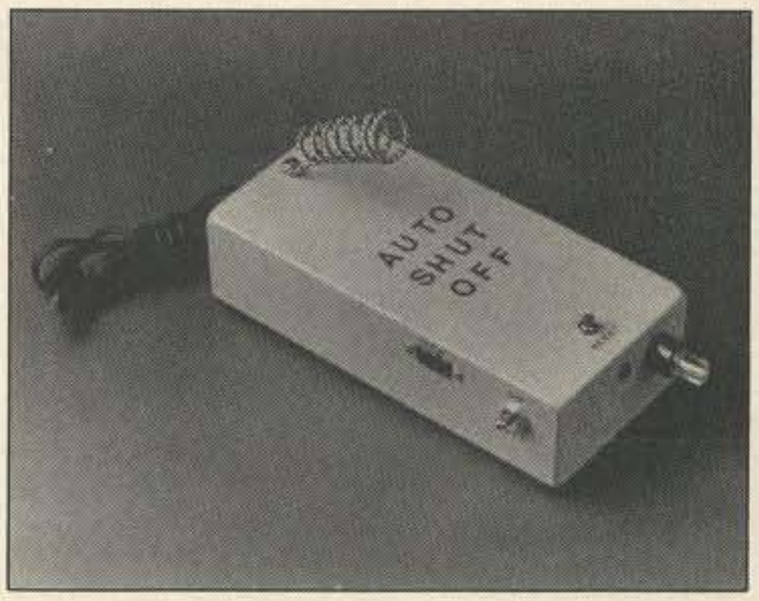


Photo B. Completed project showing line socket and switch on side, reset button and iron holder on top, fuse and LED (D-6) on end of box.

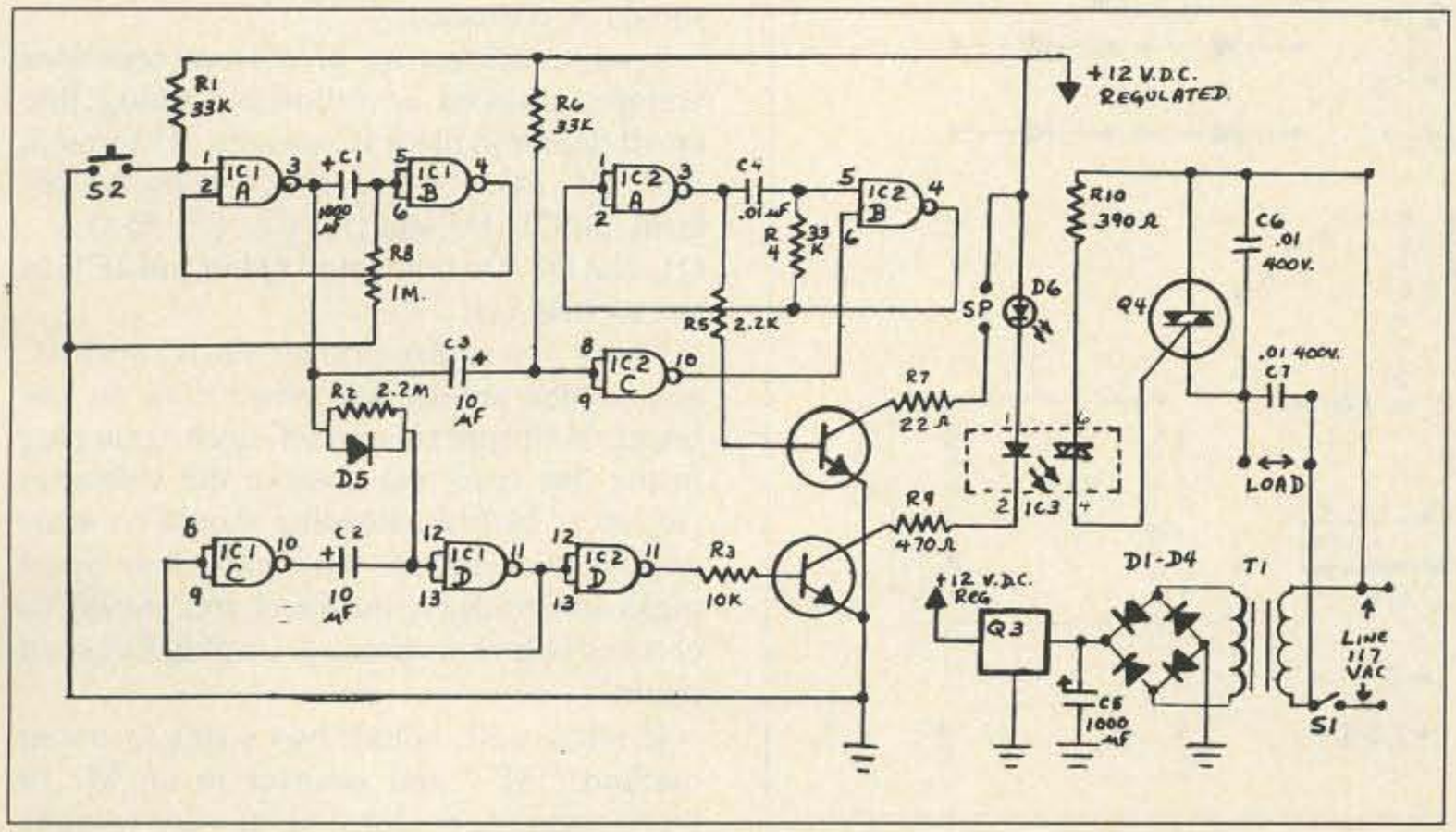


Figure 1.

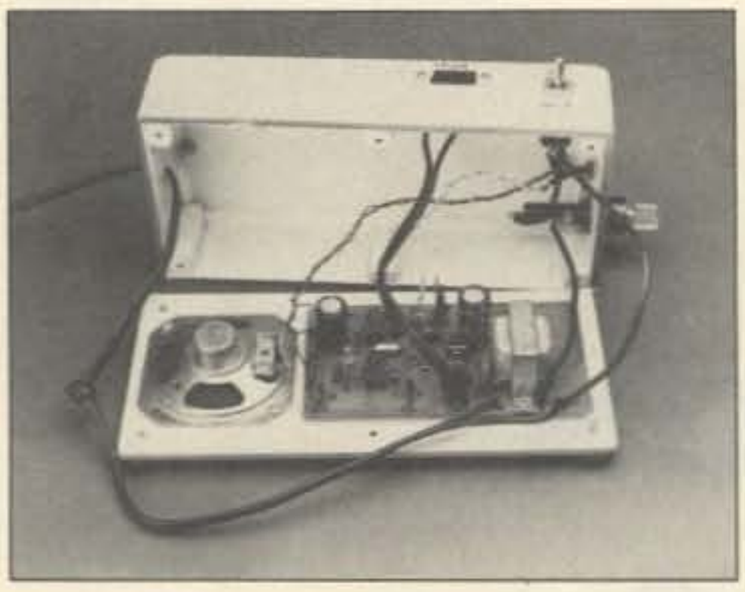


Photo C. Parts placement in plexiglass box. Note: series wired switch and fuse. Also D-6 mounted next to fuse using extension wires.

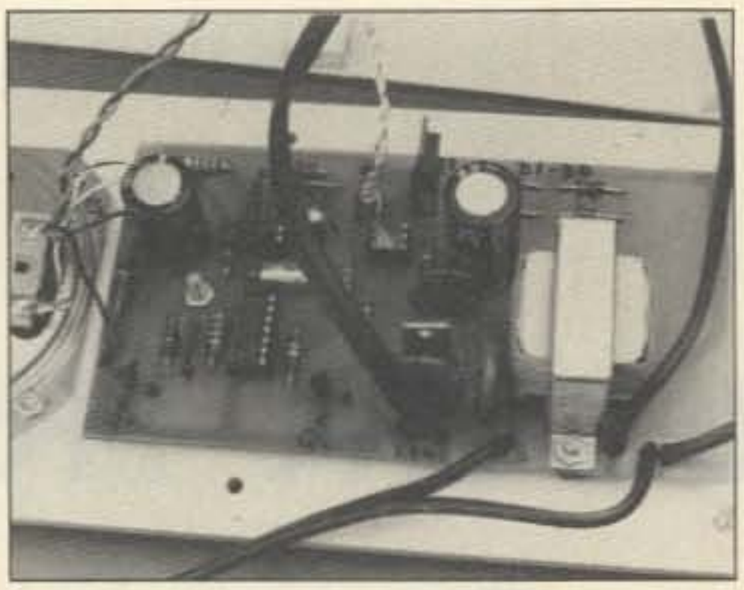


Photo D. Closeup of PC board. Note: Orientation of diodes D1–D4, also Q3, voltage regulator and IC chips.

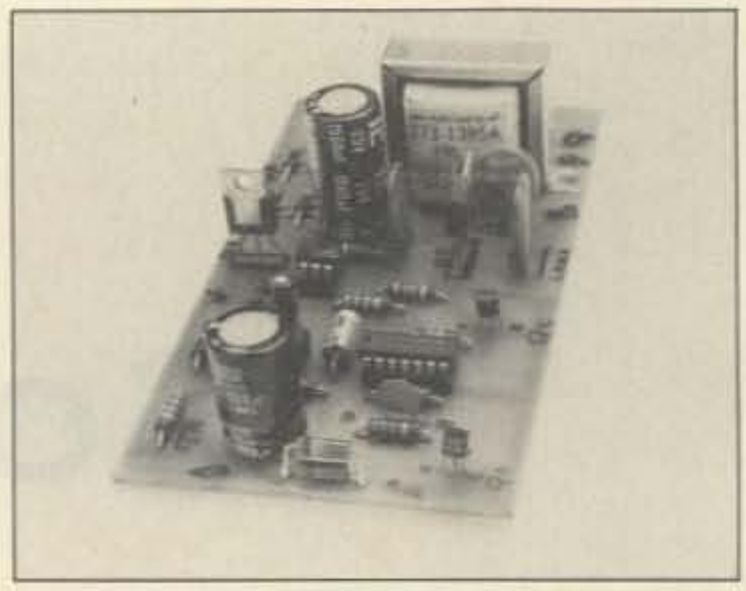


Photo E. 10kΩ resistor tack soldered piggyback to R8 in foreground. Note: Orientation of transformer, Q3, Q4, IC2 and IC3.

All parts, with the exception of the female 117 V line socket, are available at Radio Shack for about $30 total. Mail order shopping can cut the expense markedly and a well stocked junk boxes could yield virtually all the parts. The line socket is available at nearly any hardware store.

There is nothing exotic about the circuit, point-to-point wiring or a printed circuit board will work.

Using the PC board

Read the entire process, then place the transformer so the secondary faces the short end of the board. Solder each part when installed except when noted. Install diodes D1–D4 observing polarity. Install capacitor C5 (1000uF 25 V radial) voltage regulator Q3. The side with the numbers on voltage regulator (Q3) should face D1–D4. Temporarily solder a short piece (about 12 inches) of wire in the hole at point "C"–solder another short piece of wire (about 12 inches) in the point "B" hole. Connect a DC voltmeter to these points–"C" being positive. Solder test line cord in holes at "D" and "E."

A few words concerning test cords and safety is in order at this point. If constructed as in Figure 4, the test cord is useful for testing transformers and other temporary connections to line-operated devices (this project included). The user *must* put the fuse in the "hot" line, and use a polarized plug. If the fuse and polarized plug are left out, it creates what the old timers call a "suicide cord." The results may be a nasty shock and possible burns, or worse, "Permanent Ground Potential"(R.I.P.).

The next step utilizes 117 VAC line voltage. Use common sense and be careful. Time for the first smoke test. Plug in the line cord and observe the voltmeter. The transformer may rattle if not bolted down–this is normal. Proper indication is 12 volts DC plus or minus 5%. (11.4 to 12.6 VDC is acceptable.) Record the voltmeter reading. Any large variation from 12 VDC means trouble and should be corrected.

Upon confirmation of correct regulated voltage, proceed as follows. **Unplug line cord!** Solder in place IC sockets, R1 through R10, D5, D6, C1 through C4, (observe polarity on C1, D5 and D6) C6, C7, M.O.V., Q1, and Q2. **Do not install Q4 or put IC's in the sockets yet!**

Check for solder bridges on IC sockets, and solder splash anywhere else on the board. If all appears correct, once again plug in the line cord and observe the voltmeter (set up as before). Reading should be same as earlier recorded. Any variations again mean something is incorrect and should be checked before continuing. **Unplug line cord again!**

If all is well, solder two wires to points marked "SP" and connect to an 8Ω or more speaker. Solder a short wire to point "A", then connect wires from points "A"

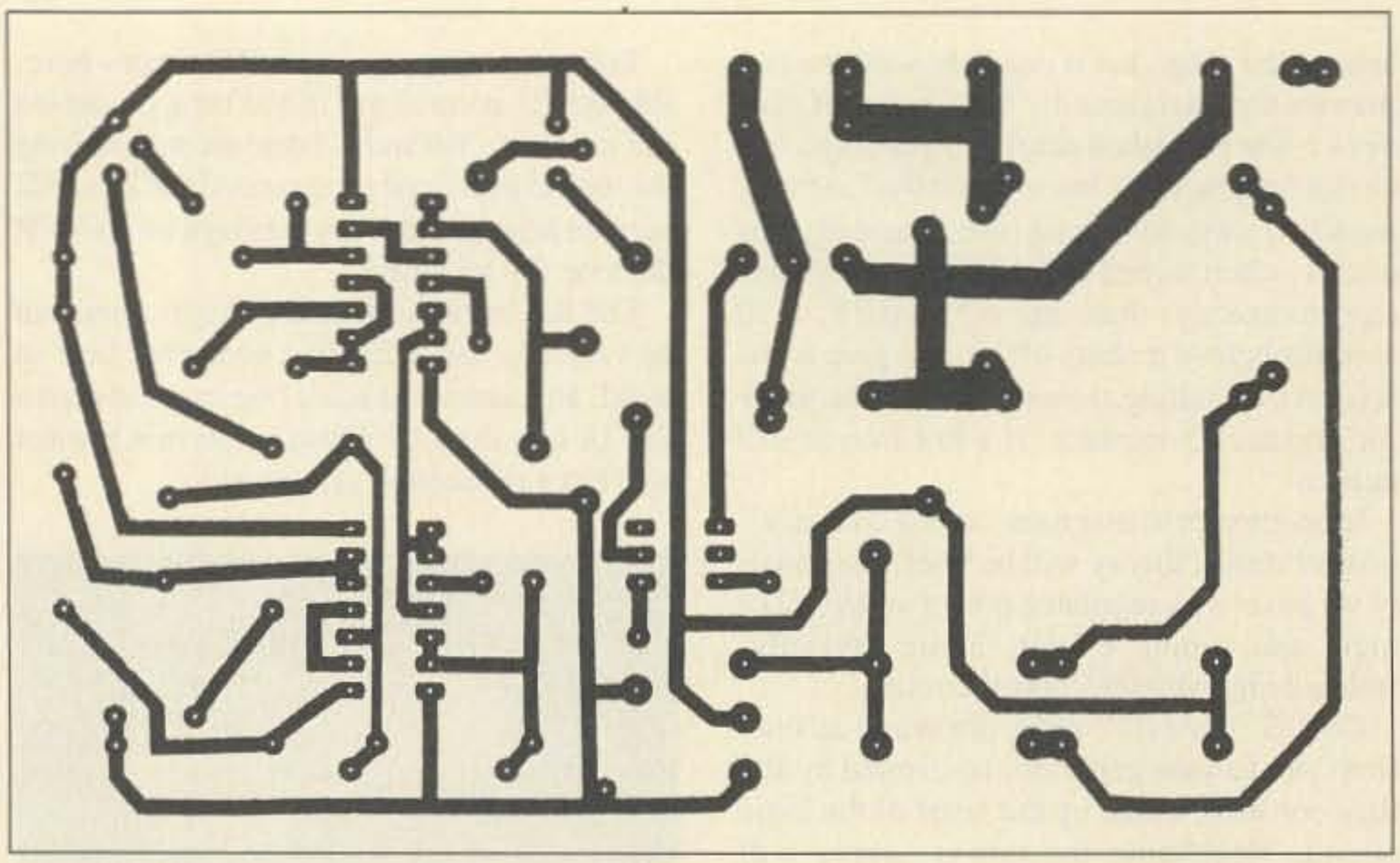


Figure 2.

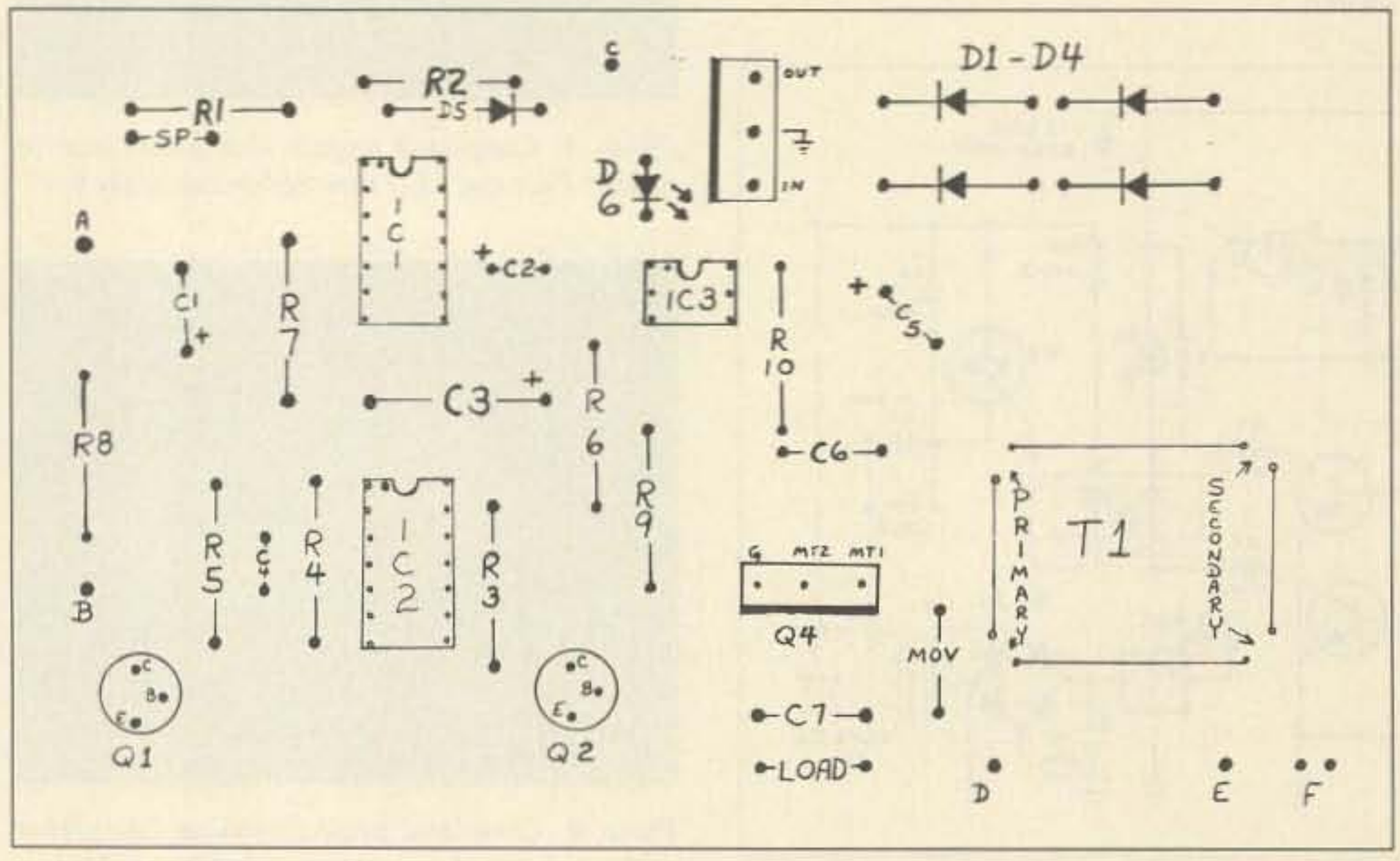


Figure 3.

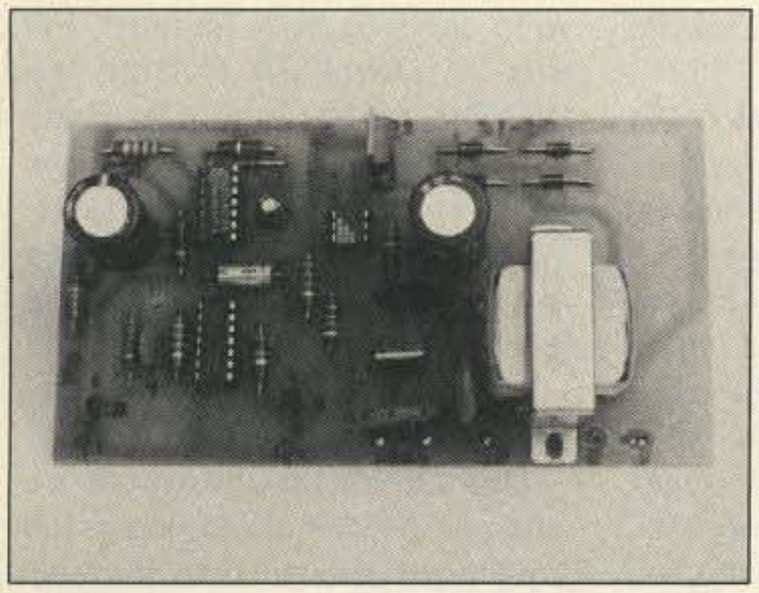


Photo F. Placement and orientation of diodes D1–D4, Q3, Q4, and IC chips 1, 2, and 3.

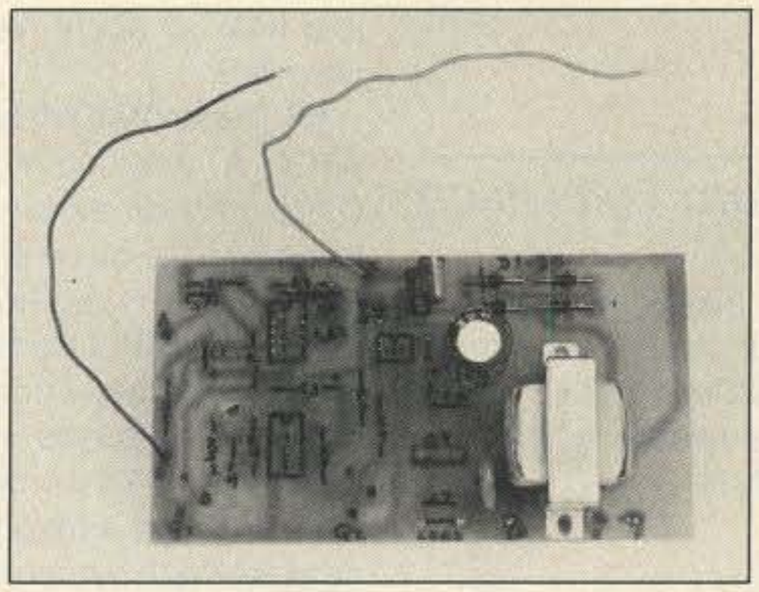


Photo G. Transformer in place as are diodes D1–D4, C5, M.O.V., and voltage regulator Q3, ready for first smoke test. (Black wire point B - red wire point C)

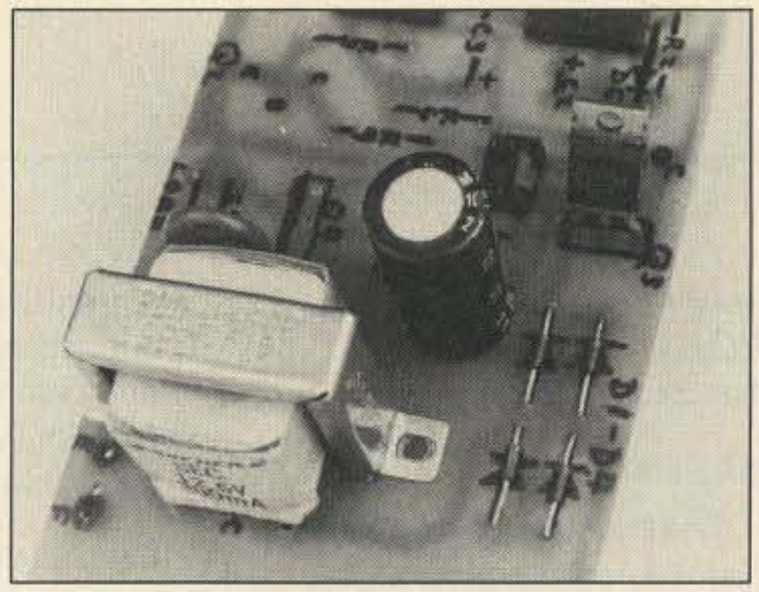


Photo H. Placement and orientation of transformer, diodes D1–D4 and regulator Q3.

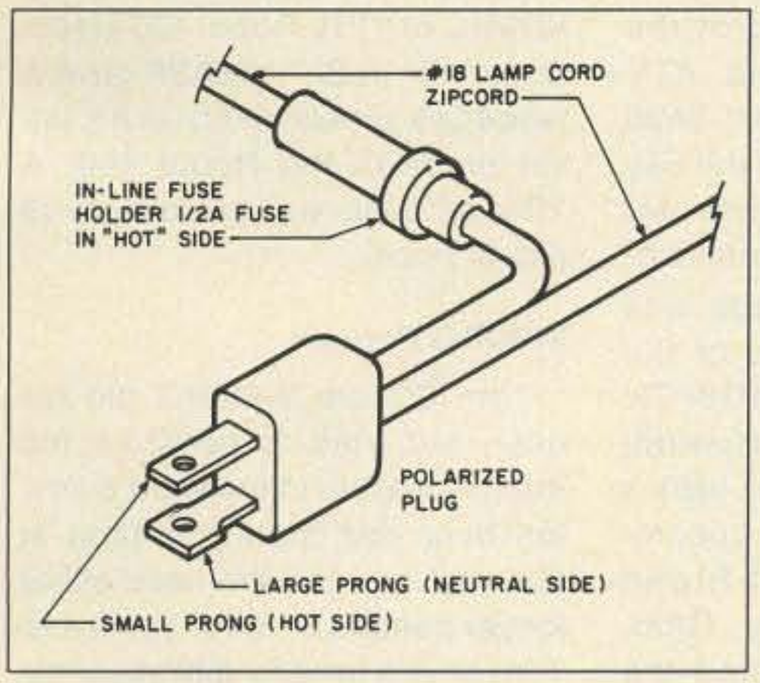


Figure 4.

and "B" to switch S-1. Unsolder wire point "C." Its only purpose was to test the power supply section and it will no longer be needed.

Temporarily tack-solder a 10kΩ resistor in parallel with R8. This will cut the main timing (15 minutes) cycle down to about 30 seconds for test purposes.

Circuit Test

Observing CMOS precautions, install IC chips 1, 2 and 3. Looking at the PC board with the transformer on the right side, the #1 pin of all three IC chips should be at the top left corner of the chip. Check the board one final time, then plug in the line cord and push the pushbutton switch. D6 should illuminate. Approximately 20 seconds later, the tone should sound for 1 second, and D6 should go off about 10 seconds after that.

Once this is confirmed, unplug line cord, remove IC's 1 and 2 and solder in Q4. Q4 should be positioned so that the side with the numbers is facing toward D1-D4. Solder the wires in the two holes marked "LOAD" and connect them to the female line plug. Unsolder the test line cord from points "D" and "E"–install a permanent line cord in points "D" and "F." Wire a switch (S2, SPST) in series with a panel-mount fuse, and solder the switch wire to the second hole at point "F," and the fuse wire to point "E."

The entire project was mounted in a plastic box made of ¼-inch plexiglass. If a metal box is used, *be sure to isolated the PC board from the metal.*

After all the soldering is completed–check for bridges and splash, then reinstall IC's 1 and 2. For the final test, plug a 75 watt (or less) lamp into the female line socket, (LOAD) for visual confirmation of proper operation. If everything works properly, clip the 10kΩ resistor off of R8, mount S1, S2, fuse holder, and the speaker, into the box. Switch S1 may or may not turn the project on (the reset button might have to be pushed again), but it **should always turn the project off!** The project does its job if it switches S1 off.

Use a ½-amp fuse in the holder. Without heatsink or modifications, this circuit will safely handle a 50 watt or less soldering iron.

A few words of caution: CMOS chips and line voltage have contradicting safety procedures. In working with CMOS, the user should use a grounding wrist strap connected to a good ground. In working with line voltage, the builder should **never** be grounded, **period!** Do one then the other. If in doubt of CMOS procedures, skip the grounding wrist strap...it would be better to zap a chip than zapping oneself!

Construction Hints

Rather then looking at D6 through the clear box, put extension wires on D6 and mount it on the box. A socket for IC3 can be made by cutting an extra 14-pin socket in half.

The solder iron holder on top of the box is constructed of #14 (or larger) copper wire folded double and twisted together tightly in an electric drill. It was then formed into a spiral shape using a large paint brush handle as a form. Form a small loop at the bottom for a 6–32 bolt and nut to hold it in place.

Radio Shack has some excellent "bulk" packages, resistor pack #271–312, transistor pack #276–1617, or LED pack #276–1622 to name a few. While these will drive up the initial cost, they make good "junk box" fillers.

All questions accompanied by SASE will be promptly answered. 73

[1] "TV TURNOFF" by Jeffrey A. Sandler, April 1979 *CQ Magazine*.

Parts List

Part	Radio Shack Part #
R1–33kΩ	271–040
R2–2.2MΩ	271–061
R3–10kΩ	271–034
R4–33kΩ	271–040
R5–2.2kΩ	271–027
R6–33kΩ	271–040
R7–10Ω to 100Ω (VOLUME)	271–005
R8–1MΩ	271–059
R9–470Ω	271–019
R10–390Ω	271–131
C1–1000uF 25 v radial	272–1032
C2–10uF 25 v radial	272–1025
C3–10uF 25 v axial	272–1013
C4–.01uF 25 v disc	272–1065
C5–1000uF 25 v. radial	272–1032
C6–.01uF 400 v disc	272–131
C7–.01uF 400 v disc	272–131
D1–1N4004	276–1103
D2–1N4004	276–1103
D3–1N4004	276–1103
D4–1N4004	276–1103
D5–1N914	276–1122
D6–L.E.D.	276–041
IC1–MC14011	276–2411
IC2–MC14011	276–2411
IC3–MOC3010	276–134
Q1–2N2222 or NPN equivalent	276-2009
Q2–Same as Q1	
Q3–LM7812	276-1771
Q4–Triac 6 amp 400 volt	276-1000
Miscellaneous:	
Wire	
M.O.V.–Opitional	276-570
Transformer–12.6 volt AC 300mA	273-1385
Switch S-1 S.P.S.T.	275-602
Switch S-2 N.O. Pushbutton	275-1547
Fuse	270-1271
Socket 117 V	
Socket 14 pin IC (2)	276-1999
Speaker 8Ω	40-245
Line Cord with Plug	
Fuse holder	270-264a
Printed Circuit Board	

(An etched and drilled printed circuit board is available for $8 postage paid from Robert Krieger, Jr., P.O. Box 3385, Davenport, IA 52808.)

ATV

Ham Television

Mike Stone WB0QCD
PO Box H
Lowden IA 52255

DAYTON ATV SESSIONS

The Dayton Hamvention is now history! April 29, 30, and May 1 will be embedded in the memories of many forever. Nearly 30,000 amateurs saw beautiful weather with weekend temperatures in the 70s and sunny skies at the world's largest hamfest. As usual, the Dayton Amateur Radio Club put on a fine show, maintained excellent crowd control, and provided much help to all.

It was good to see so many hundreds of ATVers, to renew old acquaintances and make a few new ones. The USATVS/Spec-Com Journal-sponsored "ATV Workshop" sessions were on Friday and Saturday nights at the Ramada Inn North, just off the I-70 and I-75 on Little York Road. A total of 106 registered "Fast Scanners" attended the two-day informal get-together. Several attendees missed official registration, and head counts on both nights tallied up a total of about 130. This was the best attended Dayton ATV Workshop session ever.

We met in the Ramada's moderate size meeting room, a step up from the converted suite we all crammed into in past years. The same room has been reserved for the 1989 Hamvention.

Some suggested meeting where the SSTVers are, at the nearby Holiday Inn North. We did that one year, and it didn't work out so well—most don't operate both FSTV and SSTV modes. We need two nights exclusively for FSTV to bring in all the speakers and scheduled events.

Took a Little Soaking

Also, the USATVS and *Spec-Com Journal* always lose money by holding these meetings. One dollar per registration more than covered the $50 rent for the meeting room, but we sold beer and pop at a *fifty cents per can* loss. We did not recoup the rent of the overhead projector ($25) or the color TV and VHS VCR ($100). Maybe now you will see that a few book sales, subscriptions, and the dollar per night charge fell quite short of actual operating costs. It's called a "thank you" for the support of our *Spec-Com Journal* and USATVS Organization, and a contribution payback to the amateur radio hobby.

Friday Night

We had, without a doubt, one of the best technical speaker lineups and entertainment programs ever for the two evening ATV Workshop sessions! We kicked off the meetings on Friday evening with a VCR tape, "This is Amateur Television," produced by W7SRZ and The Seattle Washington ATV Society. Many were delighted with the professional production of the program's contents. Next, Henry Ruh KB9FO showed a very funny production, called "Ham Police." Would 'QCD really have jumped off the 501st floor of a downtown Chicago apartment building just to give N9AB a few extra points in working an HT Air-Mobile? I guess we'll never know.

Gerald Cromer led an informal discussion with me on the use of horizontally polarized gain Alford Slots, and how ATVers are now installing them on several ATV repeater systems across the country. Results of a recent Iowa and South Carolina measuring event were given out as well as mention of these antennas to be entered in Sunday's VHF/UHF Antenna Measuring Contest at Dayton. Mike Bogard KD0FW (Kansas City), Ron Cohen K3ZKO (Philadelphia), and Rolly Paulson KB0GL (Minneapolis/St. Paul) all commented on how well these designs were working in their areas. John Shaffer W3SST (York, PA) expressed, as did others, their interest in these designs as well for their local ATV/R systems. Technical building sheets were passed out on both the K4NHN and W9DNT designs.

Mike Sheffield ZL1ABS from Auckland, New Zealand, gave an interesting short talk about Fast Scan TV operations in the 600 MHz band "way down under." Mike stayed with me here in Iowa for about a week and spent some time with Henry Ruh KB9FO in the Chicago area as well. He left for a short visit with relatives again in Chicago after Dayton before traveling down to see Dr. John Fox WB2LLB in Birmingham, Alabama. It was fun to meet Mike and hear all about New Zealand Ham-TV!

Bill Parker W8DMR of the of the ATCO ATV Group in Columbus, Ohio, gave an exciting technical lecture on the study of AM versus FM TV. Bill is an excellent, dynamic speaker. I cornered him in the flea market Friday morning and asked him if he would like to speak at our ATV workshop session. Bill gave a magnificent talk, complete with a remote controlled slide projector of 90 edited color slides. He answered a lot of questions about FM-TV, especially on the pros and cons of using it on a future Space Shuttle mission.

Hap Griffin WA4UMU of the Palmetto, South Carolina, ATV group talked further about Slots and their Portable ATV in the Sky event using a FSTV transmitter and camera on a remote controlled aircraft. Videotape was shown on the highlights of the event. Andrew Emmerson G8PTH and Trevor Brown (not Howard) G8PYH were introduced, said a few words about their upcoming Saturday talks. Bill Brown WB8ELK of the Findlay, Ohio, ATV group was presented the

"This was the best attended Dayton ATV Workshop session ever."

USATVS/Spec-Com Journal 1987 "Good Image Award" (1952 orthocon image camera tube mounted on plaque) for his exciting promotional and pioneering work and operations on ATV! Bill then gave an hour long presentation on the Helium Filled ATV Balloon Flight (last summer), and ATV in Ohio. The Friday night meeting officially broke up around 12:30 in the morning. An international breakfast Pizza Run crew reassembled at 2 AM in the meeting room, to fortify eight hearty sleepless ATVers.

John Shaffer W3SST gave a brief update on the York, Pennsylvania ATV group and ATV/R antenna system. He invited us all to the 33rd Annual York Hamfest and Computer Show that will be held this year on September 24 and 25 at the York Fairgrounds. (For more information, send an SASE to Membership Services or write direct to York Hamfest, PO Box W, Dover PA 17315.) The USATVS hosted one of its many fall ATV conferences in York a few years ago, and is considering doing so again in 1988. Watch the next few issues for any possible announcement.

SSTV Get-Togethers

Our SSTV columnist Fred Sharp W8ASF will be giving us the details of what went on at the Holiday Inn North at the Don Miller W9NTP SSTV evening meetings. Don's Saturday afternoon SSTV Hamvention forum (1345–1500, Room 3) included Tom Hibben KB9MC of "TTL Robot 400 Meets Computer VLSI." W8ASF gave a taped talk presentation on his latest mods to the Robot 400. A "Blinky" tuner was given away as a door prize.

W6ORG Forums

Tom O'Hara W6ORG did his best, but tried to combine too many speakers in too short a time (an hour and three quarters) at this year's event. We need either longer periods or fewer speakers. Tom gave a lengthy talk about his new 33 cm (902–928 MHz band) equipment, and once again during the question and answer session denied the existence of good gain, horizontally polarized "omni" antennas for ATV. (I kept quiet for once while passing out slot literature to the crowd).

Bill Brown WB8ELK gave a quick presentation on his 1988 Summertime Helium-Filled Balloon Event. John Gebuhr WB0CMC showed a separate video and sound transmitter duplexer. Steve Goode K9NG gave a fast talk about Fast Scan Amateur TV for the space shuttle based on the Chicago Motorola N9AB proposal. Surprisingly, no one asked him about the news item in *Westlink* that reported that NASA shot down the N9AB proposal. (I was at the Repeaters Coordinators Conference meeting at the time.)

Time was running out when Andy Emmerson G8PTH and Trevor Brown G8CJS spoke to the packed crowd in the meeting area. The British guests commented later on at the USATVS ATV Workshop that they were quite disappointed at the short amount of time that they got, and at being placed at the end of the agenda after traveling so far and at so great an expense. Once again, no one was introduced from the audience, so we all sat next to each other not knowing

who each other was (something that we always correct at the beginning of our workshop sessions).

Saturday Night Workshop

The Workshop meeting room opened up about 5:30 p.m. on Saturday. Portions of the "Hello From America" videotape were run. Hap Griffin WA4UMU gave a short presentation on the Palmetto, South Carolina ATV group's remote controlled aircraft special event mentioned earlier. John Gebuhr WB0CMC of the Omaha, Nebraska, ATV group, gave a technical talk and spectrum analyzer demo talk on homebrew interdigital diplexers for ATV use. I welcomed and introduced our two British guests sent over by the BATC–Andy Emmerson G8PTH and Trevor Brown G8CJS, accompanied by yet another English ham, Steve Mitchell G8JMJ. The master "Hello from America" videotape was presented to Andy and Trevor, and G8PTH quite graciously accepted the six-month, edited 2-hour tape depicting ATV operations in the United States. Both promised a return tape of European ATV activity by this time next year back to the USATVS.

Andy and Trevor then talked with great captured interest from the crowd on what ATV is like in the UK, and showed us some new books that are available. Many questions came from the audience on FM TV and the availability of boards, circuits, and negatives not available here in the USA from present ATV manufacturers. They announced that Don Miller W9NTP was the sole agent for handling USA BATC Club Memberships and the sales distribution of books and other materials. (The cost of subscribing to the BATC in America was about three times as much as it will be now via the Wyman Research connection. We swapped a lot of books from the USA for their British books and some are available to USATVS members.)

"(Bill W8DMR) answered a lot of questions about FM-TV, especially on the pros and cons of using it on a future Space Shuttle mission."

John E. Thomas of Lindsay Specialty Products of Lindsay, Ontario, spoke for a few minutes about their unusual line of UHF TV antennas. Lindsay Products had a booth at the Hamvention and is looking to expand into the amateur UHF market. They are most interested in the work of W9DNT and K4NHN on the successful Alford Slots for ATV/Rs, and would like to build and further develop these antennas for worldwide distribution. Thomas handed out brochures depicting their 150,000 square foot plant in Ontario containing 350 employees. Lindsay makes cable TV (headend) antennas, and expanded into the amateur market in 1969. He can be contacted at 50 Mary Street, Lindsay, Ontario, Canada K9V-4S7 or called at (705) 324-2196.

Don Miller W9NTP of Wyman Research showed off his new FM goodies around 10 PM. Don has a fine new line of FM ham TV gear and components imported from Europe. One of Don's new pieces of gear that he was also showing at his booth at the Hamvention was a separate on-carrier sound receiver adapter box. For $85, a user can take this little box, place it in line where the Channel 2 or 3 "F" cable goes to the TV set, and it samples the line on its own mounted speaker. One can hear quality FM on-carrier sound transmissions! Don is aggressively filling a lot of the voids in ATV availability, and is listening to and responding to customer requests for new products, something of which all manufacturers should take note. Bill WB8ELK for the *third* time gave the presentation of the balloon flight and DX as seen in Ohio. Bill also showed off his new invention of a 6809 microprocessor, automatic switching, and "mini" ATV video board (see ad).

John Beanland G3BVU of Spectrum International, Inc., showed up and gave a late-night projector screen presentation of how interdigital filters really react to QRM and other types of interference. Saturday night's session lasted until about 1 AM. The same Friday night Night Owl Club had a meeting at a local 24-hour Bob Evans Restaurant on Saturday morning. Of course, the BATC, New Zealand, and USATVS were well represented! 73

Number 23 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

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

August may mean the end of the summer is near, with the hot and muggy "dog days" here in in Maryland, but with the readership this magazine gets, I try not to assume anything. After all, to our readers in Australia—and from the letters I receive from Down Under I know there are a lot of them—it is getting near spring! Either way, I think I have at least one more excuse to spend some time in the hamshack this month.

Before getting into the topic in earnest, I wonder if the scenes of Peterborough in the winter we all saw on "St. Elsewhere" were accurate. If so, this magazine is published in a very, very beautiful town, and I have a better feeling for why Wayne likes it so much. (*I've said so many times this is almost Paradise—NA5E*).

AEA PC Pakratt

I promised RTTYers a fancy commercial program last month, and fancy it is. Many have read of my admiration for the AEA PK-232 RTTY interface. One problem with it is the sheer complexity of its programming. Well, AEA has addressed this need with a dedicated program for PC-type computers which manages to wring every bit of performance out of the PK-232.

The PC-Pakratt Terminal Program runs on "100% compatibles," with 320K or more of RAM, a serial port, two 360K floppy drives (or one 360K floppy and a hard disk), and PC-DOS 2.0 or later. The manual *doesn't* specify MS-DOS—contact AEA before using this program on a Tandy or other "close clone." The manual hints that a flight simulation game, known to be finicky with different DOS, might be a good measure of suitability.

The program supports a printer, and has the ability to use a slower, impact style, printer with a buffer, or an Epson-type printer, which could also be used to print FAX pictures.

Help!

Fortunately, this relatively complex program has a "help" facility. Pop-up windows, called up by the F1 key, show options for where the user is, or details of a highlighted command. Other function keys initiate many program command processes, with the ability to define Shift- or Alt-function key combinations to encode up to twenty 256-character sequences.

The display is tailored to the user's current mode. In packet, for example, windows display connect status, and other information shows link state, transmit channel, and other vital information. In Morse mode, three windows display received and transmitted data, as well as transmit/receive status and speed.

Similar screens are used for Baudot and AMTOR operation. The digital ham can keep just about everything he needs to know onscreen at one time. FAX operation is a bit different, of course, with only status and transfer information onscreen—actual reception is diverted to the printer. (Don't confuse the FAX mode on this program with the AEA PC-FAX program, which diplays the image on a screen.)

Throughout, disk functions, such as directory listing, copying files, deleting files, and the like, remain accessible. A virtual symphony of function key assignments helps make operating in any of the PK-232's modes as easy as typing on a computer.

There still may be times, however, when the user might want to return to the "old" way of running the PK-232. This would particularly be the case when using the SIAM mode, discussed here a few months ago. This mode lets the user identify and print unknown signals. AEA thoughtfully provided a "dumb terminal" mode to deal with the unknown signals. Hitting the right key gives a blank screen, which depends on the digital ham's understanding of the PK-232 to issue the proper commands.

Finally, there's a utility to allow the operator to look at all those messages he has received, and write replies. This simple editor resembles WordStar™ setup.

All in all, this represents quite a valuable program, especially for less than $30. Those interested in more details from AEA should drop them a line at Advanced Electronic Applications, Inc., 2006 196th SW, Lynnwood, WA 98036-0918. Tell'em RTTY Loop sent you!

Amiga Info

Harvey A. Nelson N9FHO of Stevens Point, Wisconsin, passes along some information for Amiga computer users. He says that a public domain program called COMM (Version 1.34) is available on "FISH DISK #75." I assume all you Amiga owners understand that reference.

He says that after making a set of F-key macros for each mode, such as packet, AMTOR, and RTTY, the program is at least the equivalent of PC-Pakratt, with all the bells and whistles.

Harvey offered to send a copy of the program configured for the Amiga to run a PK-232 to readers who send him a blank 3 ½ inch disk and stamped mailer. Drop him a line at PO Box 736, Stevens Point, Wisconsin 54481. Thanks, Harv, for the service to the readership!

RTTY Boat Anchors Revisited

Finally, June's issue of RTTY Loop detailed some of the "classic" teleprinters many readers grew up with. This encouraged Bill McCollum KA0ZFZ of Omaha, Nebraska, to drop me a line with some of the machines and history I omitted.

The Teletype Corporation was founded by Joy Morton and Charles Krum, back in the halcyon days of digital communications. In fact, they adopted the trademarked name "Teletype Corporation" in 1929. Long a subsidiary of Western Electric, the Corporation ceased to be when divestiture took its toll in 1984. The June column's look at Teletype products in June ended with the late great Model 33. Here's a peek at some of the other machines.

Model 37: This "nightmare" of a machine ran at 100 wpm in Baudot or 150 bauds ASCII. With seven clutches for horizontal and vertical positioning, and a retraction mechanism to lower the type box to allow the print to be viewed, I can see why it was so deemed.

This unit printed both upper and lower case, and supported a reverse full- and half-line feed, and vertical and horizontal tabs. An integral tape reader could handle both five- and eight-level material, with code conversion performed on an inboard circuit card. These units found favor with the military, but apparently never really circulated much in the general market.

Model 38: A wide carriage version of the Model 33, this 132 column monster printed both upper and lower case, and even sported red and black ribbons. At 110 bauds it was slow, though, particularly when chugging along the full width of the carriage.

Model 42: This is the end of the Baudot line, as far as I know, with a dot matrix output, and able to accept TTL, current loop, or RS-232 interfacing. Tape equipment is also available for this model.

Model 43: The ASCII version of the Model 42, this is a similarly modernized teleprinter. Buffered versions of this machine are available that can run at higher speeds.

Non-Teletype Teleprinters

The Teletype Corporation, however, was not the only company making Teleprinters. The Kleinschmidt line, in particular, has often been a staple of amateur RTTY stations. While some amateurs swore at them, and some by them, those who used them regularly—particularly European amateurs who could not get Teletype Corporation products—seemed to have a good deal of success with the line.

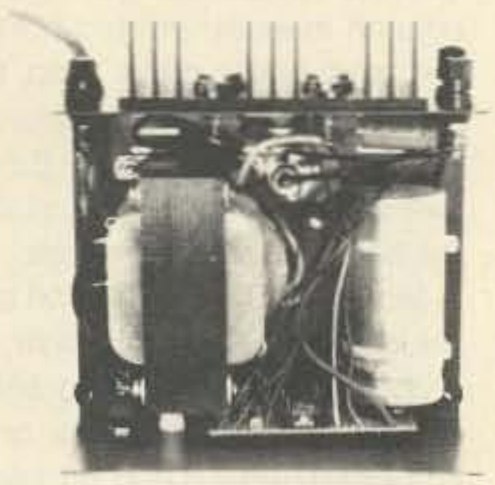
Then there was the Mighty Mite. This unique teleprinter was made by the Mite Corporation (did they ever make anything else?) and was a mobile unit which presaged today's Packet-In-A-Box attaché case. I saw one or two back in the late 1960s, usually available through the MARS system. The one thing I remember most was that parts were few and far between, which left quite a few Mites languishing on shelves.

Computers, Anyone?

Once again, a reminder about the newest feature of the Loop. Popular opinion has uncovered an acute interest in various aspects of computing, which I shall be delighted to cover here. Only problem is, where do I begin? For that, I ask the reader's input.

Interest remains quite high on the various programs and reprints available from past editions of RTTY Loop. Send me a self addressed, stamped envelope for the latest list. Of course, I remain present on both CompuServe (ppn 75036,2501) and Delphi (username MARCWA3AJR), and try to answer questions posed there as quickly as possible. Be sure to see what's new next month in RTTY Loop! 73

ASTRON CORPORATION
9 Autry
Irvine, CA 92718
(714) 458-7277



INSIDE VIEW — RS-12A

ASTRON POWER SUPPLIES

• HEAVY DUTY • HIGH QUALITY • RUGGED • RELIABLE •

SPECIAL FEATURES

- SOLID STATE ELECTRONICALLY REGULATED
- FOLD-BACK CURRENT LIMITING Protects Power Supply from excessive current & continuous shorted output
- CROWBAR OVER VOLTAGE PROTECTION on all Models **except RS-3A, RS-4A, RS-5A.**
- MAINTAIN REGULATION & LOW RIPPLE at low line input Voltage
- HEAVY DUTY HEAT SINK • CHASSIS MOUNT FUSE
- THREE CONDUCTOR POWER CORD
- ONE YEAR WARRANTY • MADE IN U.S.A.

PERFORMANCE SPECIFICATIONS

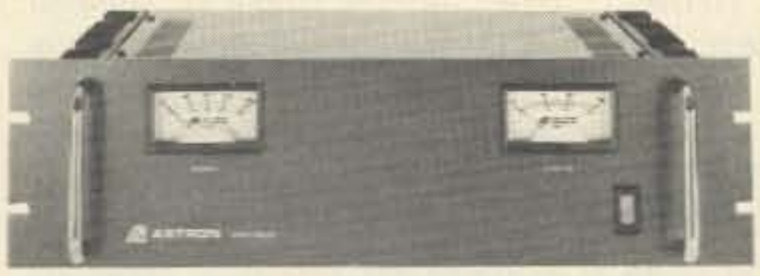
- INPUT VOLTAGE: 105-125 VAC
- OUTPUT VOLTAGE: 13.8 VDC ± 0.05 volts (Internally Adjustable: 11-15 VDC)
- RIPPLE Less than 5mv peak to peak (full load & low line)
- **Also available with 220 VAC input voltage**

MODEL RS-50A

MODEL RS-50M

MODEL VS-50M

RM SERIES



MODEL RM-35M

19" × 5¼ 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
• 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

RS-A SERIES

MODEL RS-7A

MODEL	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-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

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						
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RS-10S	7.5	10	4 × 7½ × 10¾	12
RS-12S	9	12	4½ × 8 × 9	13
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*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

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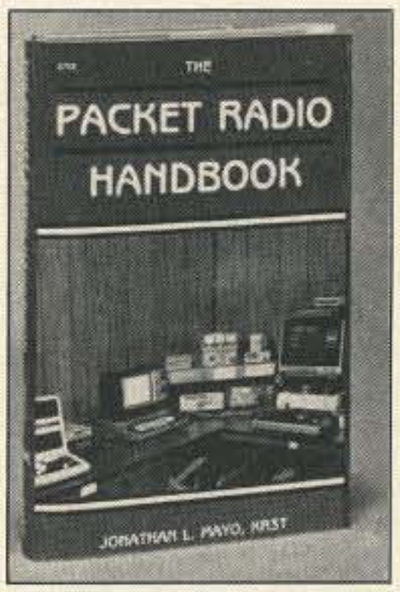

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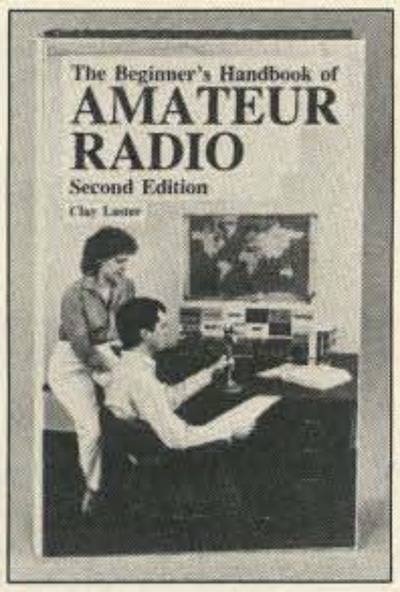

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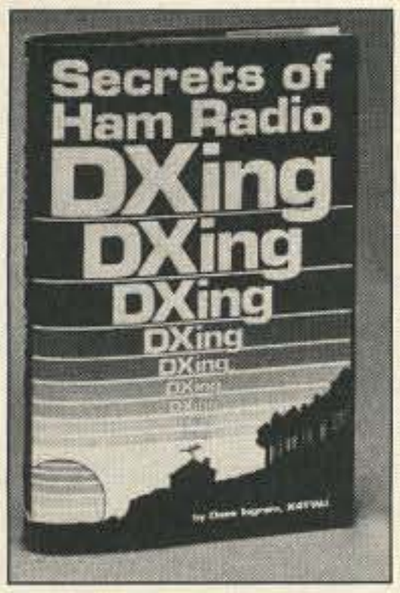

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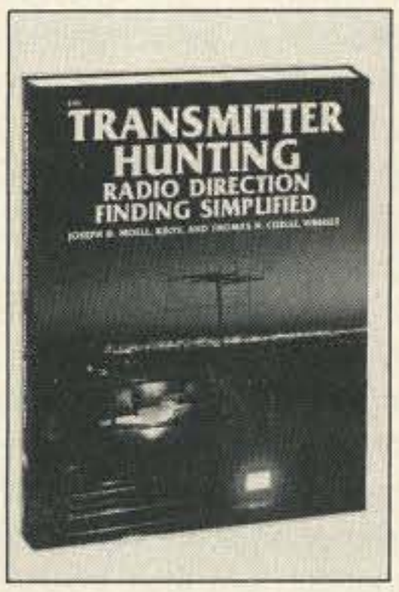

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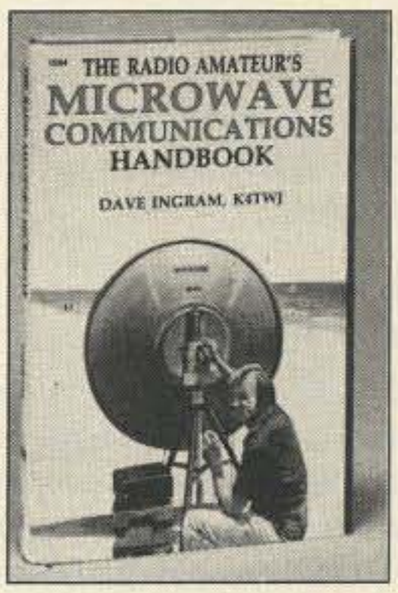

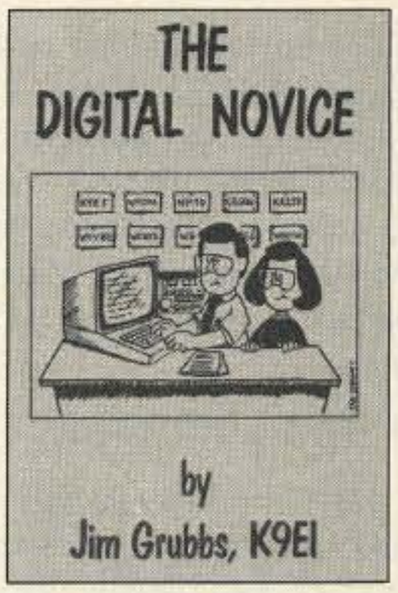

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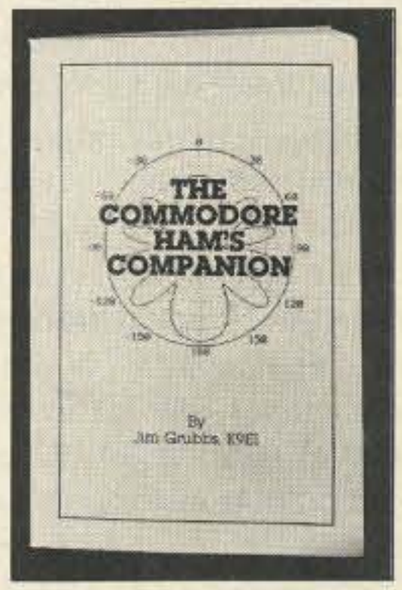

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AERIAL VIEW

Antenna News

Arliss Thompson W7XU
7314 SW 28th Ave.
Portland OR 97219

Transmission Line Transformers

Matching the impedance of an antenna to the impedance of its associated transmission line is a common problem. For example, a ¼ wave ground plane antenna typically shows a resistive impedance near 35Ω. If fed with 75Ω line, an SWR of 2.14:1 would result. In order to reduce the SWR to 1:1 (not always necessary) some means of impedance matching must be used. There are a number of ways to achieve an impedance match; the use of a transmission line transformer is one. Judging from comments received from readers, there isn't only considerable interest in this method of impedance matching, but also some confusion. Therefore, this month's column is devoted to the design and use of transmission line transformers. While some mathematics will be involved in the discussion, a BASIC computer program is included to simplify the use of information provided.

Transmission line transformers are sections of transmission lines that match the impedance of the antenna to that of the main feedline. They are inserted in series with the regular feedline, between the transmitter and the antenna. These matching sections, if properly designed, can be of nearly any characteristic impedance so long as it is not too near the impedance of the primary transmission line. They can be manufactured from commercially available coaxial cable or homemade open-wire line. Since they do not require the use of distinct coils and capacitors, they are also know as linear transformers. They can take a variety of forms, including the stub-match, the alternated-line match, and the series section transformer. Another variation, and the one with which hams are most familiar, is the quarter wave transformer.

Quarter Wave Transformers

The quarter wave transformer (or "Q" section) is an electrical ¼ wavelength of transmission line, connected in series between the main transmission line and a mismatched non-reactive load (i.e., a resonant antenna). In order to perform its matching function, the quarter wave line must have a specific characteristic impedance. That impedance can be calculated with the equation:

$$Z = \sqrt{(Z_L Z_0)}$$

where Z_L is the impedance of the antenna, and Z_0 is the characteristic impedance of the main transmission line. In the opening example, the antenna impedance was 35Ω and the transmission line had an impedance of 75Ω. Using the above equation:

$$Z = \sqrt{(35 \times 75)} = 51.2\Omega$$

Thus, a quarter wavelength of 50Ω coax placed between this antenna and its 75Ω feedline would result in a 1:1 SWR on the 75Ω line and at the transmitter. This would have to be an electrical quarter wavelength of 50Ω coax, meaning that the velocity factor of the line must be taken into account. For a solid dielectric line, the velocity factor is 0.66 requiring the length of coax to be 66% of the length of the free-space ¼-wavelength. In general:

$$\text{Length (feet)} = 246\ VF/f$$

where VF is the velocity factor and f is the frequency in MHz. Specifically, at 28 MHz:

$$\text{Length} = 246 \times 0.66/28 = 5.8' = 5'\ 9\tfrac{1}{2}''$$

More examples will be provided later. Also, the computer program mentioned above can solve these calculations with minimal effort.

Series-Section Transformers

The quarter wave transformer works well when the antenna shows only resistance to the feedline. There are times when it is necessary to match a reactive load to the feedline. The series-section transformer can provide that match. In fact, the quarter wave and other linear matching transformers mentioned are special cases of the series-section transformer. Surprisingly, many hams are not familar with this more general form of transformers.

Unlike the quarter wave transformer, the series-section transformer does not require the matching section to necessarily be placed directly at the antenna terminals. Depending on the impedances to be matched and the characteristic impedance of the matching section, it may be placed as far as ½ wavelength from the antenna. The impedance of the matching section may be either greater than or less than the main feedline, as long as the two are not too close in value. Also, unlike the quarter wave transformer the series-section transformer may be considerably shorter than an electrical quarter wavelength in length. In summary, the series-section matching unit allows more flexibility in design compared to the Q-section.

The chief disadvantage of the series-section transformer is its design is more complicated than the quarter wave transformer. The mathematics, however, are not too involved for a hand-held calculator, and are made easy with a programmable calculator or a personal computer. The BASIC listing handles both Q- and series-section transformer calculations. For those wishing a more thorough discussion of series-section transformers, including the mathematical formulas involved. Further information can be found in Regier's article "Series-Section Transmission-Line Impedance Matching," *QST*, July 1978, pp 14-16 and in the 1987 ARRL Handbook, pp 16-4 and 16-5.

Here's an example of how a series-section transformer may be used. Consider again the ground-plane antenna of the first paragraph. It had an impedance of 35Ω, with a 75Ω feedline. The operating frequency was 28 MHz. Assuming the feedline is replaced with some 50Ω coax (velocity factor of 0.66). A quarter wave transformer, designed to match the antenna to the new coax, would need to have a characteristic impedance of 41.8Ω ($\sqrt{(35 \times 50)} = 41.8$). That seems simple enough until one goes shopping for 42Ω coax!

While it might be argued that the SWR, resulting from feeding a 35Ω antenna with a 50Ω line, is rather low. There are times when it is desirable to have a near perfect match. By using a series-section transformer a 1:1 match can be achieved on the main transmission line. Leaving the number crunching to the computer, it can be shown that the 50Ω feedline to this antenna is cut 7.82' from the antenna and a 1.64' length of 75Ω coax (velocity factor of 0.66) is inserted at that point, the SWR at the transmitter will be 1:1.

More Examples

Antenna 2 is a wide-spaced quad on 21.2 MHz with a feedpoint impedance of 80Ω. With a 50Ω coax feedline (VF= 0.66), a

```
100 CLS
110 PRINT "DESIGNING SERIES-SECTION AND QUARTER-WAVE TRANSMISSION LINE
TRANSFORMERS"
120 PRINT:PRINT "ENTER DESIGN FREQUENCY (MHz):"
130 INPUT F
140 PRINT "CHOOSE SERIES-SECTION OR QUARTER-WAVE DESIGN (S OR Q):"
150 INPUT K$: IF K$= "Q" GOTO 1000
160 IF K$= "q" GOTO 1000
170 PRINT "ENTER ANTENNA IMPEDANCE RL + jXL  (RL, XL):"
180 INPUT RL,XL
190 PRINT "ENTER CHARACTERISTIC IMPEDANCE AND VELOCITY FACTOR OF MAIN
TRANSMISSION LINE       (OHMS, VF):"
220 INPUT ZO, VF1
210 PRINT "ENTER CHARACTERISTIC IMPEDANCE AND VELOCITY FACTOR OF MATCHING
SECTION       (OHMS, VF):"
220 INPUT ZM, VF2: CLS
230 N=ZM/ZO: R=RL/ZO: X= XL/ZO
240 C=SQR((RL+ZO)*(RL+ZO)+X*X)
250 D=SQR((RL-ZO)*(RL-ZO)+X*X)
260 SWR1=(C+D)/(C-D):SWR2=(C-D)/(C+D)
270 IF ZM>ZO*SQR(SWR1) THEN 340
280 IF ZM<ZO*SQR(SWR2) THEN 340
290 PRINT "IMPEDANCES OF MATCHING SECTION AND MAIN TRANSMISSION LINE ARE TOO
CLOSE":PRINT
300 PRINT "OLD IMPEDANCE OF MAIN TRANSMISSION LINE WAS"; ZO; "OHMS.  ENTER NEW
VALUE:"
310 INPUT ZO: PRINT
320 PRINT "OLD IMPEDANCE OF MATCHING SECTION WAS"; ZM; "OHMS.  ENTER NEW
VALUE:"
330 INPUT ZM:CLS:GOTO 230
340 BD=R*(N-1/N)*(N-1/N)-(R-1)*(R-1)-X*X: IF BD<0 GOTO 290
350 BN=(R-1)*(R-1)+X*X
360 B=SQR(BN/BD)
370 AD=R+X*N*B-1
380 AN=(N-R/N)*B+X
390 A=AN/AD
400 L1=ATN(A)/1.745329E-02
410 IF L1<0 THEN L1=L1+180
420 LA=L1/360*984/F*VF1
430 L2=ATN(B)/1.745329E-02
440 LM=L2/360*984/F*VF2
450 PRINT "DESIGN FREQUENCY = ";F;" MHz":PRINT
460 PRINT "MATCHING SECTION": PRINT "        IMPEDANCE= ";ZM;" OHMS":PRINT "
LENGTH= ";LM;" FEET"
470 PRINT: PRINT "MAIN TRANSMISSION LINE:": PRINT "      IMPEDANCE= ";ZO;"
OHMS":PRINT "       LENGTH BETWEEN ANTENNA NAD MATCHING SECTION= ";LA;" FEET"
480 PRINT: PRINT "DO ANOTHER? (Y/N)"
490 INPUT W$
500 IF W$= "N" THEN END
510 IF W$= "n" THEN END
520 CLS: GOTO 120
1000 PRINT "ENTER ANTENNA IMPEDANCE IN OHMS (NO REACTIVE COMPONENT ALLOWED):"
1010 INPUT ZL
1020 PRINT "ENTER CHARACTERISTIC IMPEDANCE OF MAIN TRANSMISSION LINE (OHMS)"
1030 INPUT ZO
1040 ZM=SQR(ZL*ZO): LA=0: L2=90
1050 PRINT "QUARTER-WAVE MATCHING SECTION WILL HAVE AN IMPEDANCE OF ";ZM;"
OHMS.  ENTER IT'S VELOCITY FACTOR:"
1060 INPUT VF2
1070 CLS: GOTO 440
```

Q-section would require 63Ω coax (hard to come by) to achieve a match. An alternative would be a 3.53' long series-section transformer of 75Ω foam dielectric coax (VF = 0.79) inserted in the feedline 2.26' from the antenna.

Antenna 3 is a vertical being used on 3.9 MHz. Measurements with an antenna noise bridge shows it has a base impedance of 30 - j10Ω. The feedline is 50Ω coax; the matching section is 75Ω. Both have velocity factors of 0.66. The series-section solution to the problem is a 20.3' length of the 75Ω coax inserted in the 50Ω line, 59.6' from the antenna.

For a final example, consider a 20m yagi with a feedpoint impedance of 25Ω. Presuming a frequency of 14.25 MHz, with a 50Ω transmission line and a 75Ω matching section (both with VF = 0.66), the system can be matched if a 7.35' piece of the 75Ω material is inserted in the main transmission line 13.3' from the antenna. To use a quarter wave section, in this instance, would require the fabrication of a 35Ω line for a matching section. The series-section transformer obviously provides an easier solution.

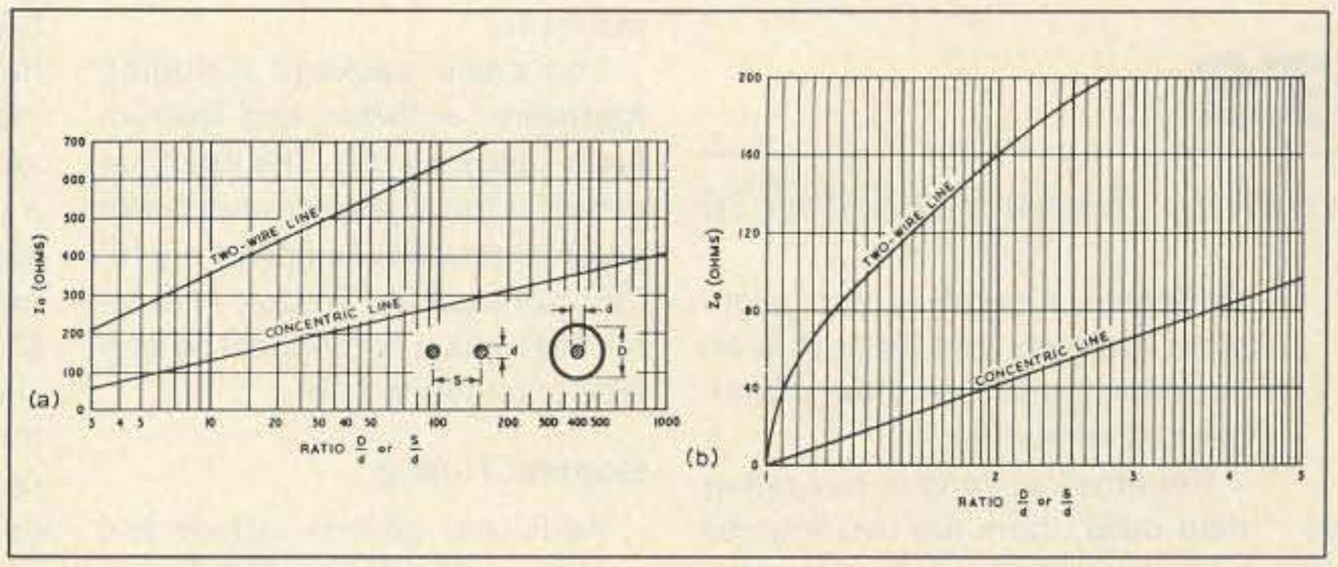

Figure 2. These graphs illustrate characteristic impedances of two-wire and coaxial (concentric) lines versus wire diameter and spacing. The calculations have assumed air insulation. When the space between the wires is filled with an insulator, the impedance given by the chart must be divided by the square root of insulator (dielectric) permittivity, or dielectric constant. The resulting ratio is the velocity factor, because wave velocity through the transmission line is reduced by the same factor. (Courtesy RSGB Radio Communication Handbook, *Fifth Edition.)*

It should be apparent from these examples of the series-sections transformers, can be very versatile. They permit matching of a wide range of transmission lines and antennas with commonly available materials. Why not load the accompanying BASIC program into a personal computer and see how the transmission line transformers can solve a host of antenna-feedline matching problems?

Some tips

The BASIC program referred to here was written to run on an IBM clone. It should, however, run with few or no modifications on other machines equipped with BASIC. Also, be aware that this is a "barebones" program written to familiarize readers with the principles of transmission line matching. Amenities can be added as the user sees fit. As it stands, its main shortcoming involves calculations for a series-section transformer when the impedance value, of the matching section chosen, is very close to the requirement for a quarter wave section. This difficulty arises from the way the computer handles the equations involved. The problem is bypassed by incorporating a subroutine that handles the calculations for Q-sections. There are undoubtedly more elegant solutions to this problem, but they are left for the user to discover.

Feedback

Readers are encouraged to write to me with their questions and suggestions. I am happy to provide examples for this column's material and type for running the program on non-IBM clone machines. I welcome suggestions on new types of antennas or old antennas in new situations. Don't forget to enclose an SASE for a reply. 73

Number 25 on your Feedback card

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5Z1B
14714 Knightsway Drive
Houston, TX 77083

HELPING HAND

Automatic control of rigs and antennas simplifies satellite operation. While tuning through the transponder passband, it's helpful to have an extra hand to work the rotators or keep the transmitter frequency locked to the receiver, during a low-orbit Fuji-OSCAR-12 pass.

Automated satellite tracking was covered in the February 1987 Hamsats column here in *73*. Since then, new options appeared as construction articles and products for sale from manufacturers.

The May and June 1987 issues of *QEX* contained a two-part article by Frank H. Perkins, Jr. WB5IPM, detailing a "Computer Interface for the Kenpro KR-5400A." It is easy to reproduce the circuit board for the project, using the layout shown in part one of the article. The parts are available from Radio Shack. The completed unit was tested on a Radio Shack TRS-80 Model 100. It was connected to the printer port and included a program in BASIC for F-O-12 tracking. Since the system presented by Frank is wired in parallel to the existing rotator control wiring, the computer need not be on to run the elevation and azimuth rotators manually. This is an advantage for passes shorter than the set-up time for the computer program.

Another construction article for a computer-to-rotator interface appeared in the December 1987 issue of *Ham Radio*. The author, Neil Hill K7NH of Mountainlake Terrace, Washington, included all the information for "A Simple Interface Board for the C-64 and the VIC-20." The analog to digital IC's are a bit difficult to find, but the unit takes very little time to build and will work with several different rotators, including the Yaesu/Kenpro series and the Alliance HD73.

The circuit boards are double-sided and may be difficult for the casual garage etcher, but Neil sells them for a nominal $20, including shipping. The project was based on previous efforts to market an interface for the Timex 1000 computer by Spectrum West of Seattle. Operation and alignment are easy and the unit is an excellent use for older Commodore computers.

For those wishing to buy rather than build, there are two sources of Yaesu/Kenpro interfaces. Encomm of Plano, Texas, and L. L. Grace of Voorhees, New Jersey, sell packages providing useful alternatives.

Encomm has two systems. Each is built for the Yaesu/Kenpro KR-5400A or KR-5600A dual-control boxes. The KR-001 works with the Commodore C-64 while the KR-010 is designed for IBM PC's and their clones. The price for either unit is $199.95. Check on availability by phoning (214)-423-0024. Encomm does not provide software for the C-64 version, but the units have been designed to work with software by N4HY from AMSAT NA. The KR-010 is supplied with information on how to use the AMSAT NA software by N4HY, W0SL and W3IWI. Details on program availability can be had for an S.A.S.E. to the AMSAT NA Software Exchange, P. O. Box 27, Washington, DC 20044.

L. L. Grace Communication Products offer several options to their "Kansas City Tracker" interface.

The basic unit is intended to connect between the Yaesu/Kenpro 5400/5600 rotor controller and an IBM XT, AT or clone, controlling the antenna array for automatic satellite tracking. The software included in the package is compatible with AMSAT's QUIK-TRAK (3.2) and with Silicon Solution's GRAFTRAK (2.0). These programs can be used to load the Kansas City Tracker's orbit tables. Then the rotator driver and status programs can operate as a Terminate-and-Stay-Resident (TSR) program. This allows the computer to be used for other purposes, like data communications via F-O-12, while pointing the antenna automatically.

The basic package including hardware, software and instructions sells for $169. The interface cable for the Yaesu/Kenpro 5400/5600 control boxes goes for $19. The Kansas City Tracker with interface option to connect to any type of rotator is $199.

Doppler Tuning

Additional options include two versions of the Kansas City Tuner. Either one is used to provide automatic Doppler shift compensation during a pass and must be used in conjunction with the Kansas City Tracker. The first version, at $59, connects to the "mike click" buttons to change the frequency of the radio, to keep received audio at a steady pitch. The second version, at $79, provides the same result but operates through the radio's serial control port via an RS232 connection. The Tuner is compatible with most rigs including the Yaesu FT726R and 736R, the ICOM 271/471, 275/475 and the R-7000. Be sure to call first at (609) 751-1018 during east-coast evenings or weekends concerning the rig to be used.

The Kansas City Tuner can take care of Doppler shift during a pass, but other devices are needed for frequency tracking between receiver and transmitter. Newer rigs like the Yaesu FT736R include frequency tracking in either the normal mode or inverted. In the normal mode, as the receive frequency is shifted upward, the transmit frequency follows. This works for satellites like RS-11. The inverted mode moves the transmit frequency down as the receiver is tuned upward. This is appropriate for F-O-12, A-O-10 and A-O-13.

The Ten-Tec 2510 Mode B transmitter/receive converter also provides automatic frequency tracking. The unit has a 435 MHz SSB/CW transmitter and a two-meter receive converter. The ten-Watt output is sufficient for A-O-10 and A-O-13 uplink when used with a good gain antenna. A 29 MHz receiver or transceiver and a two-meter antenna will complete the Mode B system. Once the 2510's transmitted signal is found through the transponder into the receiver, the 2510 will shift the receive converter to keep receive and transmit operation locked together without further adjustment of the 10-meter rig.

The ICOM 275/475 pair require an accessory from ICOM to allow automatic frequency control. This Satellite Interface Unit, the CT-16, sells for $97.50. Normal and inverted tracking for any Mode B or Mode J (two meters up and 70cm down) satellite is possible with this addition.

The ICOM 271/471 pair needs two additions from ICOM for automatic tracking. First a Communications Level Converter, the CI-5, must be installed followed by the CT-17 interface unit. They are $97.50 each.

An alternative is available for the builder. Tony Card VK1ZZT can provide PC boards and instructions for an interface designed for either the Yaesu FT726R or the ICOM 271/471 transceivers for automatic frequency tracking. The circuits are simple, but it is not always easy to get to the connections inside the radios. Boards must be lifted and jumpers installed in many tight locations. Considering the price of the radios, the easier route may be to buy, rather than build. For those interested in the cost-savings and not worried about keeping the equipment in stock condition, contact Tony at 44 Champion Cres., Flynn, Australian Capital Territory 2615, Australia.

Hearing Aid

One additional note on the Yaesu FT726R: The two-meter receiver in this radio lacks performance. In the July 1987 issue of *Ham Radio*, Peter Bertini K1ZJH, wrote an article called "Improved Gain Distribution for the Yaesu FT726R." Adding three capacitors, two resistors, a choke and a transistor really helps. The receiver sounds better and exhibits about a 12 dB gain improvement. Installing the parts is a bit tedious, and special care is needed with the transistor orientation. The end result is well worth the effort. Weak signals, like those from the satellite, will be easier to copy. 73

Amateur Radio Satellite Modes

Mode	Uplink	Downlink	Active	Bird(s)
A	145.9	29.5	Yes	RS-10/11
B	435.1	145.9	Yes	OSCAR-10 OSCAR-13
J	145.9	435.9	Yes	OSCAR-12 OSCAR-13
JL	145.9 1269.5	436.1	Yes	OSCAR-13
K	21.2	29.4	Yes	RS-10/11
L	1269.5	436.1	Yes	OSCAR-13
S	436.1	2.4 G	Yes	OSCAR-13
T	21.2	145.9	Yes	RS-10/11
K/T	21.2	29.5 145.9	Yes	RS-10/11
K/A	21.2 145.9	29.5	Yes	RS-10/11

NOTE! The satellite mode designation letter is merely a shorthand way of specifying a particular combination of "Uplink" and "Downlink" bands. Please don't let these letters become confusing!

The current satellite modes are courtesy of AMSAT NA.

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Box 1242
Burlington CT 06013

Hams as fascinated with UHF long distance propagation as I am will love the excitement of using Advanced Receiver Research (ARR) TR10GA 10 GHz equipment. There's no construction or soldering needed. Just add 12 volts, an everyday el-cheapo tape recorder mike, and a set of headphones to the already-assembled transceiver—and you're on the air! It couldn't be any easier to get on 10 GHz, the highest amateur band for which relatively inexpensive ham radio is available.

10 GHz in Perspective

Ten gigahertz is 10,000 MHz. That's ten times a higher frequency as the relatively new 1,200 MHz UHF band on which Novices just received voice privileges. It takes a Technician class license or higher to operate at 10 GHz. The Amateur Radio Service is allocated 10–10.5 GHz.

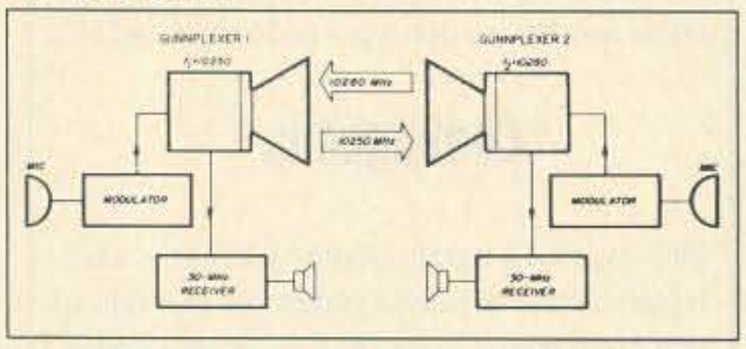


Figure 1. Full duplex operation with pair of 10 GHz transceivers.

While there are four other amateur radio allocations between 1,200 MHz and 10,000 MHz, most microwave enthusiasts stake out at 10 GHz, mainly due to the readily available equipment for that band.

Full Duplex

The most common emission type at 10 GHz is wide-band FM with an incredible bandwidth of 220 kHz! Good thing hams have 500 MHz to play around with here!

Two-way communications are normally centered around 10.250 GHz, right in the center of the band. Beacon stations normally operate near 10.228 GHz, using a Modulated Continuous Wave (MCW) IDer.

Advanced Receiver Research produces the most commonly operated equipment. These units feature wideband FM modulation, a provision for keying a MCW ID tone, and tuning capabilities of at least 60 MHz to each side of the 10.250 GHz center frequency. When ARR transceivers come in pairs, one unit is pre-set at 10.250 GHz, and the other unit is pre-set at 10.280 GHz, offering full duplex (simultaneous talk and listen) communications over some surprisingly long distances, sometimes several hundred miles.

Some microwave experts are switching from wideband FM to SSB, which will no doubt break communication distance records. The most popular mode there today, however, is still WBFM.

Photo A. The author's 10 GHz DX station.

Details of the TR10GA

The ARR 10 GHz sets use a Gunnplexer manufactured by Microwave Associates, Inc., of Burlington, Massachusetts. ARR offers four power-out levels: 10, 20, 35, and 100 mW.

The average price for the 20 mW assembled unit is $500. It's completely assembled and ready to go. Add "3 dB" (twice the price) to buy a pair—they don't offer a discount on the second unit. They come tuned for instant operation right out of the box. Place the order directly with the factory with the owner Jay Rusgrove W1VD. It takes approximately 45 days to complete the order. ARR is working on a number of microwave products, including microwave preamplifiers.

A standard 30 MHz IF is used in the United States so that each transceiver may operate full duplex with another station. Even homebrew equipment stays with the 30 MHz IF to insure that everybody may talk and listen simultaneously. I ordered a pair of 35 milliwatt units, Model TR10GA-35mW, and they arrived packaged expertly to keep things from getting banged up on their way out to California. Both units operated flawlessly out of the box, and they haven't given me an ounce of problems even though they have been banged around on many a mountain-top expedition.

The front of the unit looks like a regular two-way radio. There are pots for mike gain,

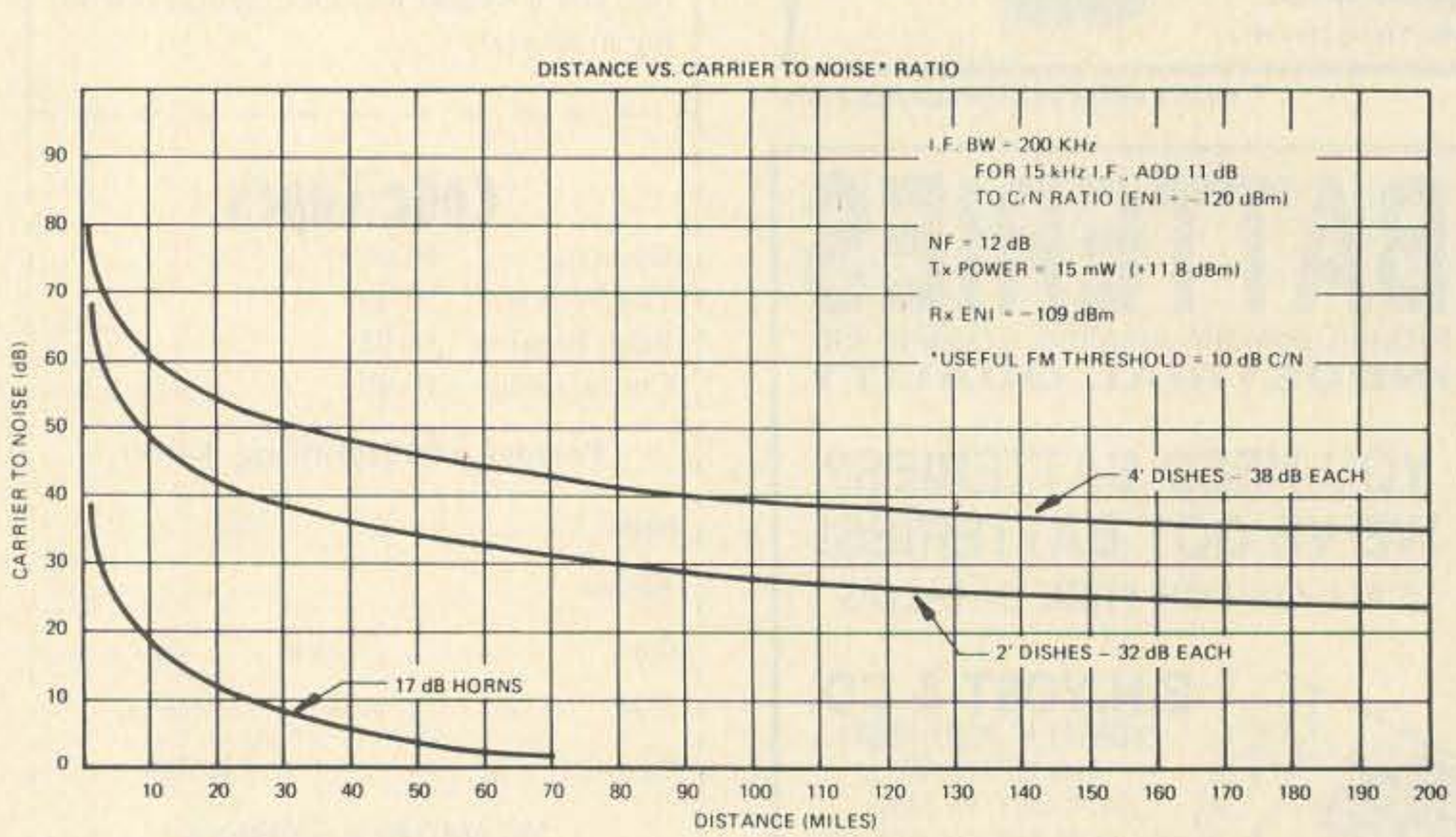


Figure 2. ARR TR10GA Specifications.

squelch, and audio, and jacks for a set of "cans" (headphones) and the mike jack for any high or low impedance mike using the supplied ¼" phone plug.

The AFC switch keeps the transceiver locked to another station on those days the unit gets hot in the sun, and the meter switch allows an op to switch between varactor tuning voltage as well as center position to properly tune in another station. That is viewed on one of the bold, back-lit meters on the front of the unit. The other meter acts as a relative signal strength meter with S-9 working out to be around 30 microvolts to the input of the 30 MHz receiver.

Then, of course, there is the main tuning dial—it would have been nice if ARR provided some calibration marks on the dial for fine tuning to specific frequencies. It is, however, a smooth and responsive dial.

Professional Quality

Construction and circuitry inside the unit is excellent and obviously professionally done. ARR puts together everything but the actual Gunnplexer device.

The Gunnplexer contains a Gunn oscillator that generates both the transmit power and the receive local oscillator injection for the mixer diode. Since the Gunn oscillator functions as both the transmitter and receive local oscillator, the IF receiver at each end of the communications link must be tuned to the same frequency. This means the Gunnplexer might be tuned to 10.255 GHz, and the other station must be tuned to either 10.225 or 10.285 GHz to provide the required 30 MHz IF.

One of the units I operated was calibrated to 10.250 GHz with a tuning voltage of approximately 3 volts. The second unit at 10.280 GHz registered a tuning voltage of approximately seven volts. After approximately five minutes of warm-up, the units held together, rock solid, and seldom was the AFC required.

Horn Antenna

The ARR units are supplied with a plastic 17-dB horn antenna that protrudes from the rear panel of the transceiver. It's an easy job to remote-mount the horn and Gunnplexer from the ARR radio unit. Only three lengths of small RG8X coax cable are needed. The op can put the actual Gunnplexer and antenna system anywhere he wants. Since everything is down-converted to 30 MHz, there's no significant loss in a long coax cable run.

IMPORTANT—NEVER LOOK INTO AN OPERATING HORN. Waves at these frequencies have even higher energy than those used in microwave ovens!

CQ DX

The range between two ARR units is normally limited to line-of-sight. My best DX was 180 miles, between Santa Barbara in Southern California and the Mexican border. Tropospheric ducting plays an important part in over-the-horizon range. Any temperature inversion on a windless day could very well extend the range beyond 200 miles!

Down on the flat lands, as soon as anything got in between two units, communications

Photo B. X-band mobile.

quit. Foliage is a killer. Buildings sometimes reflect the waves, and sometimes block them. About the best range around a city is a half mile or so. Between two well-elevated towers, however, the range is often 30–40 miles!

I found I could bounce signals off of passing airplanes. This required precise alignment of the set-up, but nonetheless, reflected communications worked nicely.

An op can go about three blocks "on the deck" (ground level) before the absolute non-line-of-sight signal is completely absorbed by houses and trees. Two ops a block apart could probably make contact even through all the stucco and leaves.

Extending Signal Range

Like any good ham, I wanted longer range, so I made some interesting modifications.

I first got rid of the headphones and routed audio to a tiny speaker. There's plenty of audio in the ARR unit to run the speaker at medium volume. Next, I went to a longer feed horn. The new horn was rated at about 26 dB, and it gave me a good boost in signal strength.

Then I went for a 4-foot solid aluminum dish—also available from ARR, but actually manufactured by Anixter Mark in Skokie, Illinois. The 4-foot dish gave a real signal-boosting 38 dB gain. I had to be, however, within two degrees of alignment of the other station, or else all signals were lost. The smaller horns allowed a ±10 degree deviation.

The feed horns are certainly more practical for portable operation and for searching out other signals on the band. While the dish did improve reception slightly, it wasn't as much as the dB figures indicated it would be, so the feed system was sent back to ARR for a checkout.

Long Wait

After 60 days and no returned dish feed assembly, my letters of inquiry to Rusgrove,

Specifications:

Tuning Range:	10.225 - 10.295 GHz typical
Power output:	10 mW, 20 mW or 35 mW nominal. Depends on type of Gunnplexer installed in the TRIBGA.
Bandwidth at −3 dB:	220 kHz
Bandwidth at −50 dB:	700 kHz
System noise figure:	12 dB typical
Tuning meter reading for 10.250 GHz:	3 volts ± temperature coefficient shift
Tuning meter reading for 10.280 GHz:	7 volts ± temperature coefficient shift
Signal level for S9 meter reading:	30 uV
Audio output:	2.5 watts into an 8-ohm load
Supply voltage:	13 volts dc nominal (13 - 16 volts)
Supply current:	250 mA, 400 mA, 550 mA for 10 mW, 20 mW and 35 mW units respectively
Size:	(HWD) 4-½ X 7 X 4 inches excluding horn antenna. (HWD) 4-½ X 7 X 10-½ inches including horn antenna
Weight:	2 pounds, 10 ounces

Figure 3. Computing charts for 10 GHz DX.

Photo C. Precise pointing between two stations is essential.

owner of ARR, finally elicited a rather terse response: "Since you seem to be unfamiliar with the working of the microwave industry, let me assure you that a 3-month repair schedule is reasonable. . . 26-week or longer time schedules. . ." I finally got the repaired system back, but bear this time factor in mind when returning microwave equipment to the factory for tweaking! It could take a number of months.

Thanks to the high quality of the products, however, most ops will never need to return their gear.

Documentation

The instruction manual accompanying the unit offers excellent documentation on the expected range. All units are computed in dBs. The documentation also includes all the details for tuning and adjusting the equipment, as well as remote mounting the antenna and Gunnplexer assembly.

Scheduling microwave contacts is a must—most microwavers won't get anywhere waving the feedhorn around in the random search for signals. Both system's antennas must be pointed at each other. I suggest coordination on a lower band, such as 2 meters. Generally, if signals are relatively strong between two 2-meter handhelds at either end of the two 10-GHz set-ups, chances are good there'll be full-quieting signals at 10 GHz FM. If the two ops can barely establish hand-held communications on 2 meters, however, chances are they won't make it on 10 GHz.

Tropo Ducting

Most fascinating is the early morning and late evening hours where tropospheric ducting takes place. An inversion layer may trap a 10 GHz signal and carry it for hundreds of miles before another station intercepts it. The record is well over 400 miles, a record which we will attempt to break during this summer's VHF and UHF tropo activity between the California coast and Hawaii.

Those looking for new adventure with quality equipment should turn to 10 GHz and the excellent sets from Advanced Receiver Research. 73

ABOVE AND BEYOND

VHF and UHF Operation

Pete Putman KT2B
3353 Fieldstone Dr.
Doylestown PA 18901

This month's column is somewhat of a hodge-podge. There's correspondence to attend to, some new products to cover, and a few thoughts on summertime VHF/UHF activity. Let's hop to it!

Philippine Hamming

An interesting letter arrived from the hams of the Malaybalay club in the southern Philippine islands: "We have read with interest your article about the IC-2AT...most of our club members are using the same model and we find it to be durable, dependable and effective...it was only by accident we came across that magazine, since it was very difficult to get a copy of any radio amateur magazine from the USA, much more to subscribe to one...

"Our club is composed of thirty members in the municipality of Malaybalay in the province of Bukidon in the southern part of the Philippines. Our club station on 144.380 MHz simplex is a Yaesu FT-211R with 45 watts...Our club is assisting the community, most especially the police force since they don't have adequate communications equipment!... We are not only using the radio as a hobby, but also as a means to help our community."

The letter goes on to ask if anyone would be interested in donating old amateur radio magazines to their club for a library, no matter how old, to "keep the amateur spirits burning." Kind of puts things in perspective, doesn't it? We have the ability to fire up the 2-meter kilowatt into a stacked array and chase grid squares, while those folks consider themselves lucky to be able to get on FM simplex. Please send donations to: Radio Amateurs of Malaybalay, Inc. c/o Roberto T. Flores, Secretary, 2nd floor Saver's plaza building, 8700 Malaybalay, Bukidon, Philippines.

Neat Stuff

Lots of goodies showed up at Dayton this year, proving that interest in VHF activity is stronger than ever. Antennes Tonna of France introduced three new designs: an 11-element yagi for 220 MHz, a 19-element long boom design with 17.2 dBi claimed gain, and a 25-element yagi for 2304 MHz. The last antenna uses an end-fired horn and 25 parasitic elements, developing 18 dB of gain at 2304 MHz. (Most European 13 cm equipment and antennas are designed with a center frequency of 2320 MHz.) I'll soon review both the 220-19 and 2304-25. They are available from the PX Shack in Belle Mead, NJ.

PC Electronics of Arcadia, CA, introduced at Dayton their new TX23 ATV transmitter for 1240–1300 MHz. It's similar in appearance to other PC models and develops 1 watt PEP output with a 4.5 MHz sound subcarrier. They supply a crystal for the 1289.25 MHz standard ATV simplex frequency, and other crystals are available. Input connection allow interfacing with just about any camera or video/audio source. It's quite a package for $299.

For the ever-expanding 33 cm crowd, VHF Communications of Jamestown, NY, introduced the complete 902 linear transverter. It takes up to +10 dBm input (or up to thirty watts with the optional attenuator) and develops two watts output. The optional amplifier (in kit form) boosts the signal to 20 watts. The basic transverter runs about $400.

Transverters Unlimited showed a new improved version of their SLA-13 13 cm amplifier which uses a Teflon™ PC board and a pair of ON4284 devices to develop 10 watts of true class AB linear power with 1.5 watts of drive. For $299, it's hard to beat.

"For the ever-expanding 33 cm crowd, VHF Communications of Jamestown, NY introduced the complete 902 linear transverter."

RF Concepts introduced a new line of 70 cm all-mode amplifiers, running 100 watts output with either 10 or 30 watts of drive. They include a 15-dB GaAsFET preamp. The RFC 4-110 and 4-310 price out at $324 and $349 respectively. RF Concepts also showed a nifty repeater controller, called the 8-RC. It is a big shift away form the bells and whistles, focussing instead on multi-tasking capabilities, including not only a repeater but several remote sites and and voting circuits. The suggested list is $395.

Telex/Hy-Gain showed off their new 215-DX 15-element 144 MHz long yagi. How well does it work? Well enough to win the antenna gain contest at the Hamvention measuring 14.3 dBd. The boom length is 28 feet, similar to the Cushcraft 42-18XL. Great to see Hy-Gain back on VHF and UHF as well, with the 7031-DX for 70 cm fans. It finished second on the antenna range with 16.5 dBd.

Photo A. A view of the station at KT2B. Output is 100 watts on every band except 903 MHz (25W) and 2304 MHz (2W). An Amqute PC is used for logging and duping during contests, as well as word processing and preparing this column!

Newsletters

Two publications VHF/UHF fans should add to their monthly mailbag: The *Midwest VHF Report* and *VHF/UHF and Above Information Exchange*. Roger Cox WB0DGF edits the first. I've quoted extensively from the *Midwest VHF Report*. It contains a wealth of information about VHF, UHF and microwave activities in the Midwest and Southwest. *The Report* is produced on an Apple MacIntosh and runs only $10/year for a subscription. Write to: Midwest VHF Report, 3451 Dudley St., Lincoln NE 68503-2034.

Rusty Landes KA0HPK edits the *VHF/UHF and Above Information Exchange*. It covers all aspects of VHF operations, including moonbounce (with the 432 and up EME News) and extensive grid square standings. Subscriptions for this monthly run $16.50/year bulk rate or $21/year first class. Write to: VHF/UHF and Above, PO Box 126, St. Mary of the Woods IN 47876.

Sprints

The ARRL Spring Sprints were a flurry of activity. Most of the sprints were well-attended, especially those for 432 and above. The 2304 Sprint (its first running!) had a lot of activity. Many such stations here in Pennsylvania fired up and made contacts. (I participated in this, though my station suffered from an oscillation problem, which kept me from hearing other stations.)

Some VHF operators discussed moving the microwave (i.e 902 and above) sprints to the fall. Tropo conditions are generally nonexistent in May, and frequent thunderstorms and rain make mountaintopping unpleasant! I suggest moving this event to late September/early October when conditions are peaking and the weather is favorable. Send in opinions on this!

Conventions

The biggest of all the VHF/UHF conventions is the annual gathering of members (and friends) of the Central States VHF Society. This year's meet took place 21–24 July at the Villager Motor Inn,

5200 "O" St., Lincoln, Nebraska. There were tours of Hy-gain, and antenna gain/preamp measuring events.

Microwave Update '88 will take place 25–28 August at The Inn At Estes Park. There will be papers on phase-locked oscillators, antenna feeds, microwave cavity amplifiers, transverters, lasers, and filter design. Don Hilliard W0PW is the coordinator. The conference is pre-registration only—no drop-ins. Conference rates are $32 before 15 June, and $40 from 16 June to 1 August. Room rates are $46/night. Write to Don at PO Box 563 Boulder CO 80306.

Contests

By this printing, the CQ VHF WPX will have come and gone, no doubt bringing the usual hot weather and numerous grid DXpeditions. The low power categories are becoming very popular in this contest. My plans were to activate both KT2B/2 in FN24 and KT2B/VE3 in FN14 with low-power equipment on 6, 2, 220, 432, 903, and 1296. The readers will have to wait until October to find out how it all went! In the meantime, why not pack up some gear and go portable for the ARRL August UHF Contest? It's the first full weekend of the month, and the contest period is only 24 hours . . . plenty long enough for tropo, but short enough for a weekend jaunt. I'll be checking in from Cathead Mountain, NY, in FN23 on 432, 903, 1296, and 2304 MHz.

"Most of the sprints were well-attended, especially those for 432 and above."

Help!

The October Issue of *73* will be devoted to microwave operation . . . that is, activity on the bands on and above 900 MHz. Readers who have appropriate articles need to submit them to the magazine before 1 August. *Get schematics and other graphics in as soon as possible!*

I'm compiling a list of manufacturers of equipment, antennas, and kits, which will appear much the same as the Hand-held Directory from December 1987. If your company has an amateur microwave product—transverters, amplifiers, surplus items, test equipment—I want to hear from you! Mail this material to me no later than 29 July, at the above address. Interest in centimeter- and millimeter-wave operation is definitely on the upswing, as shown by the Sprints and and the January VHF Sweepstakes results.

Sources

Anyone who spends any time installing and removing antennas knows the value of using stainless steel hardware and brackets. Now there's a fairly inexpensive source for just about any stainless steel hardware including U-clamps and nuts. The company is Jacob Schmidt and Son, located at 1908 Sumneytown Pike, Harleysville PA 19438, (215) 234-4641. Their recent catalog shows such stainless items as U-bolts and keepers, screws, lag bolts, socket screws, hex head hardware, wing nuts, hex nuts, set screws, cotter pins, washers, tubing, and much more. Write for their catalog!

Steve Kostro N2CEI is a good source for all kinds of VHF goodies, including some dirt-cheap preamp kits for 28–2304 MHz, at $30 each. Among his wares are MMICs, GaAsFETs, voltage regulators, chip capacitors, helical filters, piston trimmers, diodes, SMA connectors, toroids, and Teflon™ PC board material. He also carries one-of-a-kind items such as filters, mixers, splitters, power amplifiers, and connectors. His address is Box 341A, RD1, Frenchtown NJ 08825. He can be reached at (201) 834-1304 from 9 a.m. to 7 p.m., and at (201) 996-3584 from 9–11 p.m.

Finally, Bob Seydler N5KET of Rt. 2 Box 2170, Boerne TX 78006 published a small catalog of all kinds of surplus microwave equipment, including transmitters, receivers, oscillators, isolators, circulators, and power amplifiers for 1 GHz and up. Some of these active devices work, and some don't, but all are clearly labelled. He also has a sizeable stock of connectors, GaAsFETs, microwave diodes, and attenuators. I bought four of the 2304 isolators which are ideal between solid-state gain blocks where 50Ω impedance matches are sometimes hard to achieve.

That's it for this month. See you next month with a complete write-up on our June DXpedition to Chincoteague Island! 73

10 and 75 Meter Contest Results

10 Meter World Championship—Contest Results

Single Operator:

Callsign	QTH	QSO's	St/Prov	DX	Score
KD8AQ	FL	549	39	1	107,250**
AA4LE	AL	537	36	0	96,660*
K1NYK	CT	525	32	3	92,050*
N3II	MD	386	40	5	87,300*
N0CDH	MO	348	40	3	75,035*
VE3FWQ	ONT	331	35	3	62,890*
K9JS	IN	257	37	3	51,000*
K9ZO	AL	291	35	0	50,925
KS4S	NC	268	37	1	50,920*
KJ4NN	KY	333	25	3	46,620*
NE9O	IN	241	36	2	45,790
WD4KXB	VA	214	38	2	42,800*
N4HQT	TN	306	25	2	41,580*
AD0O	CO	214	35	3	40,660*
K3TX	PA	252	31	1	40,320*
KA5PGA	AR	254	23	2	31,850*
W3HXI	MD	206	26	4	31,500
AC3T	DE	201	29	2	31,155*
W4WKQ	FL	213	28	0	29,820*
KT3U	PA	182	30	1	27,450
K2OLG	NJ	144	34	3	26,825*
W0EJ	IA	171	29	1	25,800*
NF9R	WI	161	31	0	24,955*
N8CXX	MI	151	27	2	22,185*
WB8MDG	MI	155	27	1	21,840
KV0I	NE	139	27	2	20,010*
W6MKB	CA	135	13	9	18,370*
KD7UF	NJ	99	31	2	16,335
WB5SSD	LA	154	21	0	16,170*
VE1TE	NB	101	32	0	16,160*
K8HVT/1	CT	115	25	2	15,660
K3YDX	MD	94	25	2	12,960
KA1MXZ	CT	80	24	1	10,125
N0FZR	IA	102	19	1	9,265
NR5O	FL	85	20	0	8,500
KJ4WH	FL	86	19	0	8,170
KI4UJ	KY	64	24	1	8,000
N4GTU/5	TX	49	20	2	5,610
WA5IYX	TX	53	20	1	5,565
KD9OY	WI	49	19	1	5,000
KA0VYM	MD	46	18	1	4,370
N5AFV	TX	44	15	1	3,520
KC3XD	PA	39	17	1	3,510
N5IET	TX	33	17	1	3,060
W9HOT	IL	29	15	0	2,175
KA0QQP	IA	33	12	1	2,145
WA6FGV	CA	32	6	4	2,000
K9OCU	MO	25	12	1	1,625
KC3ZG	PA	23	9	1	1,150
VE3IR	ONT	18	12	0	1,080
WB2TKD	NY	14	8	1	630
W1LUG/4	MA	9	4	1	250
WB0YJT	KS	7	6	0	210
WA3JXW	PA	6	3	0	90
KF1B	CT	1	1	0	5

Multi-Operator:

N43JV	FL	941	44	3	219,255**
KB4RXM	TN	623	42	6	151,920*
K5LZO	TX	572	43	7	137,000*
N2EOC	NJ	532	40	4	117,260*
KA5DLM	LA	431	35	2	79,735*
N4EQS	CA	79	17	1	5,525
WV2ZOW	NJ	29	16	1	2,465

DX Stations:Single Operator:

VP9AD	Bermuda	1487	45	10	411,675**
XE1L	Mexico	91	17	6	11,960
HK3MAE	Colombia	43	10	8	6,930
CO2CB	Cuba	41	14	1	3,150
JE1SLP	Japan	80	0	3	440
JH1UUT	Japan	17	0	2	190
JE7HFQ	Japan	10	0	1	50
JI3BFG	Japan	6	0	1	30

Multi-Operator:

JA9YBA	Japan	1	0	0	5

Multi Operator Station Participants–

N2EOC ..... N2EOC and N2CEI
WV2ZOW ..... WV2ZOW and WB2TIX
N4EJV ..... N4EJV and N4EJW
N4EQS ..... N4EQS and N6HC
KB4RXM ..... KB4RXM and N4JII
KA5DLM KA5DLM, N5JBZ, KB5ACJ, N5JWA, and KD5RW
K5LZO K5LZO, KE5IV, NM5M, WB5N, N5VF, and WB5RUS
JA9YBA ..... JA9VDA and JA9-10148

10 Meter Honor Roll–All Time Record Holders–

	Category	Call	Year	Score
Single Operator:	USA	KD8AQ		107,250
	Canada ...	VE3FWQ	87	62,890
	DX	VP9AD ..	87	411,675
Multi Operator:	USA	N4EJV ..	87	219,255

75 Meter World Championship—Contest Results

W/VE Single Operator:

Callsign	QTH	QSO's	St/Prov	DX	Score
KQ3V	PA	641	58	38	336,960**
KE5FI	TX	680	56	37	332,940*
K5ZD	MA	651	55	37	329,360*
K0HA	NE	795	58	18	309,700*
WB2ULI	NJ	412	53	43	242,880*
KC8P	MI	555	58	16	214,230*
AD0U	CO	613	54	14	211,480*
N8CXX	MI	570	59	13	207,360
KV0I	NE	594	58	6	191,040
KI4DC	KY	477	55	13	163,540*
NC9F	IL	457	56	12	160,140*
WB7OJV	WA	446	52	10	138,260*
NE9O	IN	445	50	9	132,455*
W4TME	NC	384	54	11	125,125*
KS7T	MT	352	51	16	122,610*
W4WKQ	FL	390	51	6	112,290*
VE5RA	SASK	323	53	10	102,060*
AA4LE	AL	327	52	5	94,050*
K4ADI	SC	326	50	3	86,655*
N4HQT	TN	323	47	0	75,905*
K3TX	MI	301	40	4	66,220
KI3L	NM	229	48	8	64,960*
KA7DLV	MN	251	49	1	63,000*
NR4S	TN	212	47	6	58,300
WB5SSD	LA	214	47	5	56,680*
WA6FGV	CA	235	47	3	56,640*
K4GKV	GA	218	43	7	55,500*
KM0L	MO	200	45	1	46,000*
KC1BG	MA	128	46	4	32,250
KA2OSV	NJ	162	36	0	29,160
KA1PA	MA	103	41	6	24,440
KA8ZDF	MI	139	35	0	24,325
N0CLV	KS	105	40	1	21,525*
WA3EZN	OH	102	36	1	19,055*
WB0BJP	MN	90	37	4	18,660
WA1UJU	WI	106	35	0	18,550*
WB2EKP	NY	111	31	1	17,660*
W4UYC	GA	85	36	3	16,770
N8AXA	OH	72	40	3	15,695
WK4F	FL	73	34	7	15,170
W4XT	KY	66	34	2	11,880
WB9SAU	WI	64	36	1	11,840
KB9MS	IL	65	34	2	11,700
KT2D	NJ	101	20	0	10,100
W0CEM	KS	74	26	0	9,620
N9EOM	IL	63	28	4	9,600
WB8YEW	OH	5F7	29	1	8,550
W9REC	IL	62	26	0	8,060
KD9OY	WI	51	31	0	7,905
NA8W	OH	48	27	2	7,540
K8GSR	MI	48	29	0	6,960
KE8IR	MI	48	28	0	6,720
KC3XD	PA	49	26	0	6,370
WA5IYX	TX	44	25	2	5,940
KB1XD	CT	38	20	5	5,250
KE7QA	UT	43	22	0	4,730
KA3OGY	MD	34	20	0	3,400
N5AFV	TX	28	21	0	2,940
KC3ZG	PA	19	16	0	1,520
W1LUG	VA	19	12	0	1,140
KF1B	CT	17	11	0	935
K0JVZ	CO	8	7	0	280

Multi Operator:

K2PM	NJ	1310	59	56	890,100**
W7MR	UT	689	57	16	257,325*
KS3F	PA	698	57	14	249,920*
KB9S	WI	640	56	12	219,300*
NK7U	OR	553	57	14	200,575*
KB4RXM	TN	608	54	4	177,480*
WA5VVT	AR	437	53	10	140,775*
WD9INF	OH	367	55	9	116,440*
KA5DLM	LA	337	51	5	95,200*

DX Single Operator:

NP4P	Puerto Rico	669	55	49	428,480**
HI8RKM	Dominican Republic	373	49	30	165,900*
CO2CB	Cuba	305	54	5	90,565*
8P9AY	Barbados		156	38	25 61,740*
OZ1DPW	Denmark	6	2	4	300

Multi Operator:

JA9YBA	Japan	2	2	0	40

Multi Operator Participants

K2PM ..... K2PM and K2NJ
KS3F ..... KS3F, NE3F, and KC3RY
KB4RXM ..... KB4RXM and N4JII
KA5DLM ..... KA5DLM, KD5RW, N5JBZ, and KB5ACJ
WA5VVT ..... WA5VVT, WB5GFA, WD5BZO, and KB5BRI
W7MR ..... W7MR, N7IDG, KE7ST, KE7RU, and N7IEM
NK7U ..... NK7U, NI7T, and KE7OC
WD9INF ..... WD9INF and K9EC
KB9S ..... KB9S and KI0F

* State, provincial, or DX Country Champion
** World Champion

Continued from page 23

from Jameco. BCD Electro[4] is another good source of many of the parts. The circuit is relatively simple. The builder can breadboard it with point-to-point wiring.

Since I received so many requests, I made a printed circuit board available. The PC board is configured to plug directly into the cassette port, and all power comes from this port. (To obtain the −5 VDC, use an ICL7660 voltage inverter chip.) As an alternative, use a 6-conductor cable to mount the unit remotely. Both mountings that use the PC board eliminate the need for an external power supply. Complete parts kits and assembled units containing the watchdog timer and reed relay output options (both containing cassette port connectors and the PC board) are also available.[5]

If breadboarded, the power supply has many options. Several hams have used wall transformers from old video games or toys. (Jameco has several available, for example, part #DC512. It is a wall transformer with DC outputs at +5 V, −5 V, and +12 V.) Make sure the transformer's output is DC, not AC! Adding a 100 microfarad capacitor across the output will provide better filtering and regulation.

Another option to power the circuit is the +5 VDC from the C64. The C64's power supply has a limited reserve, however, so, if used to power the modem, don't connect other devices to the accessory or cartridge ports.

Overall, the AM7910 interface should cost less than $50 in parts, assuming no junk box parts. Not bad to get on packet!

Software

As with any packet system, there is a command mode and a converse mode. Digicom>64 recognizes a colon (:) as the first character of all commands. Any line not beginning with a colon is transmitted. Commands may be abbreviated to the least number of characters that make it unique. For example, this is the command string to connect to me via the WD3IGI digipeater:

:C W2UP V WD3IGI (carriage return)

Several parameters must be set prior to initial operation. While most parameters have default values, users will probably want to set many of them for their personal preferences (for example, screen color, 40 or 80 character screen, etc.). On the disk, I have included a "PERM file" that boots with the program. It's set for VHF operation at 1200 baud, while using 60 Hz AC. One parameter the user needs to set is MYCALL, which enters his callsign, and is transmitted in every packet. The system won't allow transmissions when this isn't set. It's set individually for each user port as follows:

:MYCALL W3XYZ (carriage return)

Full documentation is contained on the program disk.

Hardware

The modem requires connections to the receiver's audio output, the transmitter's microphone (or accessory audio) input, the PTT line, and ground. All connections to the computer are via the cassette port. Once this is done, it's a simple matter of selecting the correct mode of operation. Experiment with the Equalize mode on VHF to determine whether or not it's needed. Once that is done, just flick on the switch and it's ready to go!

LEDs show POWER and DATA. Whenever packet data is received (whether intended for that station or not), the DATA LED will lights. It's purely for show, and is optional.

Final Comments

As of early 1988, I have sent out to five continents about 900 copies of Digicom>64 with associated circuit diagrams. A warning: I have heard rumors that both the software and interface diagrams have appeared on some "commercial" telephone access bulletin board services with incorrect information.

Before initial testing, recheck the wiring and make sure there are no solder bridges between connections. NEVER plug or unplug the cassette port connector with power applied to either the computer or modem.

This project provides an inexpensive and easy way to join the many hams already on packet. It also gives the builder a sense of accomplishment and the satisfaction of "rolling his own."

I would like to thank the authors of Digicom>64, DL2MDL, DL3RDB, and DL8MBT for writing such a superb program, and releasing it into the public domain. I thank Frank DL1SBR for providing the English translation of the documentation.

Willy YV1AQE provided the basic AM7910 circuit, which I have modified. I also thank the many hams to whom I have sent copies of the program over the last year, and who provided me with valuable feedback and tips concerning both the software and the interface, which have culminated in this article. 73

Notes

[1] *QST*, November 1987, p. 59. *Gateway*, 3:22, p. 2.

[2] Software is available from me on 5 ¼-inch floppy disk for $6. This includes shipping and handling. Please include a self addressed mailing label. The disk inlcudes the Digicom>64 program and documentation files.

[3]. Jameco Electronics, 1355 Shoreway Road, Belmont CA 94002. Phone (415) 592-2503.

[4]. BCD Electro, PO Box 830119, Richardson TX 75083-0119. Phone (800) 456-2233 or (214) 343-1770.

[5]. The following parts and kits are available from me:

Blank PC board	$10.65
Blank PC board with disk	$14.95
Kit of parts with PCB and disk	$49.95
Assembled/tested PCB and disk	$79.95
Shipping and handling (US only):	
Orders less than $50	$2.50
Orders greater than $50	$3.50

For orders outside the US, please inquire for shipping charges. For all inquiries, please include an SASE.

Number 29 on your Feedback card

QRP

Low Power Operation

Photo A. This small five watt panel will supply all the power needed for the HW-9.

Mike Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

Solar Energy—Background in Brief

The process of producing electricity from sunlight is called Photovoltaics, or simply PV. The phenomenon was first observed in 1839 by French physicist Edmond Becquerel. In 1905, Albert Einstein explained the photoelectric effect and, since the 1950s, PV has gained widespread use. Today, solar generated electricity is used throughout the world for water pumping, refrigeration, communications, lighting, and virtually any use requiring electricity. During the past several years, the thin film PV panel has made low cost solar electricity quite common. Chances are you may even use a solar calculator or wear a solar powered watch.

Light consists of trillions of invisible particle-like photons. These are best described as tiny bundles of energy. When a cell (usually made of silicon) is exposed to sunlight, the photons release their energy to electrons within the cell. The charged electrons are then collected on the surface of the cell. A wire is soldered to the top of the cell. This becomes the negative lead. After the flow of electrons pass through a load, the electrons lose their energy and return to the bottom of the cell via a second wire lead. Following this process, the electrons are ready to pick up more energy from the photons. As a result, the electrons themselves are never physically "used up."

Photovoltaics received widespread use and acceptance beginning in the late '50s, with the advent of the space program. As a lightweight and highly reliable power source, photovoltaics rapidly found a niche in space applications.

Of course, this is a very simple explanation of the photovoltaic (PV) effect. Reams of paper have been filled explaining the hows and whys of PV. "Sunlight in, electricity out," however, is all we really need to know here.

Each cell, regardless of size, generates about 0.5 volt of electricity. Amperage increases with the intensity of the light and the surface area of the cell. Cells are connected to form modules and modules are connected together to form arrays. Depending on the end use, modules are normally wired with 36 cells in series. This produces a module with a open circuit voltage of about 20 volts. This will load down to roughly 14 to 15.6 volts when connected to a battery.

Standard wattage for PV modules is 35 watts. Smaller and larger modules are also produced.

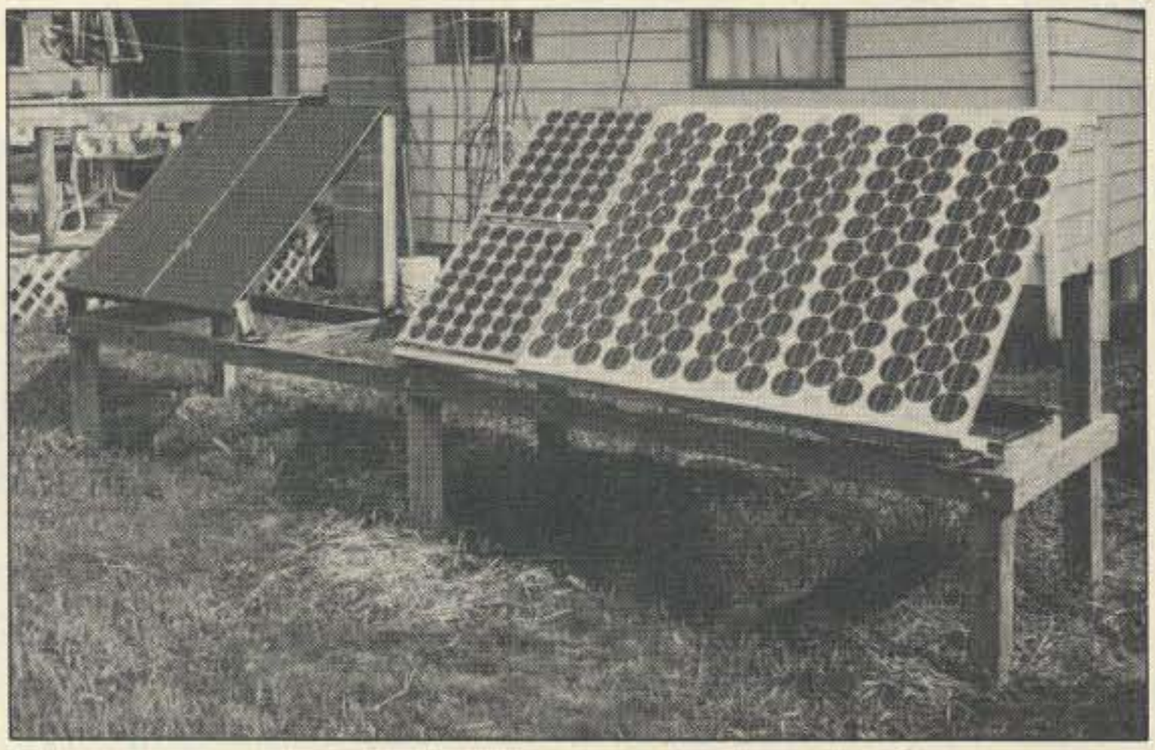


Photo B. This photovoltaic array supplies all the power for my station. This includes 24 hour packet repeater and lighting for the shack.

Amorphous Silicon PVs

Up to now, almost all solar cells were made of crystalline silicon, the most common element on the planet. The silicon had to be melted, refined, and melted again. Converting sand to semiconductor-grade silicon is an expensive process.

The introduction of amorphous silicon thin film photovoltaics, however, has sharply dropped prices. Amorphous silicon has no defined crystal structure—the molecules are arranged haphazardly. This lack of order makes their properties extremely difficult to analyze mathematically. Glass, and some hard candies, are examples of substances with amorphous structures. Amorphous silicon materials are far easier to make: The ingredients need only be melted together in a crucible. Each atom is free to bond to any other it happens to find itself near. The number of possible combinations in amorphous materials is practically unlimited.

By adding a little of this and some of that in the right mixture, we have a ovonic device, or semiconducting glass. The term ovonic is derived from Stanford Ovshinsky, the forerunner in amorphous technology. Stanford Ovshinsky formed Energy Conversion Devices Inc. Sovonics, a wholly owned company of ECD, produces thin film photovoltaics.

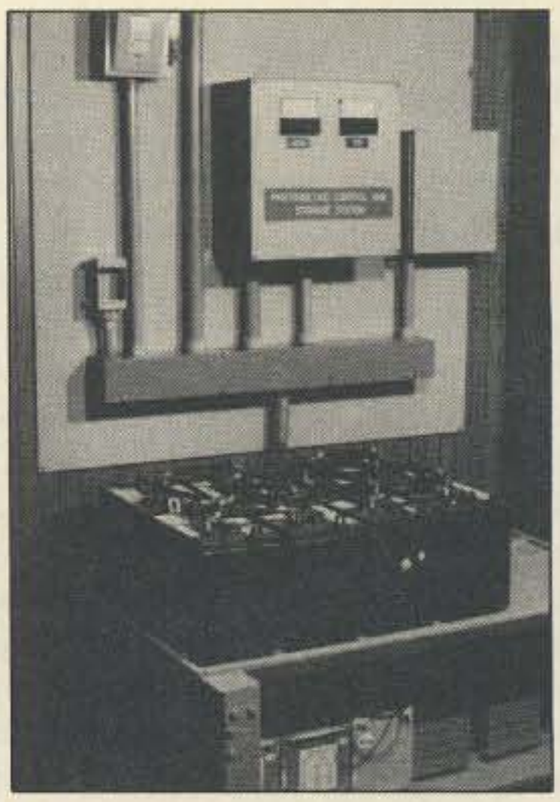


Photo C. Control system that resides in the basement of the house. All energy from the photovoltaic array and wind mill is stored here.

Sovonics produces high performance tandem solar cells on flexible stainless steel and covers them with Tedlar™.

This high volume manufacturing process is the ultimate in solar cell production technology. Sovonics mass-produces solar cells in a process similar to how newsprint is produced, called continuous roll-to-roll deposition. The process produces the largest solar cell in the world—a 35-pound roll that will produce 40 kW. The active cell total thickness is about 1.100 of the thickness of one human hair!

Since Sovonics uses a substrate of stainless steel, you can bend, drop, twist, and generally rough-up these panels and they'll still work. They're light-weight and non-breakable. If it sounds like I'm impressed with Sovonics, you're right! There are others who also manufacture thin-film photovoltaics. Among those: Arco, Solarex, and Chronar. These companies chose to use glass as a substrate instead of stainless steel.

Take a Look

Photo A is a good example of solar energy at work. A five-watt Arco Genesis thin-film panel charges up a gel-cell battery to operate the HW-9. I used this set-up for several Field Days and have had great results.

Photo B is the PV array that stands in the back yard for home operations. There are three different types of photovoltaic panels shown: Arco, Solarex, and Sovonic. This array produces a peak power of 200 watts. I plan to upgrade the entire array later on this

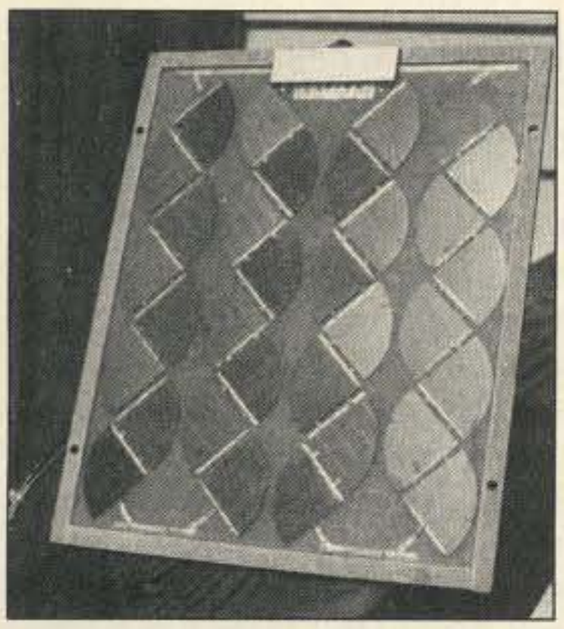


Photo D. Small three watt photovoltaic for the QRP operator. Would supply quite a bit of power.

summer to 500 peak watts.

Photo D shows a small two watt module. This module was made by Solarex. It uses crystalline silicon cells in quarter disks. The module shown in Photo E produces a bit more power–it is a 12 watt Sovonics Sun Flex unit.

How To Use a PV Cell

The user must not connect a photovoltaic module directly to any electronic device—the unregulated voltage may well destroy a unit it's meant to power. Use either a battery or a voltage regulator. The battery serves as both a regulator and storage device. I will discuss batteries in greater detail in a future column.

While smaller PV modules can safely connect directly to a battery, it's generally a good idea to protect the battery from overcharging. When large arrays with days of battery storage are included, the control system can get quite involved. Photograph C is the control and energy storage system I use in my home. Since this photograph was taken I have added more metering.

Additional batteries were also placed in service. The batteries on the top shelf are Exide EV-IVs rated at 220 amp-hours at a 20 hour rate. There are twelve of these in my system now. The batteries located on the bottom shelf are for portable and emergency use. The three 105 amp-hour deep-cycle Exide SP-015s and two 60 amp-hour torque starters are charged by an energy dump. The control system will first charge the main batteries (top level). When the batteries are fully charged, the controller will float them at the proper voltage, with the majority of the current going to the bottom batteries.

The controller inside the smaller enclosure is the heart of my solar storage system. The controller is a two-step regulator—it switches back and forth between constant current and constant voltage modes. The terminal voltage of the battery bank instructs the controller when to switch. There are, of course, other ways to determine the state-of-charge of a lead-acid battery. Terminal voltage is perhaps the most common. No one as yet invented a fuel gauge for batteries.

Go Solar!

Photovoltaic electricity is rapidly becoming the technology of choice for powering amateur radio stations. Power reliability is essential to emergency communications. More times than not, commercial power is not available during a disaster. Sometimes it is necessary to carry communications equipment by hand into disaster areas. This man-portable set-up also requires light-weight power generation. Photovoltaic energy fills the bill nicely, as sure and silent as the sun.

Hook up to the sun! Charge those batteries with sunlight using photovoltaic modules. Electricity produced from sunlight is a silent, non-polluting, and non-rotating source of energy. I will soon show in more detail the finer points of running a station from the sun's rays.

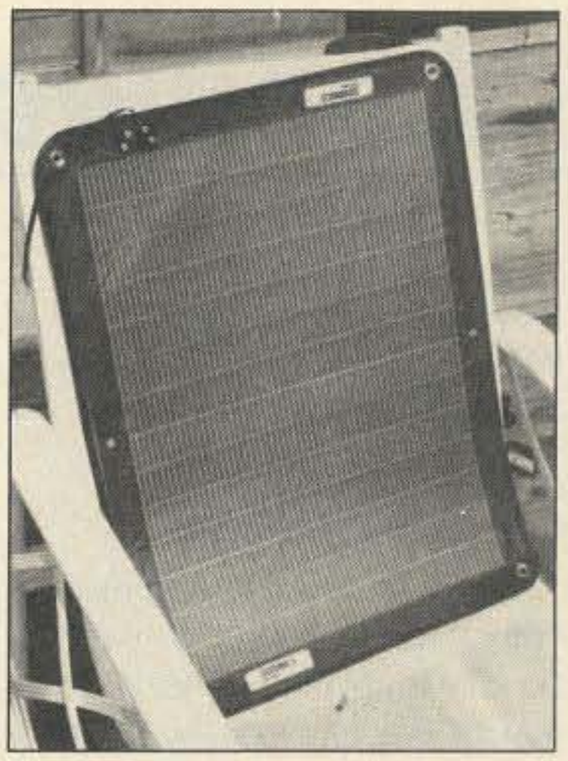


Photo E. A larger 12 watt Sovonic thin film module.

Next month's QRP column will look at antennas. I'll have some new ones to put up along with a second look at the vertical antenna. It is going to be a "don't miss" issue.

I'm still looking for Field Day photographs. As always, this column is for the QRP operator. Those who want bragging rights must send in their photos! 73

Number 30 on your Feedback card

LOOKING WEST

Bill Pasternak WA6ITF
28197 Robin Ave.
Saugus CA 91350

Definitive Coordination Recognition?

There was another surprise for FMers and repeater owners at Dayton Hamvention '88 in addition to the unexpected appearance and talk by former FCC Special Services Division Chief Raymond A. Kowalski. This one took place a day later at the FCC Forum on Sunday, May 1. ARRL Hudson Division Director Steve Mendelsohn WA2DHF and Rocky Mountain Division Director Marshall Quiat AG0X brought the League into the middle of the national coordination mess. The two directors conferred before the FCC forum and realized that affirmative action was needed to end the repeater coordination debacle—the one created by the FCC now sweeping the land.

It was about half way through the question/answer session when Director Mendelsohn requested the microphone. The following exchange ensued between WA2DHF and FCC Personal Radio Branch Chief John B. Johnston W3BE:

Mendelsohn: "(Suppose) the League undertook a national referendum—writing to every repeater trustee listed in our database—and asked them if if they support their local repeater council as it currently exists? In the case where the majority of responses support a given local repeater council on this independent referendum, and we (the ARRL) certified to you that that given council has the majority support in their area, would you then recognize and work with those councils?"

Johnston: "I would think so, because we are trying to use your Repeater Directory now, even with the disclaimer. . ."

Mendelsohn (interrupting): "Hold on. I didn't say anything about the Repeater Directory! I said that we, the League, will undertake a third-party referendum! We will do the mailing! We will do your footwork to find out who is and isn't supported! We will then certify to you the following people by whom the following majorities are supported. Will you then recognize those councils?"

Johnston: "I think there's a good chance we would consider it. . ."

With the FCC's hesitant receptiveness to Director Mendelsohn's proposal, it now must be brought before the ARRL Board of Directors for their stamp of approval. The votes needed to pass it likely exist, as the League would never have opened it to the public. They will be meeting at the time this column appears, so watch the ham newsletters and listen to the bulletin updates for news of the Board's action.

How will such a vote be handled and certified? The following is only my hypothesis. The ARRL already has the needed machinery and personnel in place. Every year the ARRL runs elections for its Directors, Vice Directors and Section Managers. They use the highly prestigious outside accounting firm (Price-Waterhouse) to supervise the Committee of Tellers from the ARRL in the vote tallying. This adds much credibility to the process.

The same tamper-proof, though highly expensive system, might be used where working with a Committee of Tellers from the ARRL Board of Directors assembles in a real-time supervised basis to open and count each vote in an election. In the case of their political elections, the results are certified to the membership—in the case of this proposed repeater coordination referendum, the outcome of the voting would be certified to the FCC. Using the same committee to do both jobs could save much time and money.

Questions

There are questions that still need answers: Will all coordinators agree to such a vote? Only the long-established groups, after all, have anything to gain. The so-called new "instant coordinators" may decline because to lose the election means giving up their coordinating ego-trip. Why should an instant coordinator accept this method, since it will probably mean an end to his activities?

How far to extend the franchise? Currently it's set up for the repeater-owners only. The sheer cost of the process is the limiting factor. The cost of having some 10,000 or more repeater owners vote for their favorite coordinator might run the ARRL into tens of thousands of dollars, and this is with the electoral machinery already in place. Imagine the cost to have every ham in the nation cast a ballot on this measure? Yet, according to the December Kowalski letter, even repeater users can be held liable for interference. Is it not unfair, then, to exclude this group from the franchise?

Finally, how binding will it be? The ARRL implied that this referendum could be a one-shot affair, not an annual event. Once this election takes place, the names selected by individuals and groups will be cast in concrete. Yet how will this stand up to a court challenge?

More On Ray Kowalski

Last month's column dealt with former FCC Special Services Division Chief Ray Kowalski's surprise appearance and talk at the Third Annual National Frequency Coordination Conference at Dayton Hamvention '88. This section continues giving excerpts of that talk.

It's interesting to note the difference of opinion between repeater coordinators (and now obviously the ARRL, as noted above) and the former FCC Division Chief. They generally believe it's only the repeater owners who should have any say in the coordination process. Kowalski definitely disagrees:

". . .you can't give franchise to repeater owners and disenfranchise every Tech and above ham who doesn't own a repeater. A repeater owner does not necessarily have to have his amateur license. Thus, in this solely ham-related issue, it's possible for a non-ham to have a vote in a strictly ham related issue, and for a ham not to! Some fresh thinking is needed here."

Kowalski then turned to a topic on the mind of everyone seated in the very crowded room:

". . .I suppose when many of you heard that I was going to be here today you thought I was going to defend my infamous letter of last December. (The letter of regulatory interpretation that permits more then one coordinator to function in the same geographic area at the same time.)

". . .That letter. . .is an absolutely asinine outcome. It puts people in a totally ridiculous position. To say that there could be two repeater coordinators in any geographic area is absurd!!!

"I would reach the same result today, however, under the same circumstances. I'm not sure how you fix it. I have. . .some suggestions.

"The letter tries to appeal to the coordinators' sense of compassion to their users as a way to get them to resolve their differences—or even compel the users to pressure the conflicting bodies to resolve their differences. We said that if you dual-coordinators don't want to expose your users to the potential for some enforcement stemming their coordinated versus non-coordinated status, you guys will get together and share your information so that you do not have inconsistent positions. That of course makes two repeater coordinators into one.

"The general body of repeater users, (however), whom that language was designed to protect doesn't know about it and could care less. Someone was telling me yesterday that, 'As long as the repeater kerchunks when they hit the key, that's all they (the users) care about.' Well, maybe you have got to get a little better grassroots support and understanding among the people who use these things and get them to realize that it's not just the repeater coordinators who have to carry all of the weight here. (Let them know) that there's some real (legal) exposure for the repeater users. . ."

Ray next commented on the FCC. "The Commission isn't going to conduct a fact-finding hearing to determine who is a legitimate coordinator. That's exactly what would have been called for in the situation last December (in reference to the 220-SMA vs. 220-FCC case in California, and the MoKan Council of Amateur Radio Clubs vs. the Missouri and Kansas Coordination Councils in the Mid-West). In order to reach a determination on who was the rightful coordinator, the Commission would have had to go into an investigation that they can't afford!

"I checked this out the last time I was there. . .the enforcement list. . .was two and a half pages long. (There are) only three people writing regulations. One person does enforcement. One person does rule making. The third splits his time between the two. That's it!"

To be continued. . . 73

73 Advertiser's Product Index

A convenient service for our Readers.

FEEDBACK

In our continuing effort to present the best in amateur radio features and columns, we've decided to go directly to the source—you, the reader. Articles and columns are assigned feedback numbers, which appear on each article/column and are also listed below. These numbers correspond to those on the feedback card opposite this page. On the card, please check the box which honestly represents your opinion of each article or column.

Do we really read the feedback cards? You bet! The results are tabulated each month, and Larry (our editor in chief) takes a good, hard look at what you do and don't like. To show our appreciation, we'll draw one feedback card each month and award the lucky winner a free one-year subscription (or extension) to 73. To save some money on stamps, why not fill out the Product Report card and the Feedback card and put them in an envelope. Toss in a damning or praising letter to the editor while you're at it. You can also enter your QSL in our QSL of the Month contest. All for the low, low price of 25 cents!

Feedback#	Title
1	Welcome, Newcomers
2	Never Say Die
3	QRX
4	What a Mess!
5	Auto VIM: Part One
6	Review: Heathkit SB1000
7	Handheld Transformation
8	Winnebiko: Portability
9	Digicom>64
10	Smart "S" Meter
11	IBM PC Clones
12	National Emergencies
13	Review: QSYer
14	Review: Pac-Comm Micro Power TNC
15	Modernizing the SB-200
16	Oscilloscope Preamplifier
17	Propagation
18	Review: PRO-2004
19	New Products
20	CAT to RS-232 Interface
21	Soldering Iron Auto Shut-off
22	ATV
23	RTTY Loop
24	Aerial View
25	Hamsats
26	Review: ARR TR10GA 10 GHz Transceiver
27	Above and Beyond
28	10 and 75 Meter Contest Results
29	QRP
30	Looking West
31	Ad Index
32	73 International
33	QTH DX
34	Barter 'N' Buy
35	Dealer Directory
36	Special Events
37	Index: 8/88
38	PRO-2004 Secrets

Number 32 on your Feedback card

73 INTERNATIONAL

edited by Richard Phenix

WELCOME TO THE USSR

We are pleased to bring you this first (brief) report from our Russian correspondent, Gennady Kolmakov UA9MA. Others will follow in the coming months.

No doubt this opening of communications with the USSR through the pages of *73 Amateur Radio* will inspire some of you to write to UA9MA, to request information, share information, or just to chat. Before you do, **please read this page and the boxed information carefully!**

The information here will remind you (or help you to understand) that one volunteer ham, in the middle of the largest nation in the world (8,650,000 square miles), with a population of 280,000,000 in 15 different Republics and including 104 different national groups speaking 70 different languages, will not be able to answer either all questions or all letters! (Write him in Russian, if you must write, and, of course, enclose IRCs.)

We don't want to load too much on him—and lose him—we can show him thoughtful consideration best if you will send your letters through us, care of this column. We can combine requests for information, translate them into Russian if necessary, and airmail them. (Your name, call, address, and IRCs can also be sent—if you wish—so that he will have the option of replying direct to you if he wants to.)

USSR

Gennady Kolmakov UA9MA
PO Box 341
Omsk - 99
USSR

I was very happy to receive the 1-year subscription to *73 Amateur Radio*!

Recently I came back from a Moscow radio conference (9–10 April) where we discussed many problems and questions at great length.

1. Now we can send and receive direct mailing.

2. We can print our addresses and personal picture on QSL cards.

3. We can publish our addresses in any Call Books (and also probably publish new USSR Call Book for the 88–89 Year).

4. We can QSO with 4Z4, 4X4 Israel stations (after [not doing so since] 1967). . . .

5. And many other questions which are shown in the newspaper article. [*See box for translated excerpts—Ed.*]

I will try to give you information which you ask in my next letters.

Many thanks! 73.

P.S. I am QSL Manager for UV1OO Franz Joseph Land DXpedition 1985–1987. [*RA9LA, Sergej Levchenko, Heyss Island, 81° N, 59° E, for which the QSL Manager used to be UA9LBR—Ed.*]

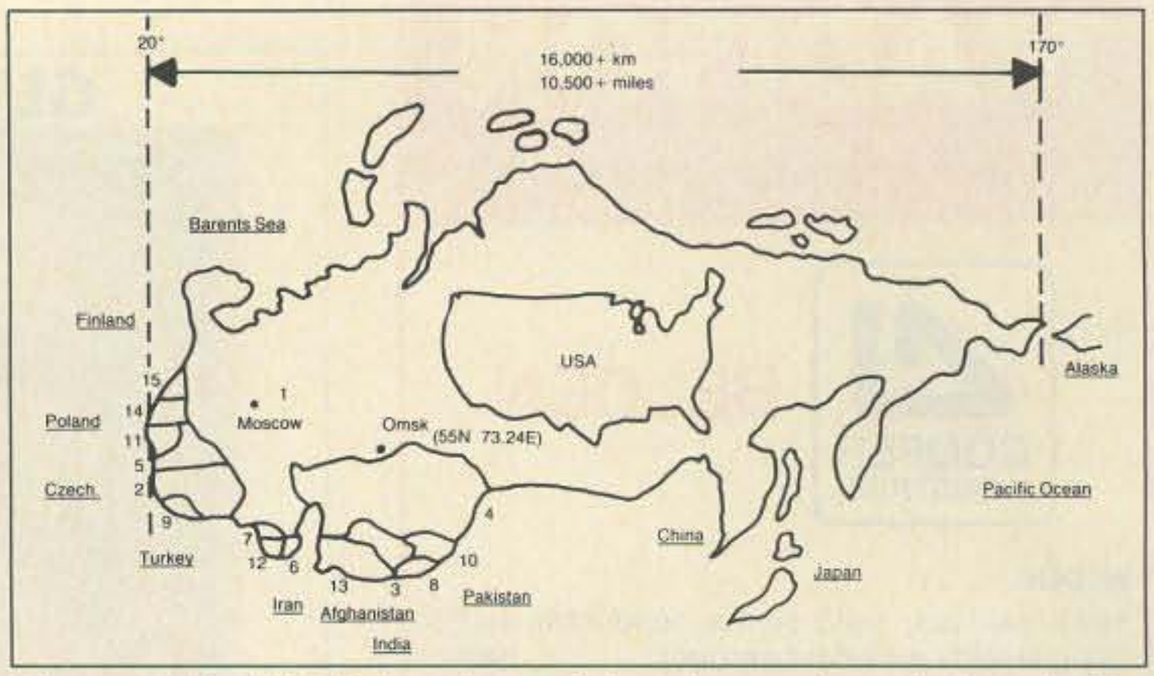


Figure 1. The USSR, location, relative size, and populations by Republics in order of size (in millions). 1—Russia (145.3); 2—Ukraine (51.2); 3—Uzbekistan (19); 4—Kazakhstan (16.2); 5—Byelorussia (10.1); 6—Azerbaijan (6.8); 7—Georgia (5.3); 8—Tadzhikistan (4.8); 9—Moldavia 2(4.2); 10—Kirghizia (4.1); 11—Lithuania (3.6); 12—Armenia (3.4); 13—Turkmenistan (3.4); 14—Latvia (2.6); 15—Estonia (1.6).

AND YOU THOUGHT *YOUR* NATION HAS PROBLEMS . . .

Russia (the Russian Soviet Federated Socialist Republic) contains a bit over half the population of the USSR and three-quarters of the territory. It has some 700 years of history behind it; the USSR (Russia and 14 Soviet Socialist Republics—SSRs) has only 70 years of history, and for many reasons faces constant challenges to its national identity.

There are, for example, more than a dozen religions, including Islam—which also is a way of life and a tradition. This is particularly strong in the south (SSRs 3, 4, 6, 8, 10, and 13 on the map). Since this is the area of greatest growth, Moslems may outnumber all the rest of the population in the USSR by mid-twenty-first century.

And obviously, in a nation which covers one-sixth of the surface of the Earth, weather, terrain, urbanization, industrial development, and agricultural pursuits are extremely varied.

The Russian language is considered to be the strongest uniting bond, yet in the Asian SSRs only about a third of the people have ever spoken Russian. However, the USSR's two main TV channels broadcast in Russian, the majority of the magazines are in Russian, the two official USSR newspapers (*Pravda, Izvestia*) are in Russian as is by far the greatest proportion of the circulation of the other USSR newspapers.

Because of these and other social and cultural differences, it is not surprising that *glasnost* (openness) and *perestroika* (restructuring) in the USSR are accompanied by considerable *smyateniye* (turmoil).

In the amateur radio field as in all facets of Soviet development, it remains to be seen how successful real and permanent changes turn out to be. However, hams, probably better than anyone else, are able to talk across national boundaries with a minimum of attention paid to all the QRMs of inter-nation communications, and can help the hams in the USSR as they work *po-novomu* (in the new way).

EXCERPTS FROM THE *SOVETSKIY PATRIOT*, 4/17/88

"Notes on the All-Union Amateur Radio Conference"

"Now in the world, according to facts from the International Radio Union, there are more than 1,600,000 Amateur radio stations. Of this, 40% are in Japan, 25% in the US, but, for our part, hardly better than three percent. One of the reasons for this is an acute shortage of communications equipment. It's difficult to obtain *many* radio components and other materials."

"[Now] there are changes to the system of forwarding 'cards of receipt.' [*QSL cards*] Now Amateurs may receive them from foreign correspondents not only through the Central Radio Committee, but also at their home address or a box number. Also, the right of transferring amateur radio stations to the first category is given now to the oblast and territorial DOSAAF Committees." [*All-Union Voluntary Society for Assistance to the Army, Air Force, and Navy of the USSR; the oblast committees are local groups for their respective geographical units (oblasts).*]

All countries waited with sharp impatience for the present amateur radio conference. Concerning the technical and amateur radio end of things, so many years of indecision went by that these areas stagnated. That's why the 360 delegates and organizers were agitated, sometimes even excessively.

The representative of the Federation of USSR Radiosport Yu. Zubarev began his speech with problems of the technical aspects of amateur radio—an area today neglected in the organizational plan of the field of the promotion of radioelectronics. The primary reason for that, he noted, is the absence of a branched net of radioclubs with laboratories, masters, and consultative offices, which successfully worked up to the beginning of the 70s. (When reorganization put them under a different administration). . . .

How to rectify the situation? Clearly, what's needed is not only a shoring up of the net of radio clubs, but also to make them broader than before . . . not only radio amateurs and builders, but lovers of radio communications suffered from the reorganization of the radio clubs. Many schools didn't even have a QSL bureau. The quality of of individual and collective radio stations in several oblasts went down. Things were even very unwell with amateur radio communications in the countryside. . . .

The issue, however, was not just an inadequate material base. The development of amateur radio communications couldn't withstand the blow to morale from the raft of many regulating documents. These documents contained more prohibitive than permittive and recommendative points. Therefore, naturally, many paragraphs of these instructions induce just discontent from radio amateurs.

Radio amateurs voiced more than a few reproaches to the Federation of Radiosport, to the local chapters, and to the All-Union Federation. Their actions were met with more than a little formalism, bureaucratism, and high-handed action. There isn't enough "glasnost" in the Radiosport Federation of the USSR. Many questions are decided in the narrow circle, without widespread explanation and the taking of account of amateurs' opinions. . . .

Now, with impatience, the participants of the conference waited for the appearance of V. Bondarenko, the head of the E. T. Krenkel' Central Radioclub of the USSR. This comes as no surprise, as the Central Committee is the headquarters of the development of amateur radio in the country.

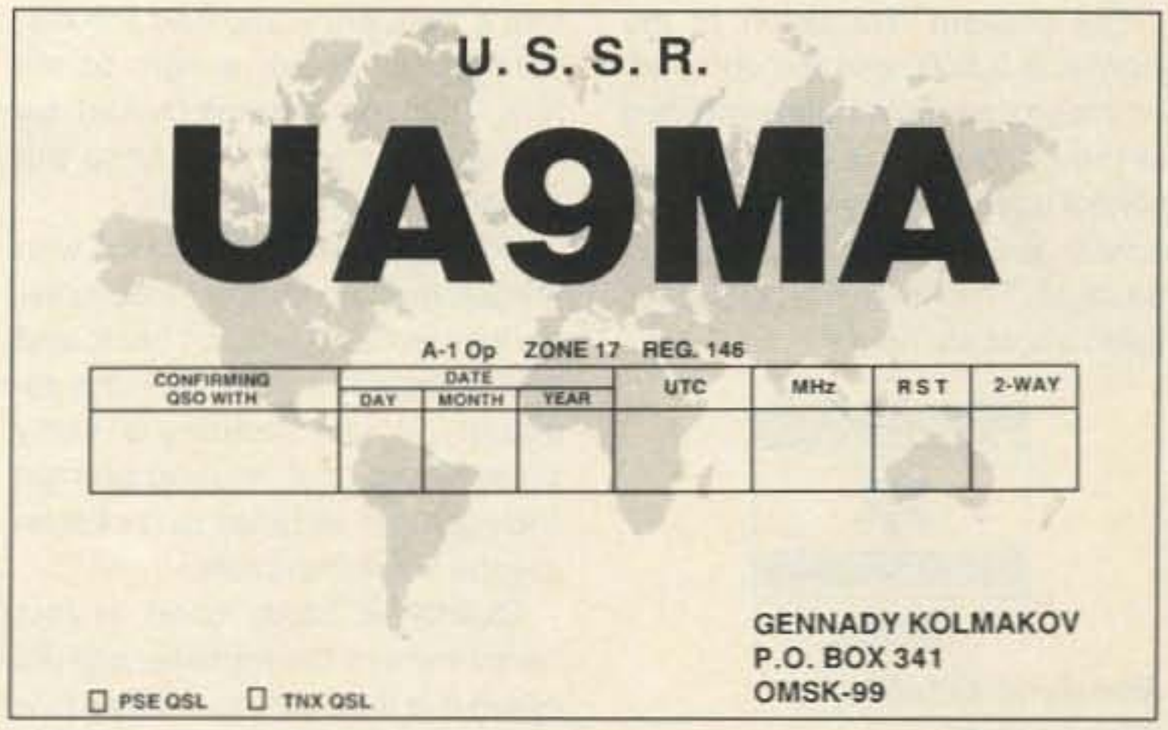
The participants of the conference were not deceived in their waiting. Bondarenko spoke about significant work that went on between the Central Committee together with the department of the Radiosport DOSAAF USSR and the All-union federation before the opening of the conference. . . .

(Hams) have sent letters to the ministries regarding the possibility of the sale of "non-liquids" to radio amateurs. We have already a letter from the ministry of industrial means that reports the organization of trade to radiodealings was taking shape in the "firm" [i.e. company . . . Ed] stores in Moscow, Krasnoyarsk, Volgograd, Nal'chika, Groznyi, Yerevan, Tbilisi, Arkhangelsk, Voronezh, Kiev, Dnepropavlovsk, Simferopel', Sverdlovsk, Irkutsk, Kirovograd, P'skov, and L'vov. ["Non-liquids" are likely surplus ham rigs . . . Ed.]

It must be acknowledged that the discussion sometimes became unruly. Clearly, a widening of democracy by itself still doesn't automatically endow us with the skill to carry a discussion. And a few delgates obviously didn't have the cultivation to respect other peoples' opinions.

[*Look for an explanation of the various committees and how they work together to administer amateur radio in the Soviet Union in 73 in the near future . . . KA1HY*]

(*Translation by KA1HY*)



Israel Gets the News

"The Iron Curtain has lifted!" says Ron Gang 4X1MK. When regulations for the April 9th, 40th Anniversary Contest were mailed out a set was sent to Box 88 in Moscow, "just in case."

"Imagine the happy surprise when [during the contest, stations] were called by and given contacts by Soviet hams! Probably a mistake on the part of the Russians, it was thought, and some didn't even bother to write in the logs. But a few USSR stations even said to QSL for sure via the bureau, and that was interesting!

"A day later the news was out on the local grapevine. A well-known ham [who had lived in the USSR] had been in touch with his buddies back in the USSR. They reported to him that on the very same weekend we were having our contest, the first-ever convention of radio amateurs in the Soviet Union was being held in Moscow."

The news was passed along: There are no more banned countries—amateurs in the Soviet Union may contact any country, including Israel.

Ron writes: "Are we indeed witnessing the dawning of a new age? Maybe! I heard UP1BYC calling CQ with an overpowering signal, gave him a short call, and Andy and I were immediately engaged in a pleasant QSO, with QSLs promised via the bureau.

"The band being very busy, I slipped up to 15 meters, and heard a Russian station CQing. My first call was ignored, and my second responded to with a request that I QSY. I implored him to respond, saying he could legally contact me now, but I suppose he thought I was trying to lead him on, and he resumed calling CQ. But on the same frequency another Russian called me whom I promptly answered, and in no time I had a small pileup of Russian stations calling me.

"Ten minutes later, the first station was now calling me, apparently now convinced that *glasnost* had taken effect on the ham bands.

"You can no doubt imagine my delight and happiness after all these years finally being able to contact stations which for me and my fellow-country hams had been out of bounds.

"After nearly 21 years we have a lot to catch up on, and I'm now enjoying contending with all the calls from the USSR when I get on HF. Poor 4X1FU, the manager of the Israel QSL bureau! He's going to be snowed under with QSLs, and I suppose it will be kind of hectic until all the Soviet hams have Israel confirmed."

[*4X1MK's regular Israel column is below.—Ed.*]

Notes from FN42

August is an even better month for celebrations of Independence Day than last month: 3—Niger, 6—Bolivia, 10—Ecuador, 11—Chad, 14—Pakistan, 15—India, 17—Indonesia, 19—Afghanistan, and 25—Uruguay. There are National Holidays for Switzerland on the 1st, El Salvador on the 2nd, and Singapore on the 9th. Five National Days: 4—Jamaica, 15—both Congo and Korea, 20—Morocco, and 31—Malaysia.

Other celebrations for you to mention during QSOs: 1—Army Day, China; 3—Memorial Day, Cyprus; 4—Freedom Day, Guyana; 7—Battle of Boyara, Colombia; 8—Bank Holiday in Ireland (on the 22nd for Great Britain); 12—Queen's Birthday, Thailand; 13—Womans Day, Tunisia; 16—Restoration Day, Dominican Republic; 20—Constitution Day, Hungary; 23—Liberation Day, Romania (on the 27th for Hong Kong); 24—National Flag Day, Liberia; 29—Heroes Day, Philippines; and 30—Victory Day, Turkey.

Roundup

Would you like to see *your* name here? It's easy. Just write us something as pleasant for us to read as these words from **Comandante Hilton Uohôa** of VARIG (Brazilian Airlines): "Yours is by far the best ham magazine. Keep it good. I'm sending for a subscription. Maybe I'll contribute with an article . . ."

China. The first Chinese polar-orbit weather satellite should be up by now if it is on schedule; an improved satellite for geosynchronous orbit is due in a year or two, making it the fourth in China's development of telecommunications. With a network of ground stations, TV broadcasts from Beijing will reach remote areas such as Tibet.

New Zealand. A 60th Anniversary is being celebrated in 1988. *Break-In*, the official monthy journal of the New Zealand Association of Radio Transmitters, Inc., turned sixty. Its first issue in 1928 was a four-page newsletter handset with metal type; today it is a 40-page journal set on computerized typesetting machines. One thing is unchanged: editorial work is still done by volunteers, with today's team being four ZL3 hams assisted by their families.

The journal survived, with continuous publication, through the cessation of amateur radio during WWII and various other trials and tribulations. With over 700 issues printed and around 250,000 pages of material written by NZART members, it is believed to be the longest surviving amateur radio magazine in the Southern Hemisphere.

The first of 34 editors/co-editors was B. Arthur Hilton ZL1AN; the current editor is Craig Campbell ZL3TLB. Current assistant editors are Ian McPherson ZL3TAO and Brent Collins ZL3TAC; XYL Denise Crawford and John Henden ZL3AFV are ad/graphics editors. (The "T" calls are ZL no-code licenses. "Where would the journal be if ZL didn't have no-code licenses?!" asks ZL2VR.

In its Jubilee issue, Editor Craig wrote, "For the record, *Break-In* is produced in the spare bedroom of my home, by the Editorial team working nights, after slaving all day for our (other) employers (sound effects here should be violins playing). Only the typesetting and printing are contracted out...volunteer enthusiasts have been involved for over 60 years in similar arrangements and in probably even more trying circumstances."

Code practice at the Holon Bat-Yam club (4Z4YH) that put 4XØR on the air at Masada in April. IARC past-president Ahron 4X1AT (ex-4X4AT), at left, instructs.

The present circulation of the journal is 3,800, and the completed magazines are hand-wrapped at the printers by a team of high school boys who also sort them by postal area codes for discount postage. The whole process takes them about six hours!

ISRAEL

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

The Phantom Is Unmasked. After four years the longest on-going occurrence of deliberate interference in the history of Israeli amateur radio has been resolved.

When it began, a distorted, metallic-sounding voice (thought to be electronically altered to prevent identification) made itself heard on the Tel-Aviv repeater, taunting the amateurs with various insults, often obscene. Efforts to track down the intruder bore no fruit as he made his transmissions while moving.

This "personality" soon was called "Doctor Bereleh," after the worm in a childrens' book who doesn't come out of his hole. When he was referred to as such during a QSO, the metallic voice suddenly broke in and announced that his name was Doctor Bereleh.

He had no set pattern of operating, and this "fly in the ointment" probably would have been endured, grudgingly, had he not decided to go on to bigger and better things.

In his second year, Bereleh's distorted voice made a megalomaniac announcement: The Tel-Aviv repeater belonged to him, and he had decided to close it down. And indeed, shortly thereafter the repeater couldn't be brought up. The IARC's Repeater Committee technical crew found the cause at the site. A weak pulse signal on the input frequency was keeping it timed out. Only after some serious DFing was a small transmitter found concealed in a tree.

For some time after this, Bereleh was not heard, but about six months later he began making sporadic appearances, generally with a weak signal, taunting his listeners. Once he asked one ham why he wasn't dead yet; he told another he had an ugly wife; and once he turned up on a trucking firm's frequency and had the dispatcher telephone a ham to tell him "Doctor Bereleh would be half an hour late." Annoying but apparently harmless, until . . .

Bereleh started up again with megalomaniac pronouncements. He wanted all the radios back, and had decided to take over the repeater. In late January a noisy pulse-type signal would appear on the repeater at times and obliterate the weaker signals.

Quietly, a hardy band of four hams went to the repeater site (located in a tall building in a Tel-Aviv borough) and waited for the signal to appear. Persisting in painstaking DFing work, they found the source of the interference: a small transmitter concealed in the telephone of a stationery store in the same building. The little rig could be turned on and off by phoning the number of the store and playing specific tones.

The couple who owned and ran the store explained that a telephone company repairman had appeared and taken the phone away for a "repair" he deemed necessary, returning it the next day. They had observed that he then came every morning, bought a newspaper, observed the telephone and connection box surreptitiously, thinking that by wearing sunglasses and a hat he wouldn't be recognized.

A whole detective story followed (too long to tell) to trap the imposter into coming to the store to repair the telephone. At the end, the police didn't arrive exactly on time when Bereleh did come to the store, but the storekeeper got her gumption up and locked the shop door with her husband (a judo expert) and Doctor Bereleh inside; he was held until the police arrived.

The suspect turned out to be a young man, not yet 24, Reuven Kushamaro 4X6KK, unknown to the Israel ham community. He had a business, Rubin Electronics, producing car radio detectors, and a forged army officers ID was found on him. There is a suspicion that he obtained his ham license fraudulently and that he had interfered with the police radio network also. The local popular newspaper, *Yedioth Ahronot* printed a color photo of a skeleton mask and a pistol on the front seat of his car.

Doctor Bereleh was jailed for six days by court order before being bailed out, and his trial is pending at this time. It appears that there may be enough reason to throw the whole book at him, and his repeater interference was one of the minor offenses. It is not clear why he made the repeater one of his major targets; perhaps the sense of it will never be known.

And so ends what has become part of the folklore of ham radio in this country. Doctor Bereleh's distorted metallic voice is heard no more—the phantom of the repeater has been unmasked. And it seems that the episode has had a deterrent value. The other few sporadic nut cases and jammers have disappeared. It is hoped that the polite atmosphere on this busiest of Israeli repeaters will endure.

[***Postscript.*** *Doctor Bereleh's transmitter was auctioned off at the annual Israel Amateur Radio Club social evening . . . to raise money for the IARC headquarters building fund. Talk about making the best of it . . . !—Ed.*]

POLAND

Jerzy Szymczak
78–200 Bia łogard
Buczka 2/3
Poland

Bunch of News

The special call SP0TPAX has been named to commemorate the first Polish amateur's radio communication, by Tadeusz Hoeftman TPAX, on December 6, 1925. Special QSL cards will be made.

The Piast Club of Radio Amateurs, SP5PAZ, of the Przyszłość Housing Cooperative in Opole celebrated its 10th year. It has achieved 170,000 contacts with 250 countries on SW and 12,000 with 19 countries (167 squares) on USW. It has 130 certificates. It has worked under such calls as 3Z6PAZ, SQ6PAZ, SR6PAZ, and SP0-FPP, PAZ, and ITU.

Niech zyje Polska! and Brawo Polak! (Long Live Poland! and Bravo Pole!) were rewards for Zbigniew Murdzia SP5EKY upon his return from a DXpedition in the spring of 1987. With the call ZK2EKY he arranged a trip to Niue Island in the South Pacific, by special charter plane from New Zealand. Young native boys helped him hang antennas on palm trees. With his FT200 and 300W amplifier, ZK2EKY made 9000 QSOs with 200 countries, 39 WAZ zones (except 34th) and got the WAC certificate on all SW bands except 3.5 (failing to reach Africa).

Ten thousand boy and girl scouts gathered for three days, a year ago, for a meeting devoted to environmental protection. Hams among them made 1037 QSOs with 67 countries and, with a 144-MHz USW station, many SP and SM contacts.

A four-day meeting near Bydgoszcz was organized by the Polish Scouts Association of that town, the Amateur Sports Radiolocation of Poland (ASR), and the District Board of PRAA. Representatives of the Radio Amateur's Association of Yugoslavia and Hans Jurgen Hahn Y23NE were among the competitors. From JO83XH 700 SW QSOs (FT101ZD, 300W amplifier, inverted V and GP antennas) were made, and 150 USW QSOs (FM3031 and FM315, 6-el yagi). At the close of the meet Krzysztof Słomczyński SP5HS was elected ASR president.

The Warsaw District of PRAA held a congress last November of 28 PRAA clubs, 21 clubs of the National Defense League, six of PSA, (1242 associate members), 902 OTs and 340 SWLs. The numbers of senders had increased by 108 and by 55 for SWLs, over the year. Those exceeding 300 contacts on the SPDXC list were recognized.

SPDX 1987 Contest winners were announced. Those placing first in each category (except individual stations) and District ratings are listed in the box. The best five individual stations and their Districts were SP3GEM, KL (306,774 points) and SP5CTY, WA; PS3HLM, GO; SP9DWT, KR; and SP3PL, PO (137,565 points). 73

1987 SPDX WINNERS

District ratings:
Włocławek (WL)
first with 71,831; then, in order,
Elblag (EL),
Katowice (KA),
Poznán (PO),
Zielona Góra (ZG),
Tarnów (TA),
Lublin (LU),
Bydgoszcz (BY),
Gorzów (GO),
and Kalisz (KL), with
33,869 points.

MHz	Winner	District
1.8	SP9DH	KR
3.5	SP2GVN	BY
7	SP8UFO	LU
14	SP3RBR	ZG
21	SP6CIK	OP
28	SP8EMO	LU

SWL winner: SP9-69006 (KR), and
Club station winner: SP6PST (OP).

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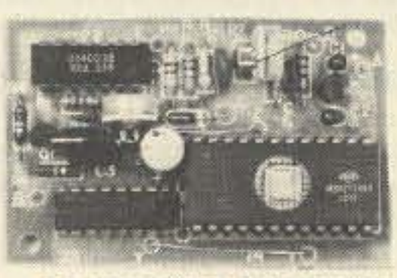

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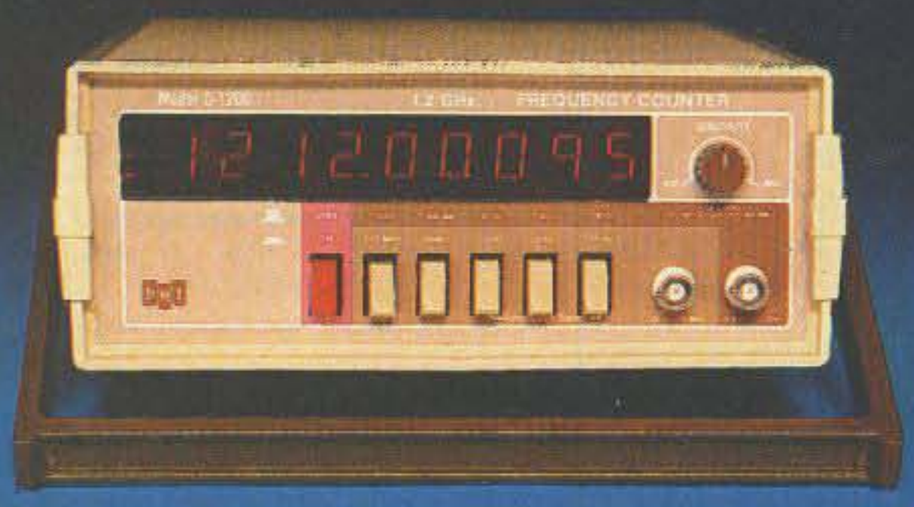

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One Of The New Ones

On the tiny island of Aruba (P4), "gold" has been discovered a few times, the most recent "ham-gold." Hamming became effective on January 1, 1986. Aruba now counts as a new country on the DXCC list.

Aruba's first discovery of gold, real gold, was in the early 1800's. Some three million pounds of the precious metal was dug out, but in 1913 the mining became unprofitable.

The second gold rush was for black gold. An oil refinery was opened in 1924. Producing 6.5 million barrels of crude, it was the largest oil refinery in the world for many years. One out of every 16 barrels of fuel used by United States aircraft in World War II came from Aruba. In 1985 the oil ran out, and the refinery closed.

A New Age

By then Aruba's third gold rush was booming, tourism. Travelers discovered the beauties of the island. Cruise ships poured in, bringing thousands of tourists for a few hours of sight-seeing, shopping, swimming, and other leisure activities.

But just a few hours of the island was not enough time for many vistors. So Aruba opened it's first luxury hotel in 1959. At last count there were 14 major hotels, including one giant with 490 rooms, and more being built. Many of the 10 newer developments are full resorts featuring a variety of combinations including swimming pools, tennis courts, shopping arcades, restaurants, bars, banquet halls, convention facilities, casinos, night clubs, discos, and even some elaborate Vegas-type shows.

Great for Hams

"Many of those hotels are very understanding and cooperate with hams. Many will let you put up antennas on the roof," says John Crovelli W2GD, who made four DX trips to Aruba. "The island's ham radio club has about 30 members, but few are active. They meet regularly at their house, on the south shore," John says. "They are a very laid-back people and really friendly."

The current *Radio Amateur Callbook* lists 59 ham stations in Aruba. None are named as holding the highest license classification—Class A. Class A requires CW at 13 wpm with three years hamming experience and allows one kilowatt operation. Getting a ham license to operate in Aruba takes about two months and costs $15, plus $10 more if the operator wants a special P40 call.

To get DXCC credit for working Aruba, a distinctive rule has to be observed. If the operator already has DXCC credit for Netherlands Antilles, he has to resubmit his QSL card from there, together with a separate Aruba card. The Netherlands Antilles card should document that the operator has worked Bonaire or Curacao, not Aruba. The purpose is, of course, to prevent using a Netherlands Antilles card from Aruba to use as credit for both Netherlands Antilles and Aruba.

Aruba became "a separate entity within the Kingdom of the Netherlands," as the arrangement is worded in government publications, on January 1, 1986. Aruba's status is now the same as the Netherland Antilles.

Previously, Aruba was a part of the Netherlands Antilles, six islands in two groups in the Caribbean. One group southeast of Puerto Rico consists of Saba, St. Eustatius, and the southern part of St. Maarten. The other group, near the coast of South America, had consisted of Curacao, Bonaire, and Aruba.

Mixed Lot

Aruba's government seems complex, at least to many outsiders. The governor is appointed by the Queen of the Kingdom of the Netherlands. The 21 member legislature is elected by Arubans. Executive power is held by the Council of Ministers, led by a Prime Minister. Legal decisions go to Aruba's Common Court of Justice, then to the courts of the Netherlands Antilles, and finally to the Supreme Court of Justice in the Netherlands.

Island leaders seem committed, understandably, to minimizing Aruba's longtime identification as a kind of Dutch outpost. In both the major city, Oranjestad, and in the countryside, there are a great many stores, homes, and other structures that have the distinctive design and brilliant painting of typical Dutch architecture. There's even a giant windmill, brought in pieces from the Netherlands years ago, now housing a popular restaurant. But the major tourist publication distributed by the new Aruba Tourism Authority describes such attractive buildings merely as "old architecture and colorful houses."

Language, too, is involved. Most Arubans speak four languages: Dutch, the official language, English, Spanish, and the local tongue, Papiamento. The latter is a mix of Dutch, Spanish, Portuguese, plus some words from English, French, and a variety of African languages. The country's national anthem is sung in Papiamento, and that language is used increasingly in the island's schools.

Aruba has a population of around 65,000, about the same as Greenwich, Connecticut, or Charleston, West Virginia.

The island is about 20 miles long, six miles across at its widest point, and covers 70 square miles, roughly the same size as Cincinnati, OH, or Spokane, WA.

Lots to Do

For such a small land, there is a surprising variety of attractions, including snorkeling and scuba diving in waters with visibility to 100 feet deep, to tour coral formations, sea life and sunken wrecks. Tourists can hike or drive up the island's highest peak—Yamanota, 617 feet—or hike up the second-highest hill, Hooiberg (Haystack), 541 feet. Hooiberg looks like a giant anthill and is a volcanic formation that's found only here and in Iceland. Many visitors go to Ayo and Casibari to see the unusual rock formations—piles of giant boulders that seem unrelated to the rest of the island. Collectors should not miss the impressive exhibition of coins from more than 400 countries, including ancient Rome, Syria, and Greece, or one of the world's most complete private collections of shells. Of course, shopping opportunities abound with local artwork—paintings, woodcraft, pottery, leather goods, and such—on display everywhere. The Bonbini ("welcome") Festival held on the patio of Fort Zoutman every Tuesday, 6:30–8:30 PM—local foods and drinks, arts and crafts, and shows of music and dance.

Aruba is indeed a unique tropical paradise. Its seven miles of palm-fringed beaches on the southwest coast are among the most beautiful in the world. The rugged cliff-lined shore of the northeast coast, pounded by thundering waves, is spectacular.

But those features help make Aruba a difficult place to DX from—a visiting ham is constantly facing competition between the lure of the island and the thrill of being the focus of a pile-up. 73

DXPEDITION TO ARUBA

P4/KQ2M

EQUIPMENT: TS830S SB200 18AVT – ON BEACH

CONFIRMING QSO WITH	DATE DAY	MONTH	YEAR	UTC	MHz	R S T	MODE 2-WAY
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QSL via KQ2M							

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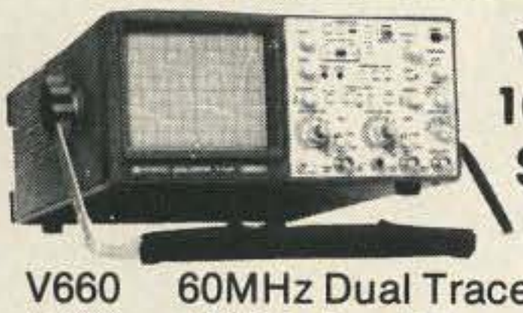

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CIRCLE 335 ON READER SERVICE CARD

"The '850 Found a New Friend"

The industry standard RC-850 Repeater Controller can now talk with your computer.

And there's so much for them to say!

The '850 computer interface improves the management of your voice repeater system. It allows you to command and program interactively from your terminal or personal computer using a MODEM or packet TNC. Even preview and edit repeater messages by typing words from the controller's vocabulary directly into message slots.

Retrieve and catalog data relating to your site measurements, equipment status, and repeater and command activity. Download and print out the information programmed into your controller. And view your system "front panel" on your computer screen.

You'll find the RC-850 controller on the leading voice repeaters around the world. ACC pioneered remote programming of repeaters – and continues to pioneer with remote computer access. While the rest of the world just talks about catching up, ACC continues to lead the way in advanced repeater technology.

Now, with its computer interface, the '850 can be best friends with your computer.

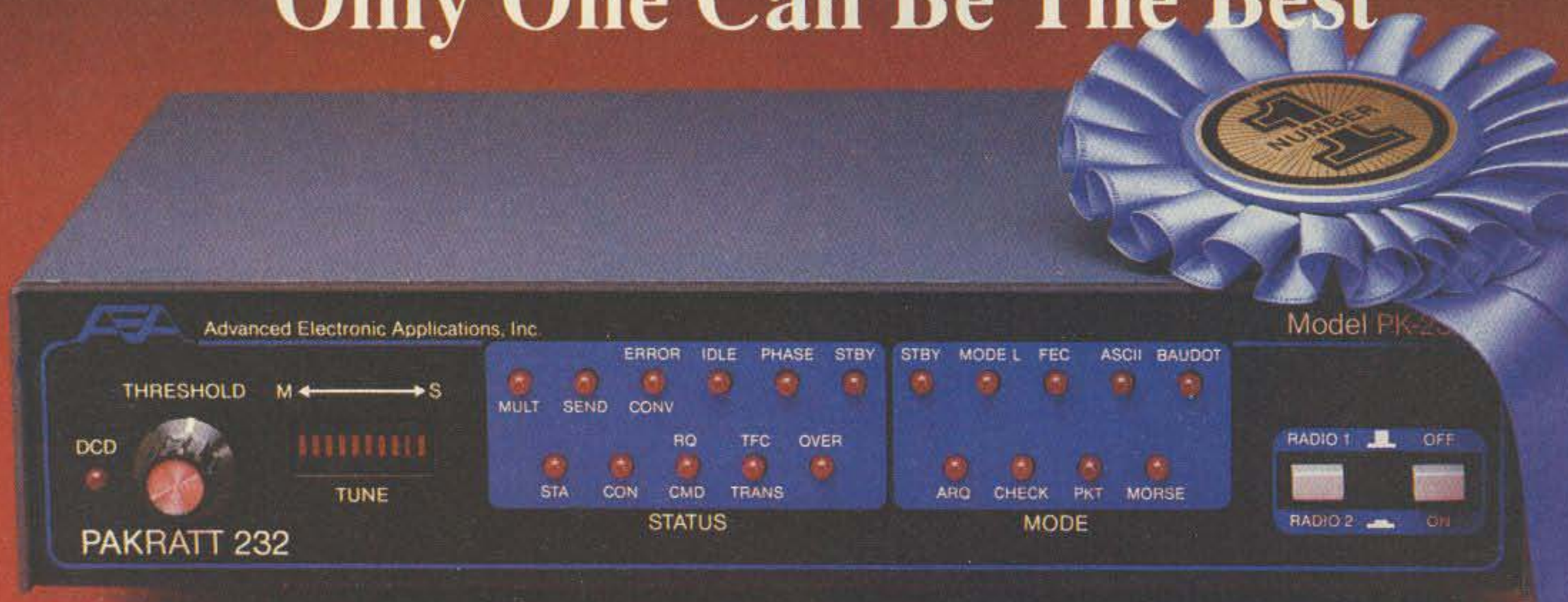
acc advanced computer controls, inc.

2356 Walsh Avenue, Santa Clara, CA 95051 (408) 727-3330

CIRCLE 1 ON READER SERVICE CARD

Others May Try to Imitate, But...

Only One Can Be The Best



Morse Code - Baudot - ASCII - AMTOR - Packet - Facsimile - Navtex

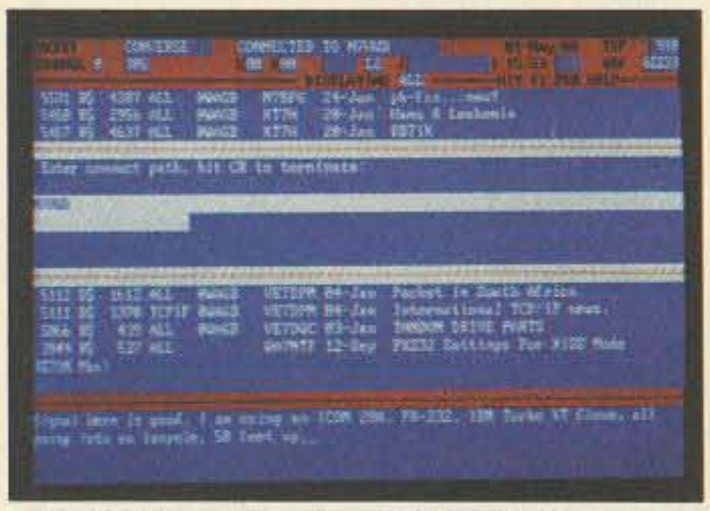
Amateur Net Price $319.95

It's a lesson you learn very early in life. Many can be good, some may be better, but only one can be the best. The PK-232 is the best multi-mode data controller you can buy.

1 Versatility

The PK-232 should be listed in the amateur radio dictionary under the word Versatile. One data controller that can transmit and receive in six digital modes, and can be used with almost every computer or data terminal. You can even monitor Navtex, the new marine weather and navigational system. Don't forget two radio ports for both VHF and HF, and a no compromise VHF/HF/CW internal modem with an eight pole bandpass filter followed by a limiter discriminator with automatic threshold control.

The internal decoding program (SIAM[tm]) feature can even identify different types of signals for you, including some simple types of RTTY encryption. The only software your computer needs is a terminal program.



PC Pakratt Packet TX/RX Display

Facsimile Screen Display

2 Software Support

While you can use most modem or communications programs with the PK-232, AEA has two very special packages available exclusively for the PK-232....PC Pakratt with Fax for IBM PC and compatible computers, and Com Pakratt with Fax for the Commodore 64 and 128.

Each package includes a terminal program with split screen display, QSO buffer, disk storage of received data, and printer operation, and a second program for transmission/reception and screen display of facsimile signals. The IBM programs are on 5-1/4" disk and the Commodore programs are plug-in ROM cartridges.

3 Proven Winner

No matter what computer or terminal you plan to use, the PK-232 is the best choice for a multi-mode data controller. Over 20,000 amateurs around the world have on-air tested the PK-232 for you. They, along with most major U.S. amateur magazines, have reviewed the PK-232 and found it to be a good value and excellent addition to the ham station.

No other multi-mode controller offers the features and performance of the PK-232. Don't be fooled by imitations. Ask your friends, or call the local amateur radio store. We're confident the PK-232 reputation will convince you that it's time to order your very own PK-232.

Call an authorized AEA dealer today. You deserve the best you can buy, you deserve the PK- 232.

Advanced Electronic Applications, Inc.

P.O. Box C-2160
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206-775-7373

AEA Brings you the Breakthrough!

CIRCLE 65 ON READER SERVICE CARD

SPECIAL EVENTS

Ham Doings Across the Country

NEW ZEALAND
AUGUST 1 - 6

The Reefton Electrical Centenary ZL6REC, will be operating on 80m or 40m during the day, 20m near 14.250, phone and possibly some CW. The VHF Group hopes to do a static display and communications via satellite. Special QSL to all contacts logged. Please do not send QSL in reply. Contact *Dave Oates ZL3MF, PO Box 20, Westport, New Zealand.*

AUSTIN TX
AUGUST 5–7

The Austin SummerFest will be held at the Austin Marriott Hotel on behalf of the Texas VHF-FM Society. This year's event is also the ARRL Texas State Convention. Flea market, dealer and manufacturer exhibits, ARRL Forum, technical program, transmitter hunt, and VEC. $5 pre-registration, $7 at door. *Austin SummerFest, PO Box 13473, Austin TX 78711. Or call Joe Makeever, 512-345-0800.*

JACKSONVILLE FL
AUGUST 6–7

The 15th annual Jacksonville Hamfest features FCC exams, free Novice exams, prizes, forums, huge indoor swap area, and major exhibitors. For hamfest information, contact *Greater Jacksonville Hamfest Association, PO Box 10623, Jacksonville FL 32207; 904-350-9193.*

TWINSBURG OH
AUGUST 6–7

The Cuyahoga ARS will operate stations K8ZFR, N8HHG, and WB8N from the Twin Days Festival. Frequencies: phone 7.230, 14.245, 28.450, and 146.22/.82 repeater, CW on the lower general portion of the 20, 40, and 80m bands. Special photo QSLs for each station worked, send completed QSL for each station and SASE to *Paul Buescher, 1752 Stone Creek Lane, Twinsburg OH 44087.*

WARMINSTER PA
AUGUST 6–7

The Warminster ARC will operate station WA3DFU from 1400Z to 2200Z on both days to commemorate the 100th anniversary of Revolving Door Day. Frequencies: 3.885, 7.26, 14.26, 21.335, and 28.335. Local contacts on 146.55 simplex. For certificate, send QSL and SASE to *WARC, 136 DeHaven Ave., Penndel PA 19047.*

BERRYVILLE VA
AUGUST 7

The 38th Annual Winchester Hamfest, sponsored by the Shenandoah Valley ARC, will be at the Clarke County Ruritan Fairgrounds. Admission, $4. VEC exams, commercial exhibits. Talk-in on 146.22/.82 and .52 simplex. Contact *Joanne Blaker WB2CMV at 703-869-4878, or write SVARC, PO Box 139, Winchester VA 22601.*

VALPARAISO IN
AUGUST 7

The Porter County ARC, Inc., presents the Annual Northwest Indiana Hamfest and Computer Fair at the Porter County Fairgrounds and Expo Center. Outside/inside vendors, VEC testing. Admission, $3.50. Talk-in on 146.775/175 or 146.52. Contact *Jamie Veiner NS9A, PO Box 1782, Valparaiso IN 46384.*

WARRINGTON PA
AUGUST 7

The Mid-Atlantic ARC will hold its annual Hamfest at the Bucks County Drive-in. There will be door prizes, ARRL representation, refreshments, and exhibits on packet, AMSAT, and ARES. Talk-in on 147.66/.06 and 146.52. Admission $3. Contact *John Bartolomew at 215-356-7197, or write MARC, 203 Second Ave., Broomall PA 19008.*

WEST MIFFLIN PA
AUGUST 7

The 51st Hamfest of the South Hills Brass Pounders and Modulators ARC of Pittsburgh features outdoor/indoor air conditioned facilities, flea market, new equipment, parts dealers, forums, and prizes. Talk-in on 146.13/.73 MHz and 146.52 simplex. Contact *Doug Wilson WA3ZNP, 185 Orchard Ave., Emsworth PA 15202.*

BRANTFORD ONTARIO
AUGUST 13

The Brantford ARC is holding a flea market at the Woodman Park Community Centre. Admission, $3. Door prizes. Talk-in on 146.520 simplex, 147.150 o/p/ VE3TCR, 147.750 i/p, 443.025 o/p, and 448.025 i/p. *Marvin VE3MWF, PO Box 1661, Brantford, Ontario, Canada; 519-442-6298.*

ESSEX JUNCTION VT
AUGUST 13

The Burlington ARC presents its annual Hamfest at the Champlain Valley Fairgrounds. Featured are packet/ARES forums, contests, and a flea market. Talk-in on 146.34/.94 MHz or 146.01/.61 MHz. Admission, $4. *Bob Hall W1DQO, General Greene Rd., Shelburne VT 05482; 802-985-2235.*

RHINELANDER WI
AUGUST 13

The 9th annual Rhinelander Swapfest will be the combined effort of the Rhinelander Repeater Association, the Oneida County ARES, and the Tomahawk Repeater Association. Rhinelander Repeater 146.34/146.94, Tomahawk Repeater 144.83/145.43. VEC testing. Contact *Leonard Bauman K9RMN, 1312 Dorothy Street, Rhinelander WI 54501; 715-369-3296.*

AMARILLO TX
AUGUST 13–14

The Panhandle ARC is sponsoring the annual Golden Spread Hamfest at the Camelot Inn. Preregistration is $6 with a deadline of August 11. Tables are $4 each. Discount motel rates are available if the "Golden Spread Hamfest" is mentioned when making reservations at 806-373-3600. Talk-in on 146.94 and 146.67. Write *Golden Spread Hamfest, PO Box 1524, Amarillo TX 79105-1524.*

CEDAR RAPIDS IA
AUGUST 13–14

The Cedar Valley ARC is sponsoring their Summerfest '88 at the Teamsters Hall with computer seminars, FCC exams, a large variety of commercial vendors, and a large flea market. Admission; $3 in advance, $4 at door. Talk-in on 16/76 and 52. Write *Summerfest '88, 2139 Randolph Rd., Marion IA 52302; 319-377-7187/362-3602.*

SOMERSET PA
AUGUST 13–14

The Somerset County ARC will operate NI3D from the top of Mount Davis. Operation will be in the lower 25 kHz of all the general phone bands. For special QSL, send an SASE to *Ernest Gelpi NI3D, RD 2 Box 71, Somerset PA 15501.*

GEORGETOWN KY
AUGUST 14

The Central Kentucky ARRL Hamfest, sponsored by the Bluegrass ARS, will be at Scott County High School. Talk-in on 16/76. Technical forums, license exams, awards, and exhibits in air-conditioned facilities. Tickets $5 in advance, $6 at gate. Free outside flea market space. For more information or tickets, send SASE to *Ed Bono WA4ONE, 2077 Dogwood Drive, Lexington KY 40504; 606-277-3768.*

ST. CLOUD MN
AUGUST 14

The St. Cloud ARC Hamfest will be at the Whitney Senior Center. Ticket donation, $3. Extra ticket, $2. Prizes. Talk-in on 34/94 primary, 615/015 secondary. Contact *SCARC, Box 141, St. Cloud MN 56302.*

TORONTO ONTARIO
AUGUST 17–SEPTEMBER 5

Canada's premier display of amateur radio will be held in conjunction with its largest annual exhibition at the Exhibition Place. Demonstrations for the public on HF operation 10–80m and VHF activity on 2m. Facilities for RTTY and packet. Come along and play. Contact *Thelma Woodhouse VE3CLT; 416-757-5593. For QSL contact VE3CNE, PO Box 307, Station H, Toronto, Ontario Canada M4C 5J2.*

FREDERICTON, N.B. CANADA
AUGUST 19–21

The Fredericton, N.B. ARC is sponsoring Atlantic Hamfest '88 on the University of New Brunswick Campus. The theme is "Approaching the Year 2000." Meetings, seminars, social events, flea market, and commercial displays. Reservations available through *Atlantic Hamfest '88, PO Box 3567, Fredericton, N.B. Canada E3A 5J8.*

ITHACA NY
AUGUST 20

The 7th Annual Finger Lakes Hamfest, sponsored by the Tompkins County ARC, will have a giant flea market, overnight parking/camping. $3 donation, $1 flea market space. Talk-in on 37/97 or 52. Contact *The Kings N2GFW or N2GFX, Box 227, Etna NY 13062; 607-347-4313.*

RENO NV
AUGUST 20

The combined radio clubs of Reno, Nevada, are sponsoring Reno Hamfest '88 from 9 AM to 5 PM in the California Building. Ham swap, prizes, and VEC exams. Talk-in on 146.61 and 147.30. Admission $3. Swap tables, $7 each. For information, registration, exam requirements, send SASE to *Curley Silva K7HRW, 3780 Hummingbird Dr., Reno NV 89506.*

DAYTON OH
AUGUST 20–21

The Dayton Microcomputer Association, Inc., is presenting Computerfest '88 with speakers, seminars, product demonstrations, dealers, and user group information. Admission is $3 per day. For booth and ticket sales, contact *Mark Hanslip, 143 Schloss Lane, Dayton OH 45418; 513-263-FEST.*

HUNTSVILLE AL
AUGUST 20–21

The Huntsville ARC will hold its Annual Huntsville Hamfest at the Von Braun Civic Center. Dealer show, flea market, forums, and walk-in license exams by CAVEC. Free Admission. Indoors, air-conditioned. Talk-in on 146.34/.94 K4BFT. Contact *David L. Reasoner N4KTY, 3103 Holly Hill Rd., Huntsville AL 35802; 205-883-7629 or Don Tunstill WB4HOK, 1215 Dale Dr., Huntsville AL 35801; 205-536-3904.*

INDIANAPOLIS IN
AUGUST 20–21

The Legion of Indianapolis DXers will operate KA9OIH to commemorate the opening of a new addition to the world's largest children's museum. Hours: from 1500 to 2200 UTC on the 20th and from 1700 to 2200 on the 21st. Suggested frequencies: 3.988, 7.288, 14.288, 21.388, and 28.388. For certificate, send QSL and 9 x 12 SASE to *Ham Radio Exhibit, c/o Renee Henry, Indianapolis Children's Museum, PO Box 3000, Indianapolis IN 46206.*

GEORGETOWN DE
AUGUST 21

The Delmarva Hamfest will be at the Delaware Technical Community College from 8 AM to 4 PM. Inside tables are $5, tailgating is $3. Admission $3. Exams. Swimming at beaches. Talk-in on 147.075, 146.52, 224–84. Write *Delmarva Hamfest, Rte. 2, Box 244G, Georgetown DE 19947.*

TOKYO JAPAN
AUGUST 26–28

The Japan Amateur Radio League, Inc., will hold their HAM FAIR '88 at the Tokyo International Trade Center from 10 AM to 6 PM on the above dates. Featured discussions: The Fas- cination of Ionosphere Communication, A Challenge Toward High Technology, and First Encounter with GHz. Commercial exhibits, displays, contests, outdoor flea market, technical forums, homebrew, and ARRL publications. Contact *JARL, PO Box 377, Tokyo Central Post Office 100-91 JAPAN.*

LEBANON TN
AUGUST 28

The Lebanon Hamfest, sponsored by the Short Mountain Repeater Club, will be at the Cedars of Lebanon State Park. Outdoor facilities only, exhibitors bring own tables. Talk-in on 146.31–.91. Contact *Mary Alice Fanning KA4GSB, 4936 Danby Drive, Nashville TN 37211.*

FLORENCE ITALY
NOVEMBER 27

CALL FOR PAPERS. HAMBIT '88, the third international congress of amateur radio and digital techniques, invites papers in Italian or English on telecommunications, CAD, circuit simulation, computers in measurements, digital signal coding, decoding, processing, security applications, computers as aids for the handicapped, and more, no later than August 31. For writing guidelines and requirements, write *HAMBIT '88 Coordinator, Carlo L. Ciapetti I5CLC, Via Trieste 36, 50139 Florence ITALY.*

Index: August 1988 Issue #335

220 MHz Model FT-312RM Now Available

Introducing the only mobiles that double as answering machines.

Now you can stay in touch—even when you're away from your radio.

With Yaesu's 2-meter FT-212RH and 70-cm FT-712RH, an optional, internal digital voice recorder serves as a convenient answering machine for you and your friends. And that's just the beginning!

High performance mobiles. The FT-212RH features wideband receive coverage of 140-174 MHz (144-148 MHz Tx), while the FT-712RH covers 430-450 MHz. An oversize amber display includes an innovative photo-sensor which increases the display brightness during the day. The function buttons are arranged in a chromatic musical scale—ideal for visually-impared operators. You get 45 watts output on 2 meters, 35 watts on 70 cm.

An autodialer DTMF microphone with 10 memories, each ready to store telephone numbers up to 22 digits long.

And, like our FT-211RH Series mobiles, you'll enjoy simple controls, yet sophisticated microprocessor-based flexibility. Including 18 memories that store frequency, offset, PL tone, and PL mode (PL encoder built in, decoder optional). Band or memory scanning. Offset tuning from any memory channel. Memory channel lockout for scanning. High-low power switch.

All in an amazingly small package, shown actual size below.

Digital voice recorder option. Only Yaesu brings you the advanced technology found in our digital voice recorder option.

You can store messages or your call sign—in your own voice, not a synthesized replica—or give your friends a private code for leaving messages on your radio. All they need is a DTMF microphone! Then you can play back your messages either in-person, or remotely by using another radio with a DTMF microphone. And you've always got security because you can command your radio to respond only to in-person playback requests.

Visit your Yaesu dealer today. And test drive Yaesu's FT-212RH and FT-712RH mobiles. The only radios with the power to keep you in touch. Always.

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Yaesu USA 17210 Edwards Road, Cerritos, CA 90701 (213) 404-2700. **Repair Service:** (213) 404-4884. **Parts:** (213) 404-4847.

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CIRCLE 165 ON READER SERVICE CARD

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Good for Satellite Digital QSOs

Matching Pair

Look for FUJI and PHASE III-C

TS-711A/811A VHF/UHF all-mode base stations

The TS-711A 2 meter and the TS-811A 70 centimeter all mode transceivers are the perfect rigs for your VHF and UHF operations. Both rigs feature Kenwood's new Digital Code Squelch (DCS) signaling system. Together, they form the perfect "matching pair" for satellite operation.

- **Highly stable dual digital VFOs.**
  The 10 Hz step, dual digital VFOs offer excellent stability through the use of a TCXO (Temperature Compensated Crystal Oscillator).
- **Large fluorescent multi-function display.**
  Shows frequency, RIT shift, VFO A/B, SPLIT, ALERT, repeater offset, digital code, and memory channel.
- **40 multi-function memories.**
  Stores frequency, mode, repeater offset, and CTCSS tone. Memories are backed up with a built-in lithium battery.

- **Versatile scanning functions.**
  Programmable band and memory scan (with channel lock-out). "Center-stop" tuning on FM. An "alert" function lets you listen for activity on your priority channel while listening on another frequency. **A Kenwood exclusive!**
- **RF power output control.**
  Continuously adjustable from 2 to 25 watts.
- **Automatic mode selection.**
  You may select the mode manually using the front panel mode keys. Manual mode selection is verified in International Morse Code.
- **All-mode squelch.**
- **High performance noise blanker.**
- **Speech processor.**
  For maximum efficiency on SSB and FM.
- **IF shift.**
- **"Quick-Step" tuning.**
  Vary the tuning characteristics from "conventional VFO feel" to a stepping action.
- **Built-in AC power supply.**
  Operation on 12 volts DC is also possible.
- **Semi break-in CW, with side tone.**
- **VS-1 voice synthesizer (optional)**
  More TS-711A/811A information is available from authorized Kenwood dealers.

Optional accessories.

- IF-10A computer interface
- IF-232C level translator
- CD-10 call sign display
- SP-430 external speaker
- VS-1 voice synthesizer
- TU-5 CTCSS tone unit
- MB-430 mobile mount
- MC-60A, MC-80, MC-85 deluxe desk top microphones
- MC-48B 16-key DTMF, MC-43S UP/DOWN mobile hand microphones
- SW-200A/B SWR/power meters:
  SW-200A 1.8-150 MHz
  SW-200B 140-450 MHz
- SWT-1 2-m antenna tuner
- SWT-2 70-cm antenna tuner
- PG-2U DC power cable

Complete service manuals are available for all Kenwood transceivers and most accessories.
Specifications and prices are subject to change without notice or obligation.

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