November 1982 $2.49½
Issue #266

73

Amateur Radio's Technical Journal

A Wayne Green Publication

Great Projects You Can Build!

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State-of-the-Art Audio Filter
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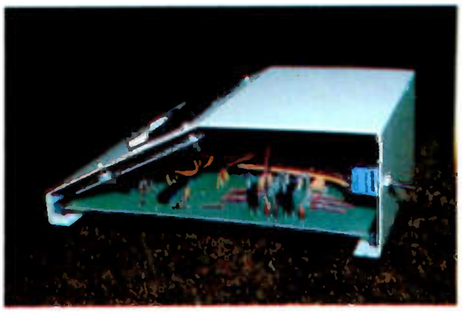
Cheapo Keyer
Page 104

Plus 8 More!



701 Remote Control—14

The Dynamic Duo

ICOM's 2 Meter and 440 MHz FM

25 watt/5 memories/2 scanning systems in a 2"H x 5½W x 7"D package is what has made the easy-to-use IC-25A the most popular 2 meter FM mobile transceiver ever. Now ICOM presents the second half of its mobile duo...IC-45A. The IC-45A covers 440-449.995 MHz. Both transceivers are supplied with touchtone® microphones standard.

Dual VFO's. Dual VFO's give an extra stored frequency for scanning (memory scan scans 5 memories plus 2 VFO's) and each VFO has a different tuning rate for easy QSY.

	VFO A	VFO B
IC-25A	5 KHz	15 KHz
IC-45A	5 KHz	25 KHz

5 Memories. Instant access to most used frequencies. VFO A information is transferred to the selected memory by pushing the write (IC-25A) or W/CK (IC-45A) button.

IC-BU1

Priority Channel. Any memory channel may be monitored for activity on a sample basis, every 5 seconds, without disruption of a QSO conducted on a VFO frequency.

LED Bar Meter. Shows strength of received signal as well as relative transmitter output from the fully protected final RF amplifier. APC (automatic power control) is used to detect SWR and adjust the power output to a safe level.

Simplex/Duplex Operation. Standard 600 KHz offset initializes into radio at turn on. Offset may be changed by pressing the priority button while in VFO operation. Rotating the main tuning knob will now change the offset up or down and the offset will be displayed on the frequency readout.

Adjustable Power Levels.

	Hi Pwr	Lo Pwr
IC-25A	25 W	1 W
IC-45A	10 W	1 W

Pulling the squelch knob out places the unit into low power. Both the high and low power may be independently set to accomodate your simplex/repeater requirements or amplifier input characteristics.

Nor/Rev Capability. Use of this button on the IC-25A or the W/CK button on the IC-45A. In the duplex mode, allows one touch monitoring of the repeater input frequency. If simplex operation is possible you will know instantly.

Scanning. Pushing the S/S button initiates the scan circuitry. With the mode switch in a memory position the unit will scan all 5 memories plus the 2 VFO frequencies.

With the mode switch in a VFO position, the unit will scan the entire band or the portion of the band defined by memories 1 and 2. Full band scan or program band scan is selected from the front panel in the IC-25A, internally on the IC-45A.

Both units have internally switched scanning choices of adjustable delay period after a carrier is received then resume scan, or resume on carrier drop.

The Most Compact FM Mobiles on the Market. Fits in the smallest of places. Stacking, matching Mobile Mounts for complete mobile communications for your car.

Memory Backup. When the optional IC-BU1 backup power unit is installed on the back of the IC-25A or IC-45A, memory will be maintained while transferring the unit from power source to power source. If the unit is not removed from power, it will maintain memory even when turned off with or without the IC-BU1.

ICOM

The World System

ICOM America, Inc., 2112-116th Ave NE, Bellevue, WA 98004 (206)454-8155/3331 Towerwood Drive, Suite 307, Dallas, TX 75234 (214)620-2780.

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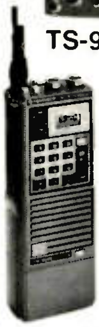

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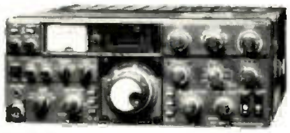
21 CHANNEL MEMORY



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The TR7A and R7A offer performance and versatility for those who demand the ultimate!

TR7A Transceiver

• CONTINUOUS FREQUENCY COVERAGE — 1.5 to 30 MHz full receive coverage. The optional AUX7 provides 0 to 1.5 MHz receive plus transmit coverage of 1.8 to 30 MHz, for future Amateur bands, MARS, Embassy, Government or Commercial frequencies (proper authorization required).

• Full Passband Tuning (PBT) enhances use of high rejection 8-pole crystal filters.

New! Both 2.3 kHz ssb and 500 Hz cw crystal filters, and 9 kHz a-m selectivity are standard, plus provisions for two additional filters. These 8-pole crystal filters in conjunction with careful mechanical/electrical design result in realizable ultimate rejection in excess of 100 dB.

New! The very effective NB7 Noise Blanker is now standard.

New! Built in lightning protection avoids damage to solid-state components from lightning induced transients.

New! Mic audio available on rear panel to facilitate phone patch connection.

• State-of-the-art design combining solid-state PA, up-conversion, high-level double balanced 1st mixer and frequency synthesis provided a no tune-up, broadband, high dynamic range transceiver.

R7A Receiver

• CONTINUOUS NO COMPROMISE 0 to 30 MHz frequency coverage.

• Full passband tuning (PBT).

New! NB7A Noise Blanker supplied as standard.

• State-of-the-Art features of the TR7A, plus added flexibility with a low noise 10 dB rf amplifier.

New! Standard ultimate selectivity choices include the supplied 2.3 kHz ssb and 500 Hz cw crystal filters, and 9 kHz a-m selectivity. Capability for three accessory crystal filters plus the two supplied, including 300 Hz, 1.8 kHz, 4 kHz, and 6 kHz. The 4 kHz filter, when used with the R7A's Synchro-Phase a-m detector, provides a-m reception with greater frequency response within a narrower bandwidth than conventional a-m detection, and sideband selection to minimize interference potential.

• Front panel pushbutton control of rf preamp, a-m/ssb detector, speaker ON/OFF switch, i-f notch filter, reference-derived calibrator signal, three agc release times (plus AGC OFF), integral 150 MHz frequency counter/digital readout for external use, and Receiver Incremental Tuning (RIT).

The "Twins" System

• FREQUENCY FLEXIBILITY. The TR7A/R7A combination offers the operator, particularly the DX'er or Contester, frequency control agility not available in any other system. The "Twins" offer the only system capable of no-compromise DSR (Dual Simultaneous Receive). Most transceivers allow some external receiver control, but the "Twins" provide instant transfer of transmit frequency control to the R7A VFO. The operator can listen to either or both receiver's audio, and instantly determine his transmitting frequency by appropriate use of the TR7A's RCT control (Receiver Controlled Transmit). DSR is implemented by mixing the two audio signals in the R7A

• ALTERNATE ANTENNA CAPABILITY. The R7A's Antenna Power Splitter enhances the DSR feature by allowing the use of an additional antenna (ALTERNATE) besides the MAIN antenna connected to the TR7A (the transmitting antenna). All possible splits between the two antennas and the two system receivers are possible.

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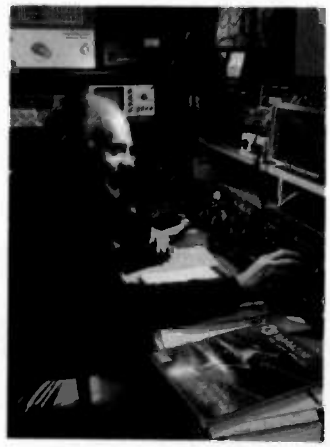
* Patent pending

W2NSD/1
NEVER SAY DIE
editorial by Wayne Green



WHERE'S THE SOLDER?

For years, the pride of my workbench was my 300-Watt soldering iron. I looked for it the other day, thinking I might frame it as a historic remnant of a long lost past, and couldn't find it. Well, I don't need that old 300-Watter anymore anyway. These days, a simple pencil iron is enough to do irreparable damage. Some of these damned chips we use today would probably self-destruct if just allowed in the room with the 300-Watt iron. But the fact is that though the tools have changed, we're getting into an era of a high interest in building electronic gadgets.

The recent emphasis on relatively simple building projects in *73* has brought in quite a bit of congratulatory mail. It's appreciated. You know, when I started *73*, back in 1960, one of the basic reasons I felt that the magazine was needed was to encourage hams to build more. As the editor, I'd had one hell of a battle with the publisher of *CQ* over this. He wanted monthly columns, which were a lot cheaper to publish. I'd built the magazine up from a real loser to a big winner with construction...and found myself fired. So I started *73* and got right at it with construction projects.

Just to make sure that you know right off when you look at the table of contents on the cover, we'll put a soldering-iron logo by each project. Mind you, these are not going to be all-band transceivers which could take you a year to build. I'll still leave those for *Ham Radio*, if they stay afloat.

While it may go without saying that I'm hoping you will write up any construction projects you develop, let me make sure that there is no misunderstanding here. If you design something which might be of interest to the rest of *73* readers, I hope you'll write it up. Type the article double-spaced, leave generous margins, get a friend with a good camera to take art-gallery-class photos of your gem...and let's have it.

Sure, it's fun to operate. But I've never gotten so wrapped up in operating that I missed a meal. Now building...many is the time I've started working on a project and found myself looking at the rising sun, having missed dinner, midnight snack, and all those usual buffering pick-me-ups in between. Hell, building something is more fun than coffee ice cream.

And yes, you can go fairly far afield. Sure, we're mostly interested in amateur radio, but that won't stop us from publishing interesting projects which are involved with other aspects of life such as photography, computers, and so on. You'll get my attention the fastest with gadgets which tie computers and amateur radio together. I know as well as you that we have the tools to make incredible changes in communications over the next few years. It's getting time for us to grab those tools and carve out some pioneer territory with high-speed Morse, RTTY, or ASCII...or whatever pleases you.

We have the parts to make incredibly sophisticated repeaters...yet I've seen little to amaze me so far. Let's get cracking...and writing. I'll publish...and pay.

CIRCUITS CIRCUITS CIRCUITS

Some years ago I began reprinting little circuits out of foreign electronics magazines which I thought might interest the more dedicated experimenter. They were presented with very little backup information ...just enough for the experienced builder to put the project together and get it working. We're running that section again and would like to have you send in little circuits for almost anything. You don't have to put together a whole article—just the circuit, the parts values, and a hint of what it will do. Perhaps you've found a circuit from some other (non-ham) magazine which readers might find of value...or from a book. We'll scan the foreign magazines and see what we can find for you. You don't have to draft the circuits. Just sketch them clearly, showing all parts values. If there are any special parts, show what they are and where they can be obtained. The address is Circuits, Editorial Offices, *73 Magazine*, Peterborough NH 03458. By the way, don't forget to include your choice of book from the Radio Bookshop, which we'll send you when your circuit is published.

For that matter, authors of articles on construction projects should remember that *73* is read in over 200 countries and that in most of them parts are darned hard to come by. Thus, if there is any way to do it, try to use commonly available parts...or at least suggest such as replacements if you've used a 1963 transistor in your unit. A builder in Chile will not be happy if you merely specify a Radio Shack part number...give a bit more in details since his Radio Shack may not carry the full line.

One of the main reasons why *73* is so treasured by DX hams is that it runs more construction projects than any other ham magazine in English in the world. We can't come close to the Japanese ham magazine, but then they have about three times as many active hams there as we do, so that's natural. If I could get someone to translate the Japanese construction projects, I could put out a couple

TECHNICAL EDITOR WANTED

The search is on! We're looking for a knowledgeable ham to become Technical Editor of *73 Magazine*. If you enjoy our small-construction-project format and can tell a good circuit from a bummer, then you're a prime candidate.

Duties of the Tech Editor include checking the technical accuracy of articles, working with authors to get the best new manuscripts, making sure *73* publishes timely reviews of the latest ham gear, climbing the tower to repair the 20-meter beam, installing Wayne's new mobile rigs, etc. There is plenty of opportunity for fun, too, working contests from W2NSD, learning about microcomputers, mountaintopping from the drive-up peak just down the road.

Furthermore, Peterborough just happens to be located in one of the most beautiful areas of the country. The quality of life is superb. Sound interesting? If you are a non-smoker, we'd like to hear from you. Resumes should be sent to Jeff DeTray, Wayne Green, Inc., Peterborough NH 03458.

R-1000

High performance, easy tuning, digital display

The R-1000 high performance communications receiver covers 200 kHz to 30 MHz in 30 bands. An up-conversion PLL synthesized circuit provides improved sensitivity, selectivity, and stability.

R-1000 FEATURES:
- Covers 200 kHz to 30 MHz.
- 30 bands, each 1 MHz wide.
- Five-digit frequency display with 1-kHz resolution and analog dial with precise gear dial mechanism.
- Built-in 12-hour quartz digital clock/timer.
- RF step attenuator.
- Three IF filters for optimum AM, SSB, CW.
- Effective noise blanker. • Tone control.
- Built-in 4-inch speaker. • Dimmer switch.
- Wire and coax antenna terminals.
- Voltage selector for 100, 120, 220, and 240 VAC. Operates on 13.8 VDC with optional DCK-1 kit.

R-600

"Now hear this"...digital display, easy tuning

The R-600 is an affordably priced, high performance general coverage communications receiver covering 150 kHz to 30 MHz in 30 bands. Use of PLL synthesized circuitry provides maximum ease of operation.

R-600 FEATURES:
- 150 kHz to 30 MHz continuous coverage, AM, SSB, or CW.
- 30 bands, each 1 MHz wide, for easier tuning.
- Five digit frequency display, with 1 kHz resolution.
- 6 kHz IF filter for AM (wide), and 2.7 kHz filter for SSB, CW and AM (narrow).
- Up-conversion PLL circuit, for improved sensitivity, selectivity, and stability.
- Communications type noise blanker eliminates "pulse-type" noise.
- RF Attenuator allows 20 dB attenuation of strong signals.
- Tone control. • Front mounted speaker.
- "S" meter, with 1 to 5 SINPO "S" scale, plus standard scale.
- Coaxial and wire antenna terminals.
- 100, 120, 220, and 240 VAC, 50/60 Hz. Selector switch on rear panel.
- Optional 13.8 VDC operation, using DCK-1 cable kit.
- Other features include carrying handle, headphone jack, and record jack.

Optional accessories for R-600 and R-1000:
- DCK-1 DC Cable kit. • SP-100 External Speaker.
- HS-6, HS-5, HS-4 Headphones.
- HC-10 Digital World Clock.

TS-660

The TS-660 "QUAD BANDER" covers 6, 10, 12, 15 meters.
- FM, SSB (USB), CW, and AM
- Dual digital VFO's
- Digital display
- IF shift built-in
- 5 memories with memory scan
- UP/DOWN microphone
- All-mode squelch
- Noise blanker
- CW semi break-in/sidetone
- 10 W on SSB, CW, FM; 4 W on AM.

Optional accessories:
- PS-20 power supply
- VOX-4 speech processor/VOX
- SP-120 External speaker
- MB-100 Mobile mount
- YK-88C, YK-88CN CW filters
- YK-88A AM filter.

TS-530S

"Cents-ational"...IF shift, digital display, narrow-wide filter switch

The TS-530S SSB/CW transceiver covers 160-10 meters using the latest, most advanced circuit technology, yet at an affordable price.

TS-530S FEATURES:
- 160-10 meters, LSB, USB, CW, all amateur frequencies, including new 10, 18, and 24 MHz bands. Receives WWV on 10 MHz.
- Built-in digital display (six digits, fluorescent tubes), with analog dial.
- IF shift tunes out interfering signals.
- Narrow/wide filter selector switch for CW and/or SSB.
- Built-in speech processor, for increased talk power.
- Wide receiver dynamic range, with greater immunity to overload.
- Two 6146B's in final, allows 220W PEP/180 W DC input on all bands.
- Advanced single-conversion PLL, for better stability, improved spurious characteristics.
- Adjustable noise-blanker, with front panel threshold control.
- RIT/XIT front panel control allows independent fine-tuning of receive or transmit frequencies.

Optional accessories:
- SP-230 external speaker with selectable audio filters.
- VFO-240 remote analog VFO.
- VFO-230 remote digital VFO.
- AT-230 antenna tuner/SWR/power meter.
- MC-50 desk microphone
- KB-1 deluxe VFO knob.
- YK-88C (500 Hz) or YK-88CN (270 Hz) CW filter.
- YK-88SN (1.8 kHz) narrow SSB filter.

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hundred pages a month of things for you to build.

I've mentioned before that if you have a DX friend you can help him a lot by giving him a subscription to *73*. The magazine gets positively worn out in most countries. A few years ago, when the dollar was weak, they had no problem getting the magazine, but today it's almost prohibitive in many countries. Of course, behind the Iron Curtain they are not permitted to send money for magazine subscriptions, so they have to depend entirely on the friendship of fellow hams who are more fortunate in where they live.

CQ FAILS CODE TEST!

One of our readers in New Mexico sent in an envelope he received from our friends at *CQ*. On the cover is a bunch of Morse code. The reader translated the code for us, chuckling

Continued on page 140

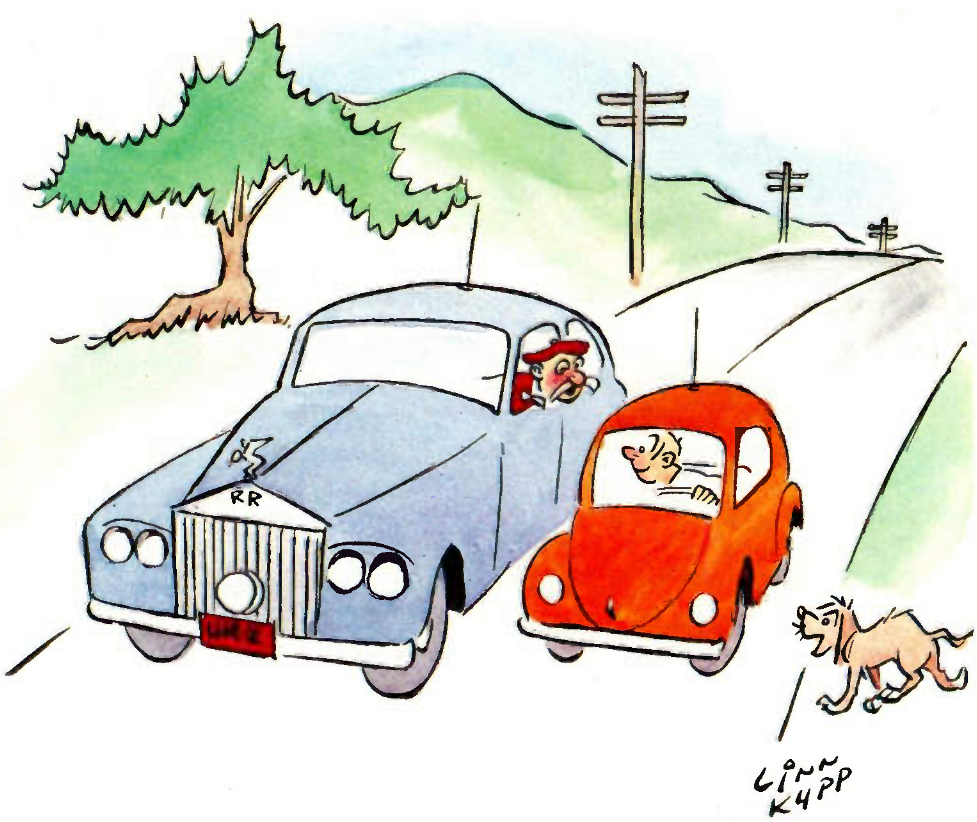
QSL OF THE MONTH: AG5X

This month's winning QSL is from Bob Jackson AG5X of Webster TX. Bob has a stunningly simple ultra-modern QSL design. The callsign is presented visually around the upper left-hand perimeter of the card. The callsign is displayed in modern type in the lower right-hand space balancing the image and contributing to the overall pleasing effect of the card.

To enter *73 Magazine*'s QSL of the Month Contest send your QSL in an envelope to: Editorial Offices, *73 Magazine*, Peterborough NH 03458. Specify a book from *73*'s Radio Bookshop (located elsewhere in this magazine). Entries which are not in an envelope or do not select a book will not be considered.

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

by Bandel Linn K4PP



"I'm the guy you were talking to on 2 meters! Please follow me to our yacht landing for dinner!"

Fig. 2. Hookup connection function chart.

Mike Strange WA2BHB
PO Box 58

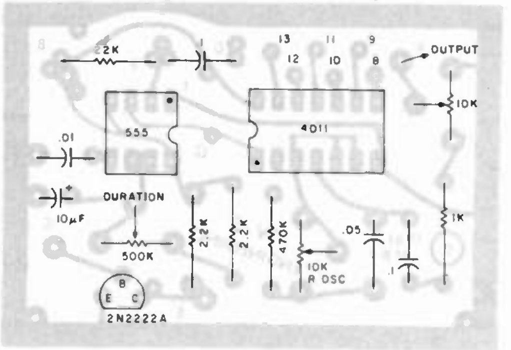


Fig. 3. MB-1 PCB layout, component side.

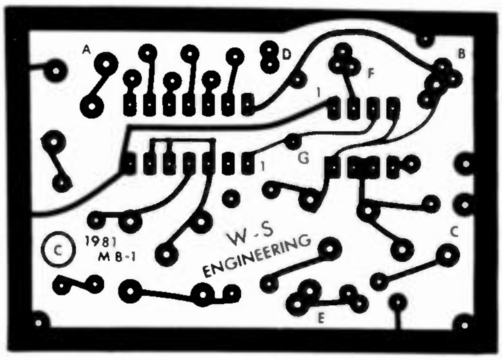


Fig. 4. MB-1 PCB layout, foil view.

tion. Timing can be set from milliseconds to hours. Note that C1 *must* be a high-grade, very-low-leakage electrolytic capacitor. Cheap or surplus capacitors have far too much leakage, and the circuit will not work with them.

The frequency of oscillation is controlled by the potentiometer labeled OSC. This potentiometer can be from several Ohms to megohms. The higher the value, the lower the frequency of oscillation. The output frequency is determined by the .05-uF capacitor and R-OSC. You can get this circuit to work up into the megahertz range, but above 500 kHz, stability becomes a problem for such a simple circuit.

A buffered input is available by using the 2N2222A. It also acts as an inverter.

The output level from the circuit for the astable and oscillator modes is controlled by the 10k-Ohm *output* potentiometer. As designed, the circuit will drive an 8-Ohm or greater speaker. In a reasonably quiet room, you can hear the audio output quite well.

Construction

Building of the circuit is very easy if you use the printed circuit board approach. Fig. 3 shows the pictorial layout of the PCB. Fig. 4 is a foil view of the actual printed circuit layout. Parts are not critical, but if you use cheap parts, the circuit performance is significantly degraded. Since this circuit is so small, it pays to use first-class prime parts.

Checkout and Setup

The fastest way to verify that your MB-1 works is to configure it as a generator. Hook up the board as per Fig. 2, function 1. Fig. 5 shows sample physical configurations, so you can make sure you have everything correct. Set R-OSC at mid-range and R-OUTPUT for maximum audio. After you apply Vcc, you will hear a tone from the speaker. If no output, vary the R-OSC and R-OUTPUT settings. If you still don't hear anything, start checking for bad ICs, incorrect wiring, solder shorts, etc.

Applications for the MB-1

I have found the MB-1 to be the most useful and cheapest little circuit I've designed. I have one in two different testers acting as simulated microphones. Another is used as a CMOS spare logic probe. I particularly like the audible feature so I can hook it to one part of a circuit and not have to look at it to know what is going on. And yet another is being used as a basic 455-kHz signal generator for rough applications. And last but not least, one is the original "beeper" for my Porta-Peater repeater.

You will probably think of more applications for this circuit after you have made a few. Figs. 2 and 5 should get you up and running. After you have put a few of these modules to work, you'll probably wonder how you got along without them!

I'm more than happy to answer any questions or provide any application assistance you may need. However, please provide an SASE. This greatly speeds up the answer process and keeps me from destroying the household budget.

W-S Engineering has a complete kit of all parts including a PCB for $12.00 postpaid in the U.S.A. (W-S Engineering, PO Box 58, Pine Hill NJ 08021). ■

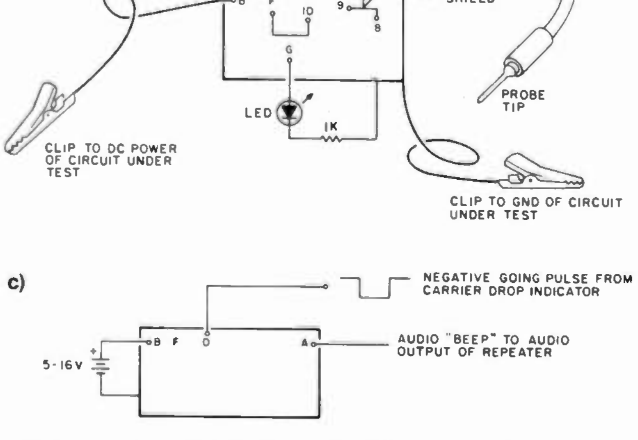


Fig. 5. Sample applications. (a) Hookup for audio signal generator (function #1). (b) CMOS logic probe with LED indicator (function #7). (c) Repeater beeper (indicates timeout reset) with negative pulse trigger (function #3).

Parts List

Bare PCB	8-pin DIP socket
NE555 IC	2N2222A transistor
CD4011BE IC	47-uF, 16 V dc capacitor
10k trimpot (Panasonic Q0A14)	22k, ¼-W resistor
2 500k trimpots (Panasonic Q0A56)	2 2.2k, ¼-W resistors
.01-uF bypass capacitor, 50 V dc	470k, ¼-W resistor
.10-uF capacitor, 50 V dc (2)	1k resistor
.047 metallized polyester capacitor	100k, ¼-W resistor
16-pin DIP socket	T1 ¾ Red LED

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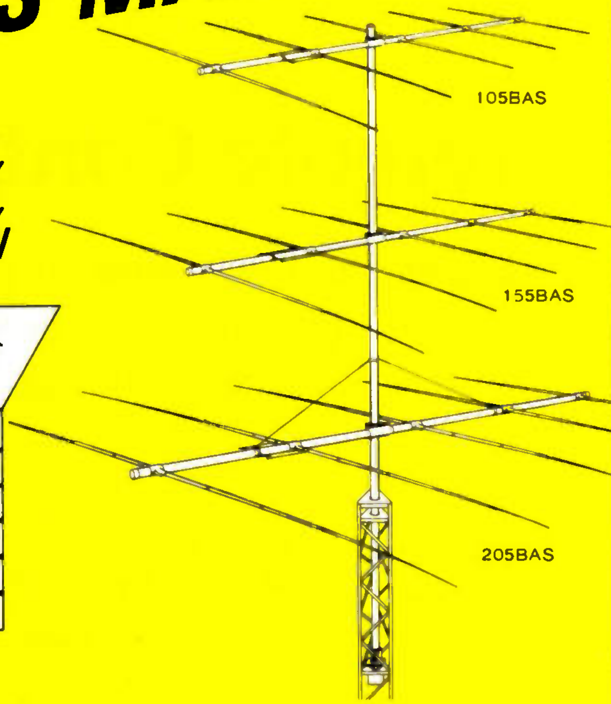
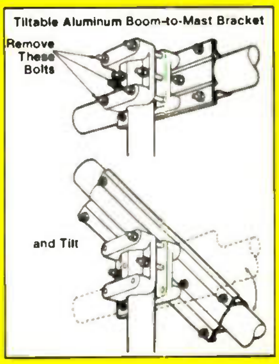


MODEL NO.	AVERAGE GAIN (db)	MAXIMUM F/B RATIO (db)	NO. OF ELEMENTS	LONGEST ELEMENT (ft)	LONGEST ELEMENT (m)	BOOM LENGTH (ft)	BOOM LENGTH (m)	TURNING RADIUS (ft)	TURNING RADIUS (m)	BANDS (Meters)	SHIPPING WEIGHT (lbs)	SHIPPING WEIGHT (kg)
402BAS	4.9	25	2	45.9	14	16.1	4.9	25	7.6	40	47	21.3
204BAS	10	25	4	36.5	11.1	26	7.9	22.5	6.7	20	55	25
205BAS	11.6	35	5	36.5	11.1	34	10.4	25	7.6	20	77	35
155BAS	12	25	5	24.5	7.5	26	7.9	17.5	5.3	15	42	19
105BAS	12	35	5	18.5	5.6	24	7.3	15	4.6	10	29	13

3-Element Monobanders also available.
Optional BN-86 balun recommended for above antennas.

Tiltable Aluminum Boom-to-Mast Bracket



MECHANICALLY Hy-Gain monoband antennas employ the best materials available and are fabricated with accurate tooling for an integral balance so all parts work together. For example, our element-to-mast brackets are the best in the industry and our tiltable mast-to-boom clamps are unique. Stainless steel hardware is chemically passivated to eliminate rust. All tubing and parts are deburred and finished so you don't have to re-manufacture the antenna before installation. It all adds up to antennas with maximum mechanical integrity that withstand 80 mph (129 km/h) windloads and radial ice.

ELECTRICAL performance is not based on theoretical calculations alone but is tuned and tested for optimum results on our government approved test range. Hy-Gain's factory tuned 52 ohm Beta Match is exclusive and assures positive dc ground for lightning protection and reduced precipitation static. Though sometimes unconventional, our meticulous element spacing assures maximum F/B ratio and uncompromising power gain. VSWR at resonance is less than 1.5:1. All Hy-Gain monobanders handle maximum legal power with a 4:1 safety margin. In short, electrical performance is at maximum by design and requires no re-tuning.

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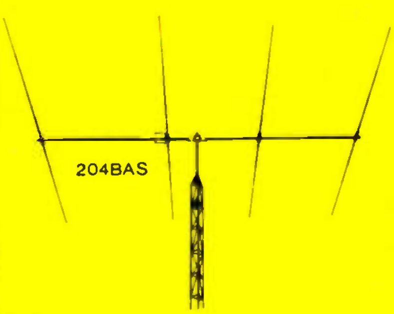
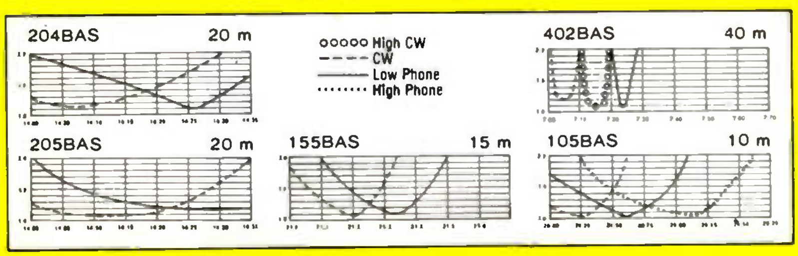


MONOBAND BEAMS



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Remote-Control Your IC-701

Simpler than commercial controllers, this home-brew unit nevertheless features push-button band changing and frequency selection, scanning, and expanded coverage.

Glenn Williman N2GW
612 Auth Avenue
Ocean NJ 07712

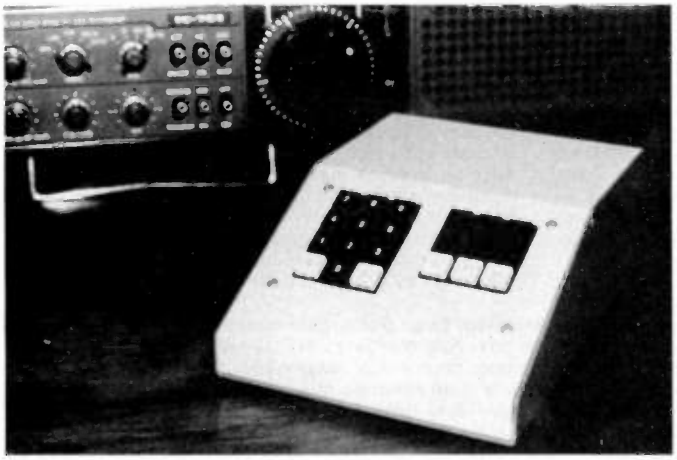
Soon after purchasing my 701, I became interested in exploring the remote-control capabilities of the radio. I was not willing to spend the money for the manufacturer's unit, but I also did not need many of the built-in features obviously intended for use with their companion 2-meter set, the IC-211. Some cautious experimenting with the accessory connector on the rear panel led to the design of this relatively simple control unit which can perform all the operations I feel are necessary for operation on the HF bands. Basically, this unit can perform the following functions:

- push-button control of bandswitching
- frequency selection
- manual frequency scanning (fast or slow)
- extension of frequency range of standard IC-701

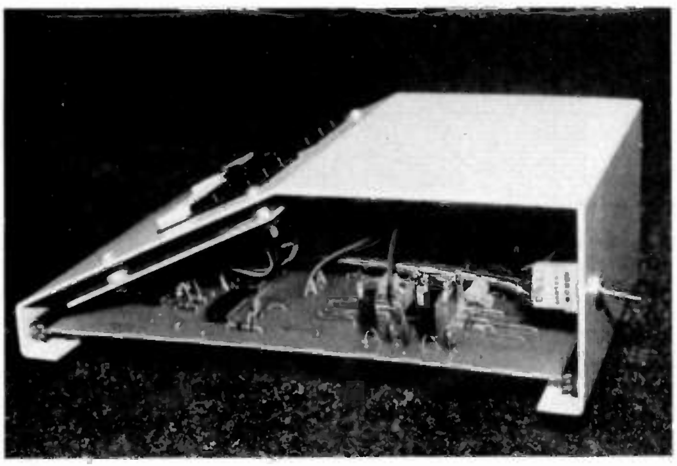
Theory of Operation

In order to understand the operation of the remote-control unit, the requirements for controlling the IC-701 must first be examined.

The synthesizer in the IC-701 contains two presettable up-down counters which control the programmable divider in the phase-locked loop (PLL), one counter for each of the two vfo positions selectable on the front panel. The frequency data is encoded and read in serially, and in the normal mode of operation the data contains four characters, i.e., after the serial



Front view.



Side view.

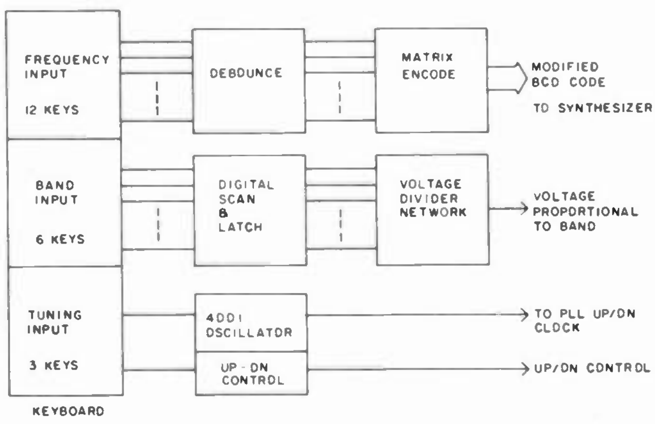


Fig. 1. Block diagram.

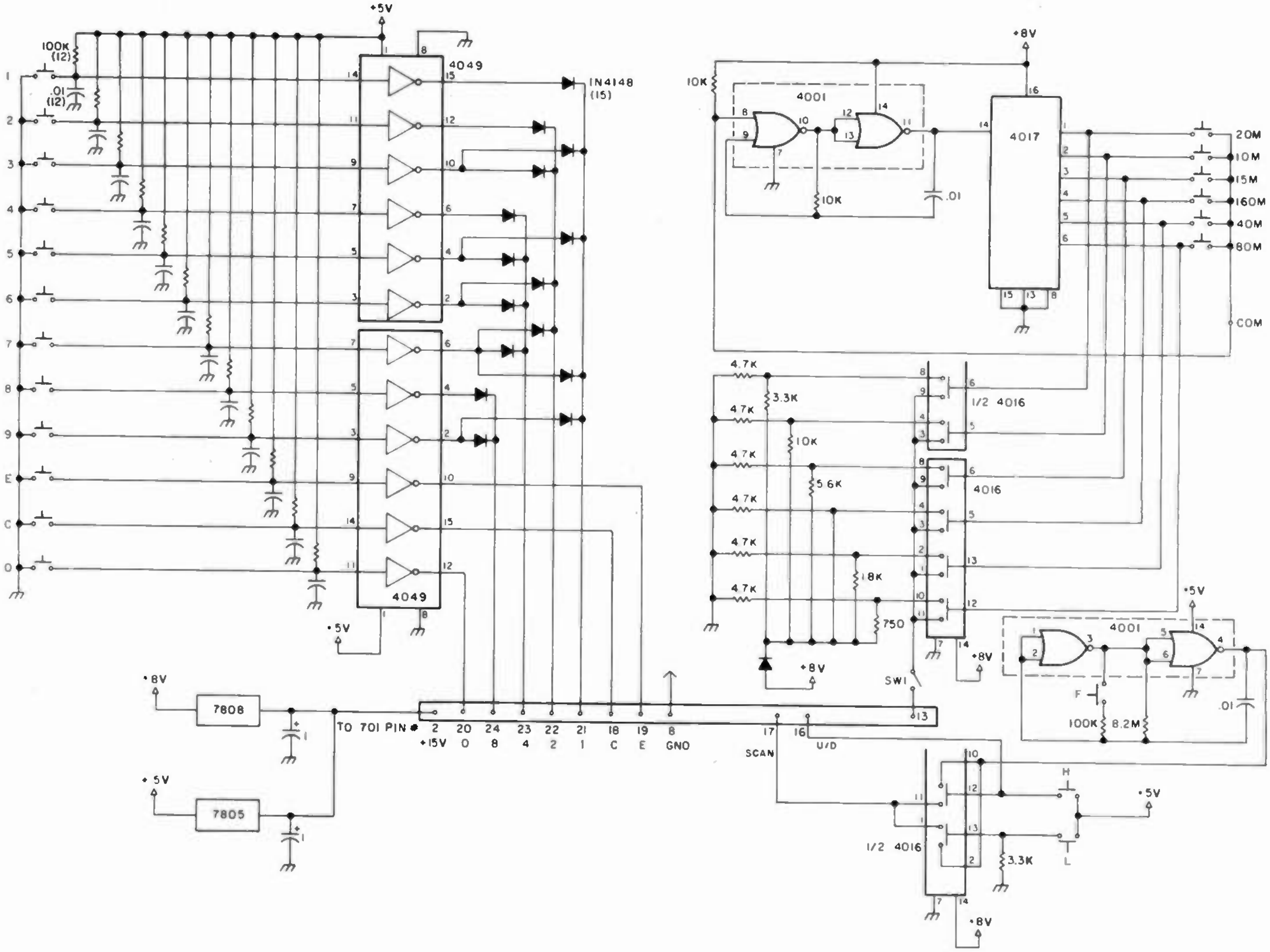


Fig. 2. Remote-control circuit.

data of the first four characters is entered, any succeeding data is ignored until the counters are again cleared.

Automatic bandswitching is accomplished by a stepping relay which is driven by a differential comparator. A front-panel switch selectable tap on a voltage-divider chain is compared to a similar voltage-divider chain switched by the stepping relay. When the two voltages are approximately equal, the relay is de-energized.

Therefore, two types of signals are required: a series of pulses to program the frequency of the synthesizer and an analog voltage proportional to the desired band. Fortunately, access to these signals (and many others) is provided at the accessory plug on the rear panel of the IC-701. The frequency programming inputs are always active and are terminated internally either by resistors to ground or within the PLL LSI unit. The analog voltage input for bandswitching becomes active only when the bandswitch on the front panel of the IC-701 is placed in the external position.

Circuit Description

Knowing the types of signals required and the further requirements which I imposed of using simple push-buttons and CMOS circuitry, the circuit shown in Fig. 2 evolved. A block diagram is shown in Fig. 1.

The frequency information is keyed in by twelve SPST push-button switches which are effectively debounced and encoded with a diode matrix.

As the switch is closed, in Fig. 3, the inverter is pulled to ground and any bounce is damped by the effect of the RC network. When the switch is opened, any bounce is again damped since as long as any of the damped or filtered bounce transients do not exceed $V_{CC}/2$, the switch is effectively debounced at the output of the inverter. For this circuit, 100k and .01 uF provided the necessary time constant for the switches used.

The debounced switches for 0 through 9 are then encoded into a BCD code. The exception is the 0 key. A separate line is used for the 0 character, rather than representing it as the absence of all other lines. This is presumably required since the PLL unit loads

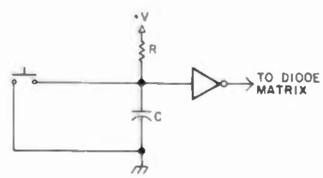


Fig. 3.

data serially one "digit" at a time with each keystroke. The C and E keys are control signals. The C key clears the counters, and the bottom edge of the selected frequency band will be displayed. The E key resets the counters and must always be used prior to entering digit information.

In order to achieve push-button control of the bandswitching, a digital scan and latch circuit is used. A 4001 RC oscillator running at about 4 kHz clocks a counter with decoded outputs (in this case a 4017,

RIBBON CABLE PIN #	IC-701 PIN #
1	2
2	19
5	16
6	17
7	13
8	21
9	22
10	23
11	24
12	8
13	20
14	18

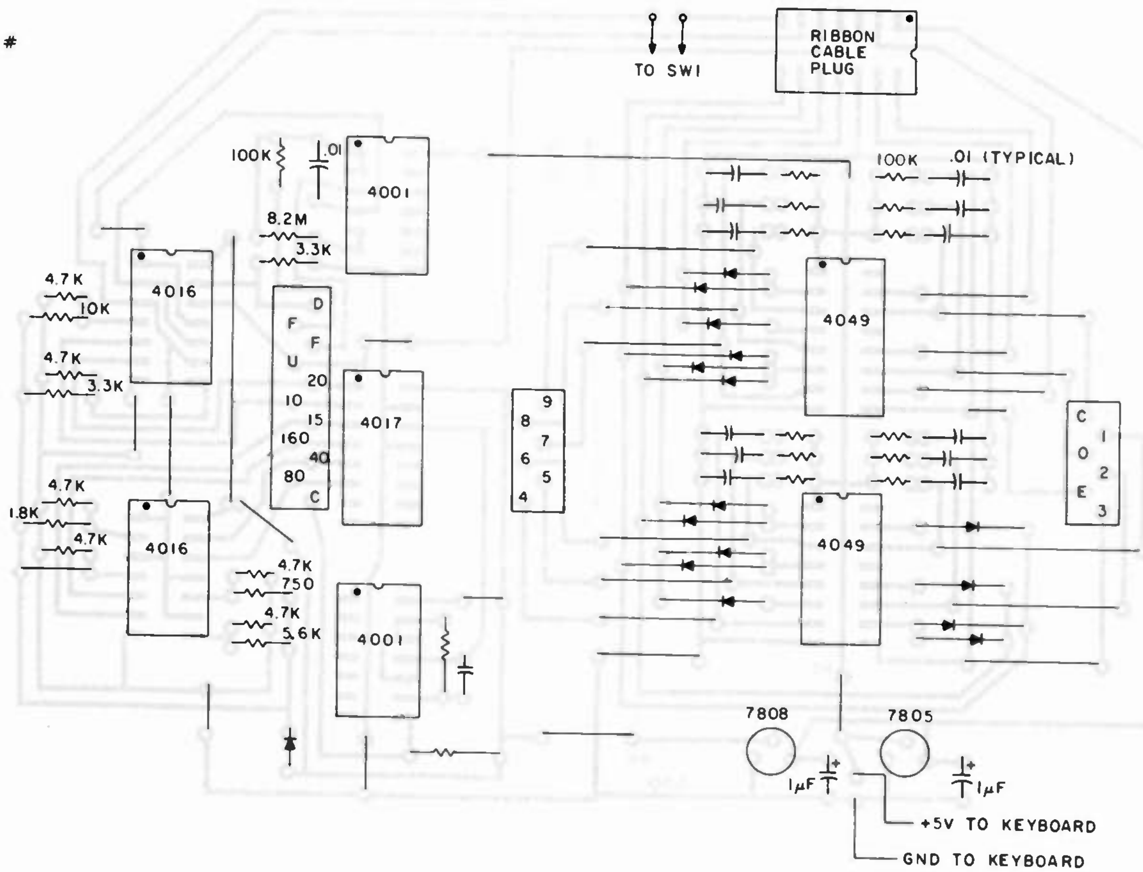


Fig. 4(a). Control circuitry component layout.

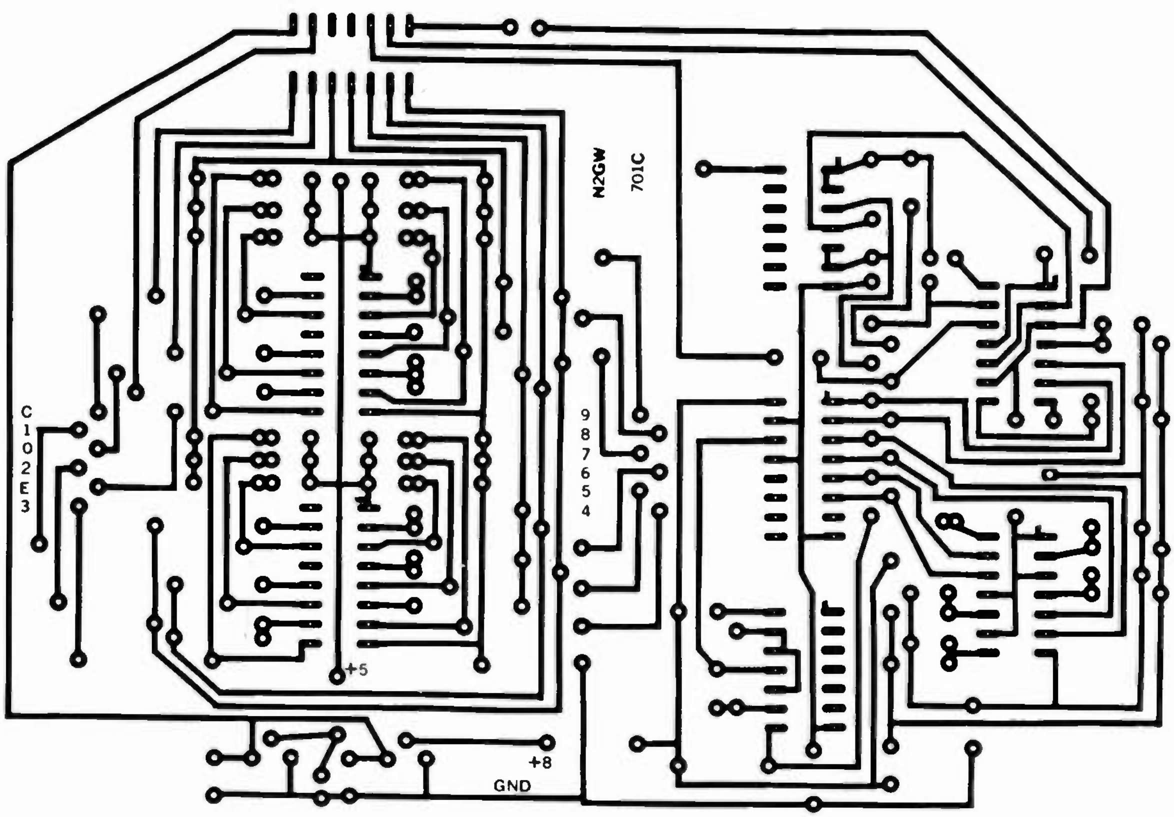


Fig. 4(b). Control circuitry PC board.

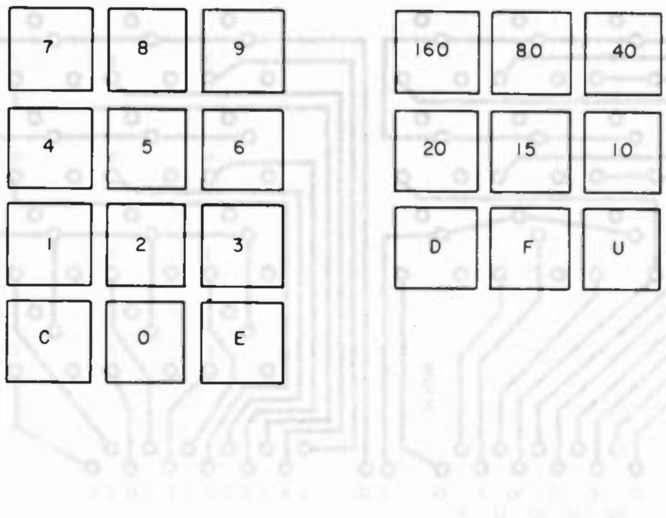


Fig. 5(a). Keyboard component layout.

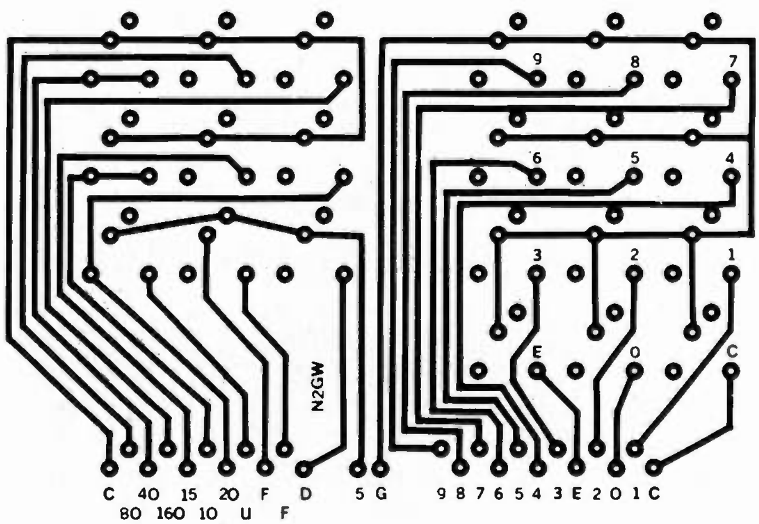


Fig. 5(b). Keyboard PC board.

since they were available). Assume the counter is stopped in state #1, and the clock is inhibited by the 10k pull-up resistor. Depressing any of the other five keys corresponding to states 2 through 6 pulls down pin 8 of the 4001, since outputs 2 through 6 are low, and enables the clock. The counter cycles until the high decoded output corresponds to the depressed key. Then the clock and counter are again stopped. Essentially what happens is that the selected output line of the counter is latched high by whichever key is momentarily pressed. This selected line also controls one of six bilateral switches (4016s). The input side of the bilateral switch is connected to a voltage divider whose voltage corresponds to a particular band, and the outputs are all common and fed to the band select input of the 701.

Another 4001 RC oscillator serves as the scan clock input to the 701 in order to clock the divider in the PLL unit which tunes the synthesizer up or down in frequency. There are two inputs for this on the 701. Clocking one line will increment or decrement the synthesizer depending on an up or down signal on the other line. The RC oscillator is run at both a fast (500-Hz) and slow (10-Hz) rate so that fast and slow tuning can be accomplished. The H key tunes the 701 higher in frequency; the L key tunes lower in frequency, and the F key increases the tuning rate to a fast scan and must be depressed with an H or L key for fast tuning.

Power for the remote control is obtained from the 15-V-dc pin on the 701 accessory plug and is then regulated down to +8 V and +5 V for the different portions of the circuit. The up-down counters (fast and slow) and the frequency preset logic are all standard CMOS in the 701 and run at +5 V dc. The bandswitching voltage dividers in the 701 are fed with regulated +8 V dc, so this must be duplicated in the remote-control unit.

Construction

Two printed circuit boards were designed for this project, although a small IC breadboard will work nicely. One is for the keyboard (3″ × 4.5″) and one is for the control circuitry (6.75″ × 4.5″). These are shown in Figs. 4(b) and 5(b). The push-button switches mount directly on the printed circuit board. Parts placement is shown in Figs. 4(a) and 5(a). The boards mount in an LMB type MDC 752 modular console. Ribbon cable (12-conductor) is used to connect the remote control to the accessory plug for the IC-701.

Operation

The layout of the keyboard with the bandswitching and tuning keys on the right side and frequency selection keys on the left side lends itself to easy operation. Typical usage of the remote control goes like this:

1. Change band using one of six band select keys.
2. Enter particular frequency, e.g., 21.320.0, by using the 12 frequency select keys (sequence keyed in this example would be E3200).
3. Tune up or down (fast or slow) using the 3 frequency scanning keys (below band select keys).

Changing from one band to another and moving from one end of the band to the other can be done considerably faster than by manual tuning, and with no transmitter tuning, the capability for instant QSY becomes more realizable.

There are several interesting operating tricks which can also be accomplished with the remote control.

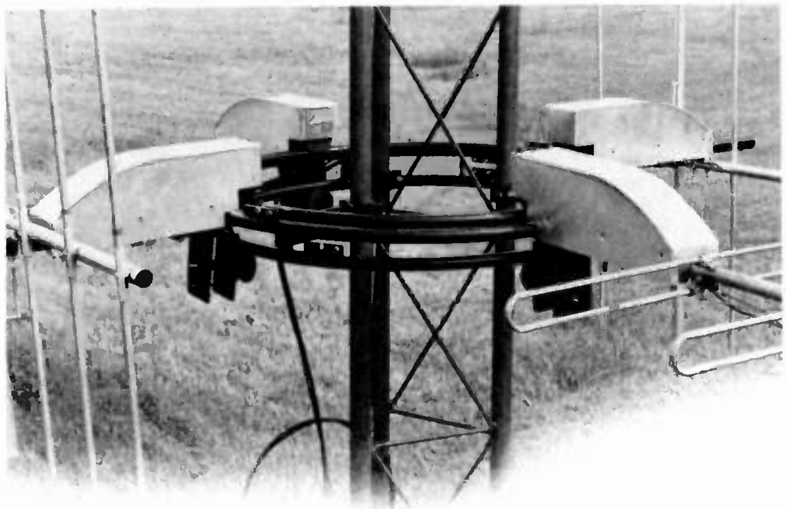
1. The RIT, once turned on, will not be defeated when tuning with the remote control, as it will with the manual tuning control.

2. Pressing "E" and "1" simultaneously and releasing the "E" first will add 1 MHz to the displayed frequency; however, the display will only change on 20 meters and the display will indicate 15.xxx.x.

The following is a list of the expanded coverage that is available:
160m—1.000.0 to 2.999.9;
80m—3.000.0 to 4.999.9, MHz will not display "4";
40m—7.000.0 to 7.999.9;
20m—14.000.0 to 15.999.9;
15m—21.000.0 to 22.999.9, MHz will not display "22";
10m—no expanded coverage.

There are obviously other features that could be built into the remote control. Memory would be a "nice-to-have" addition and really not that hard to do although the sequential (serial) data input requirement does complicate things somewhat. I don't miss additional memory, over the two in the 701, but then again I didn't miss the remote control until I began using it. The ability to instantly move to different frequencies around the band is the most useful one for me and it has become an operating convenience I wouldn't be without.

Keys for the keyboard and circuit boards are available. Please enclose an SASE for details. ■



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DEALER INQUIRIES INVITED

Automatic Beam Aimer

Here's the scoop on adding set-and-forget convenience to your rotator control. Works with most common control boxes.

Guy Slaughter K9AZG
753 W. Elizabeth Drive
Crown Point IN 46307

I have a smart knob in my shack. It looks like any other dumb old pointer knob sticking out of a black box, but it's really quite clever. Turn it to a given beam heading, and it makes the Cushcraft tribander atop the tower outside my house rotate to that same direction and stop there, all by itself.

I built its prototype originally for my sightless friend, W9PBS, who until then had a problem knowing which way his four-element monobander was aimed. The voltmeter needle on his Ham IV rotator control that usually reads out the direction his beam is pointing is worthless to him, of course. It was while mulling over the problem of converting that analog needle's silent message into something more useful that I came up with the idea for the smart knob. And I liked it so well while debugging it and burning it in on my own operating table that I had to build one for myself.

That's because my own DC-45 rotator control, identical with the Ham IV's and the control for the CDE's big antenna whirler, the Tailtwister, requires holding down both a brake release and a direction button while the beam is swinging from one compass point to another. This can take as much as half a minute for a 180-degree direction change. The smart knob, on the other hand, requires only a quick twirl to the desired beam heading and it does the rest itself, bringing the antenna around to the target while I tweak my transceiver tuning to peak that rare call up out of the mud and prepare to enter it in my log.

If you have a CDE rotator, I think you'd enjoy a smart knob, too. Mine's been in use for many months now without ever rebelling at its task. So has the one in daily use by W9PBS, who actually switches it between two separate Ham IVs, driving 15- and 20-meter monobanders mounted on separate towers.

The knob itself is fastened to the shaft of a 25k pot extending from a black box which, along with all the other parts and pieces inside except those scrounged from my junk collection, was bought at my neighborhood Radio Shack, for a total of less than $50. The heart of the gadgetry inside the box is that pot and a 12-volt-dc power supply capable of providing 150 mA or so (see Fig. 1). The supply feeds two sections of an LM339 quad comparator chip, three 2N3904 transistors, and three 12-volt relays with DPDT contacts rated at three Amps. (See Radio Shack numbers in the Parts List.) But before we get into their functions, let's discuss the CDE rotator control system.

It is a conventional low-voltage ac capacitor-start motor whose direction of rotation depends on which half of its winding pair is energized. Though the light-duty CD-45, the medium-duty Ham IV, and the heavy-duty Tailtwister rotators have different braking systems and varying numbers of ball bearings in their innards, they are similar electrically and their control boxes are identical. Each contains the motor-feed transformer, the start capacitor, three push-and-hold button switches for brake release and directional control, and the direction-indicating circuitry. That circuitry consists of a power supply which provides 13 volts dc, a voltmeter to read it, and a calibration pot.

Inside the motor housing there is a variable resistor shunted across the floating-ground, 13-volt supply (and connected to it by rotor cable terminal posts 3 and 4 on the back panel of the control box). The movable arm of that remote resistor, mechanically linked to the motor rotor, is chassis-ground, cabled to terminal post 1 on the control unit.

The resistor is tied into the direction-indicating voltmeter circuit so that the meter reads full scale—13 volts—when the rotor is fully clockwise, zero volts at full counterclockwise, and 6½ volts at the halfway point. The voltmeter face is calibrated accordingly, north at half scale, south at full clockwise and full counterclockwise, with the other points of the compass in between.

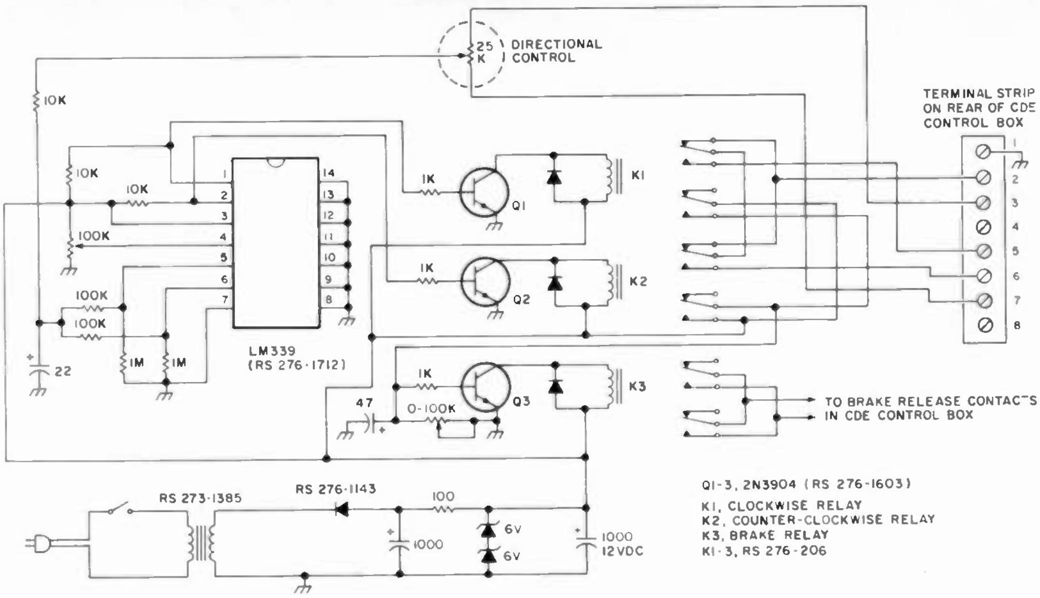

Fig. 1. Rotator control schematic.

And that's where the smart knob comes in. If we connect the outside terminals of its 25k pot across binding posts 3 and 7 on the rear apron of the control box (shunting the rotor-feed wires already there), the pot will be in parallel with the 13-volt, direction-indicator supply, and the pot's center terminal will show a voltage to ground proportional to the difference in relative settings of the pot and the rotor-mounted resistor.

With the rotor turned due north so that 6½ volts appears on the voltmeter, turning the smart knob's pot to half rotation—map north as indicated by the pointer knob, straight up—will bring to zero the voltage between its center terminal and chassis ground. Now rotate the pot clockwise, and that zero voltage will climb toward plus 6½, depending upon the degree of rotation. Turn it counterclockwise, and the voltage will fall back to zero at the midsetting, then begin a negative climb to −6½ when it's at full counterclockwise.

That's the secret of the smart knob's intelligence. All we need to do now is harness this intelligence to control the rotor motor and braking circuit so that our beam points wherever the knob tells it to.

Fig. 1 shows how the center terminal of the 25k linear-taper pot feeds two sections of the comparator chip so that one senses positive voltages, the other negative. Because each turns on a switching transistor whose collector current flows through relay coils, one or the other relay is pulled in whenever there is a difference in rotation angle between the smart knob and the beam rotor.

The relay contacts parallel the push-button switches of the rotor control box, thus energizing the brake and rotor motor, which swings the antenna to the direction called for by the smart knob; then the contacts open to hold it there. They are so interconnected that even a component failure or human error cannot trigger simultaneous clockwise and counterclockwise rotation. And there is a time-delay circuit in the brake-release relay's switching-transistor circuitry ensuring that the rotor—and the heavy load it carries—coasts to a stop before the brake is reapplied, thus averting the tower-twisting, rotor-ruining torque that the inertia of a suddenly-braked antenna can exert.

The component values shown provide a variable braking delay of about two to five seconds, adequate for my tribander and the heavier four-element monobanders used by W9PBS.

There is one small limitation. Because the voltage signalling the counterclockwise comparator to turn on its switching transistor falls to zero when antenna rotation approaches full counterclockwise south, and because even a smart knob requires a small fraction of a volt to sense, counterclockwise rotation will stop about 5 degrees from due south. But that's no big deal. Most beams have 60-degree lobes; you still can nudge the antenna the rest of the way with the manual push-buttons, or you can tell the smart knob to go full south clockwise where it has lots of voltage to sense. And it will.

There are no particular construction hints to pass along. Everything is dc and, therefore, lead lengths and dress are not a problem. I used perfboard and wired point-to-point because I'm not into printed-circuit fabrication. On one of the

Parts List

1 cabinet (270-453)
1 transformer, 12 V, 300 mA (273-1385)
3 relays, 12 V, DPDT (276-206)
1 on-off switch (275-612)
1 package (2) zener diodes, 6 V (276-571)
1 25k pot, linear taper (271-1715)
2 100k minipots (271-220)
1 package (15) 2N3904 transistors (276-1603)
1 quad comparator LM339 (276-1712)
1 14-pin dip socket (276-1999)
2 1,000-μF electrolytics (272-957)
1 47-μF electrolytic (272-1027)
1 22-μF electrolytic (272-1026)
1 3-Amp rectifier diode (276-1143)
1 PC board, 4½" x 6" (276-1394)
1 package push-in terminals (270-1394)
1 package (50) diodes (276-1620)
3 10k, ¼-Watt fixed resistors
2 100k, ¼-Watt fixed resistors
2 1 meg, ¼-Watt fixed resistors
4 1k, ¼-Watt fixed resistors
1 length, (two, three feet) eight-conductor cable*
1 knob, pointer, junk-box type

*If you've got a rotator, you must have some cable somewhere, probably hanging in the garage. My Radio Shack doesn't stock it. The other parts will add up to around $45, if you buy them all new. Happy knobbing.

smart knobs that I built, I used an eight-terminal barrier strip to wire it to the CDE control box, and on others I chassis-mounted six-contact female sockets so they could be unplugged from the rotor control box for testing and fiddling.

However you wire yours to the CDE control, there is a small bit of surgery required: You need to shunt a two-conductor cable across the brake-switch contacts inside the CDE control box and bring it out to the smart knob box. There is plenty of room to work inside the rotor control, and the plastic cabinet can be flexed enough to pass the cable between it and the chassis if you don't want to drill it for a connector socket.

If you use a plug and socket for this, be sure the brake contacts are connected to the female half of the connector, because the brake wires are hot with 120 V ac.

With the smart knob built and connected to the CDE control box, disconnect the brake-energizing cable so that the antenna won't be swinging back and forth as you adjust the pick-up-dropout points of the switching transistors by tweaking the 100k minipot feeding pin 4 of the comparator chip. Once you have that minipot properly set so that the device neither hunts for a null nor fails to respond to a 3-to-5-degree rotation of the smart knob, you can loosen the pointer-knob set screw on the 25k pot shaft to line it up at due north when the antenna is pointing due north.

Having thus compensated for any discrepancy between zero voltage at the pot's wiping contact and its precise half-resistance setting, you will find calibration is remarkably accurate at all points of the compass. ■

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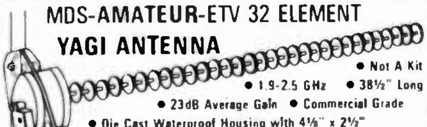

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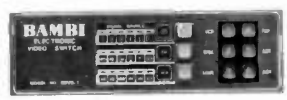

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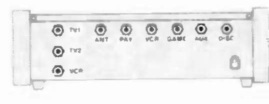

Bambi's Specifications:

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Noise	4dB ±1dB
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Model UES-A56F

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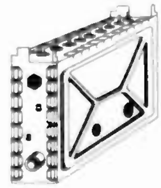

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Antenna Input 75 ohms
Channels 14-83 Output Channel 3

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At home or in the car, this do-it-yourself charger and accessory box could be the best friend your handie-talkie ever had.

For the first couple of weeks after you buy your 2-meter handie-talkie "brick" (Tempo, Icom, Yaesu, etc.), it is sort of fun to plug and unplug the unregulated charger so that the nicad battery pack stays at full charge. After that, though, the newness wears off and it is just a pain in the lower backside to try to guess at how long you ought to leave the juice on before you boil the cells dry. Not only that, but you are never really sure whether you have given the battery pack full charge or whether you are consistently undercharging the nicad pack, a notorious cause of nicad deterioration.

In addition, it would be sort of nice to be able to operate mobile with your brick and use the same mobile speaker and microphone that you use for all your other mobile equipment plus the mobile's battery-generator charging system. The brick box described here will solve these problems and perform the following functions:

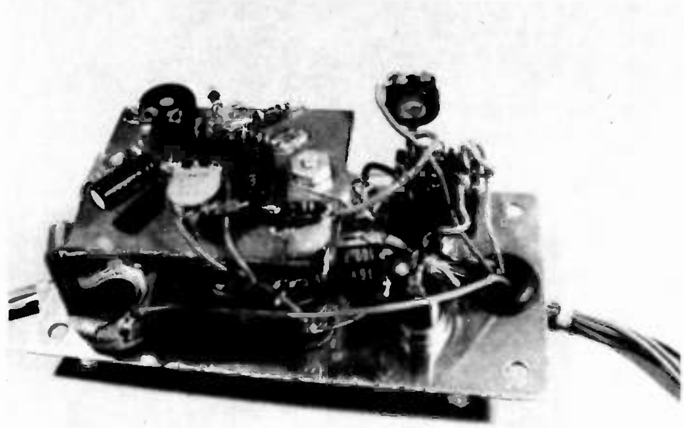
1) Regulates the voltage and limits the current from the factory-supplied wall charger so that the nicad batteries in the brick may be left on charge for as long as you like without overcharging.

2) Allows the car (or boat, or snowmobile, or aircraft) battery-charging system also to charge the brick batteries with a regulated, current-limited circuit.

3) Permits you to plug in a mobile microphone and provides an amplifier-matching circuit between microphone and brick that is adjustable for exactly the right amount of deviation.

4) Allows the speaker amplifier in the brick to drive an

The completed brick box.



Inside view of the brick box showing unique "cobweb" construction.

external mobile speaker (with an option to install a speaker-driver-amplifier for higher power output) or a set of high- or low-impedance headphones.

5) Permits you to plug in to an already-existing mobile installation such as a private aircraft audio panel or a VHF-FM boat system and use the microphone/speaker/headphone setup in the mobile craft.

6) All these goodies cost less than $10 (plus an extra $5 for the high-power speaker amp).

Here are the ground rules for using this article: Most of the parts are available from any well-stocked ham store or "hobby-shop" electronics place. You may freely substitute for any of the parts. None of the parts values is really critical—a variation of ±20% should never really be noticed. Also, this article was written using the Tempo S1, and interfacing with standard commercial FM microphones and aircraft microphone-headsets (carbon or amplified dynamic). Other rigs and other microphones may require modifications of the mike amplifier circuit as shown later.

Regulator

The power supply regulator must perform two functions. First, on a deeply-discharged nicad battery pack, the regulator must limit the charging current below approximately 200 mA. Limiting the charging current in this manner prevents the cells from outgassing and drying out the electrolyte. Second, the charger must limit the end-charge voltage to the cells to approximately 1.37 volts for each cell, at which point the cells may be allowed to trickle-charge at this voltage indefinitely.

The current limiting may be done by either of two methods. First, if the wall charger itself is one of the "12-V, 50-mA" variety, no external limiting will be necessary. The wall charger itself provides the necessary current protection by its design. However, a fully-discharged 450-mAh battery will require over 9 hours to fully recharge, so you may wish to consider the alternative fast-charge circuit described a little later.

For those using a current-limited wall-pack charger, the circuit shown in Fig. 1 will regulate the final trickle charge voltage to 1.37 volts per cell, or an output of 11.6 volts into the Tempo S1 CHG jack. (1.37 × 8 cells + 0.7 volts, to compensate for one silicon diode inside the S1 in series with the charger line.) The basic circuit uses a 7805 (or 78M05 or 78L05) regulator, with a 1k variable resistor used to set the exact output voltage. To set the output voltage accurately, connect a 470-Ohm resistor across the 11.6-volt regulated output and adjust R1 (the 1k variable) for exactly 11.6 volts on an accurate voltmeter across the 470-Ohm resistor. The value of C1 (1000 µF) is not critical at all, providing that there is less than 150 mV ripple on the output with the 470-Ohm resistor attached. Up to a point, adding more capacitance to this point increases the charge rate (milliamperes) of the wall charger. I found 1000 µF to be the optimum value; do not go below 0.1 µF or the regulator will become unstable.

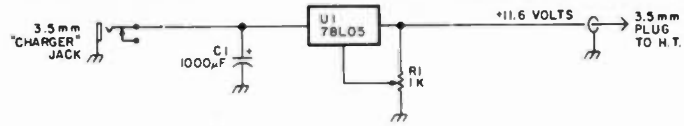


Fig. 1. The basic brick-box charger-regulator.

High-Power Regulator

In the event you can get your hands on a wall power pack with more output or for those who are going to use the almost unlimited current available from an automotive (or boat, or aircraft, etc.) supply to recharge the brick batteries, some method of current limiting must be employed to ensure that the nicad battery pack does not overheat due to excess charging current. Incidentally, for those of you looking for a very inexpensive high-current 12-volt wall-pack-style charger, look in the auto-supply stores or the automotive department of the larger discount houses for a "cold-weather battery maintenance charger." These little rascals *look* just like a low-power calculator wall pack, with one end terminated in a cigar lighter plug, but the fact of the matter is that they put out 12 volts at a whopping 300 mA. Don't forget the 1000-µF filter capacitor, though, because these high-power wall packs have a pretty raw, rectified ac waveform.

The trick to use to keep the maximum available current below 200 mA is to use a 78L05 for the regulator called out above. The 78X05 is actually a whole family of regulators where X defines the normal maximum current available. If X = L (78L05), normal current maximum is 100 mA; if X = M (78M05), normal current maximum is 500 mA; and if X = nothing (7805), the current available is 1 Amp.

Now, the internal current-limiting circuit in these ICs sets the current-limit point to about 150% of the maximum normal current, so if you use a 78L05 as your voltage regulator IC, the maximum current that your nicad pack can draw is approximately 150 mA, well within the maximum charge capacity of your brick's nicad pack.

Since I had planned to use the brick box in aeronautical mobile use in addition to use with a high-power wall-pack charger, not only did I use the 78L05 as my regulator, but I also supplied both a 3.5-mm jack on the brick box to plug-in the

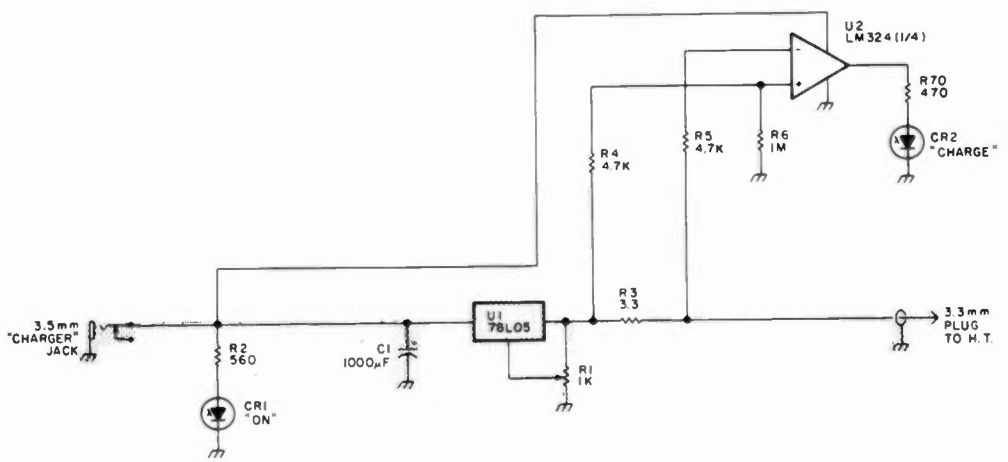


Fig. 2. Adding charge-indicator circuitry.

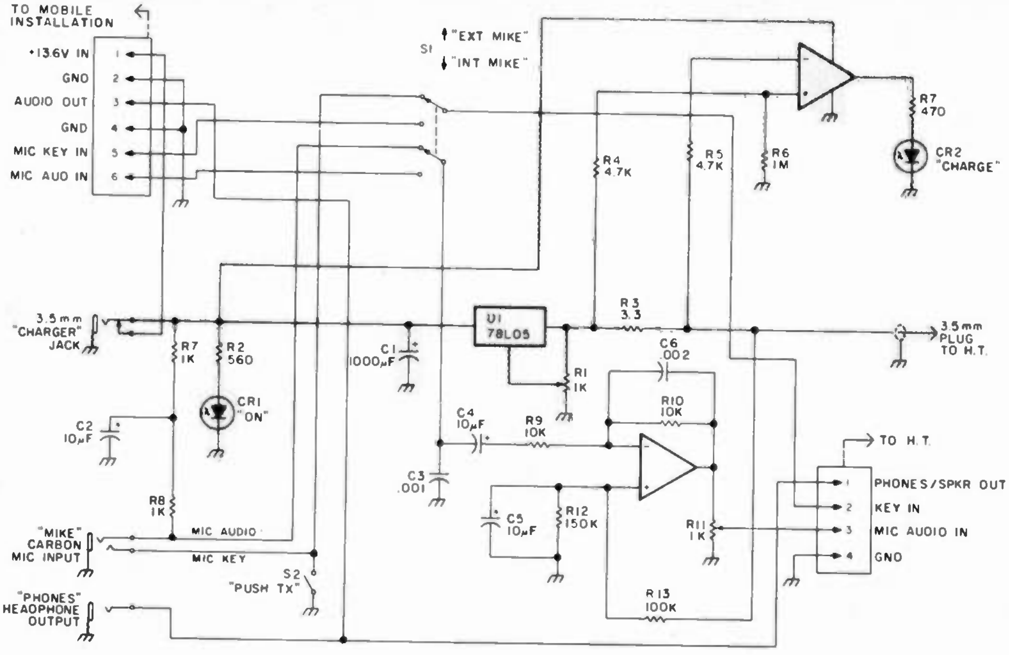


Fig. 3. The deluxe mobile-base brick-box schematic.

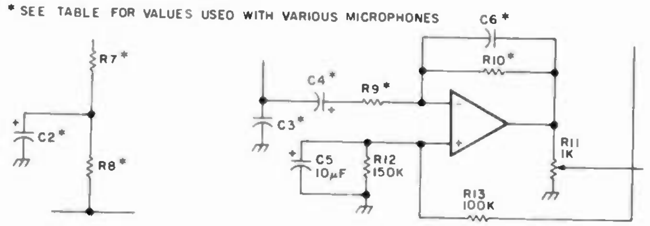


Fig. 4. Parts changes for various microphone types. See Table 1 for values.

wall pack charger and a cable connection to a molex®-type connector for attachment to the aircraft electrical system. As we shall see, using a 6-pin molex connector allows me to use the mobile microphone and speaker/phones, as well as the aircraft battery-charging system.

Charge Indicators

So far, we have a nicad battery pack charging system that will accept a low- or high-power wall pack or a battery-generator automotive-type system. The first refinement to make will be a pair of LED lamps. One of the lamps will tell us when power is being supplied into the charger and the second lamp will tell us when the end-of-charge cycle of the nicad pack has occurred. The first lamp is easy: an LED and a resistor (R2) will tell us if our wall pack or auto system is plugged in. The second (end-of-charge) lamp requires a little more circuitry.

The heart of the charge lamp is a high-gain op amp (LM324) used as a comparator. This circuit is shown in Fig. 2. The type of op amp is not critical, either. The common 741 or any other *true* op amp may be substituted. The so-called Norton (LM3900/MC3401) op amps may be used, but you are on your own for the circuit modifications which are necessary.

The 3.3-Ohm resistor (R3) introduces a negligible voltage loss to the charging circuit, yet drops more than enough millivolts for the op amp to work with. The presumption is that when the charge current drops below 20 mA, the nicad pack is fully charged. At this current, the 3.3-Ohm resistor drops about 70 mV. The op amp senses this voltage drop and when the voltage drops below 70 mV, the charge light extinguishes. R6 (1 Meg) sets the current level at which the charge light turns on and off; if you wish for the light to turn on and off at another current level, attach a resistive load of your chosen value from output to ground and select R6 until the light just flickers. Remember, now, when this lamp is *lit*, the nicads are *charging* and when it is *dark*, the nicads are either *disconnected* or *fully charged*.

Microphone Amplifier

The second refinement is a matching circuit shown in Fig. 3 which will take the output of a standard mobile microphone (carbon or amplified dynamic) and massage it to fit the input requirements of the brick. (Note: for those of you using straight low-z or high-z dynamic, ceramic, or crystal microphones, see Fig. 4. The various values for Fig. 4 are shown in Table 1.) Since the requirements of the brick are a microphone voltage of some 200 millivolts peak-to-peak and the output of the carbon/dynamic microphone biased with 10 mA (by R7/R8) is about 500 millivolts p-p, the op amp circuit shown will provide an output somewhat in excess of requirements and can be adjusted to the proper deviation level with R11. The rationale here was not so much that we *had* to have an op amp to drop a 500-mV level to 200 mV, which could well have been done with a simple resistive network, but we had one leftover op amp from the IC used in the charge-light circuit, and the op amp is necessary for the alternate mike circuits shown in Fig. 4.

Once again, since this brick box was intended for use as both a base-station patch box and a mobile interface unit, a microphone jack was installed on the brick-box chassis, plus a pair of wires to the molex connector for attachment to the aircraft microphone and PTT switch. A switch was included on the brick box so that either internal microphone (the brick-box jack) or external microphone (through the molex plug to the mobile mike setup) could be selected. This was done so that the

Microphone	C2	C3	C4	C6	R7	R8	R9	R10
Carbon	10 µF	0.001 µF	10 µF	0.002 µF	1k	1k	10k	10k
Crystal/Ceramic	Open	10 pF	.005 µF	20 pF	Open	Open	1 meg	1 meg
Low-Z Dynamic	Open	0.001 µF	10 µF	220 pF	Open	Open	10k	100k

Table 1. Values for various microphone types.

pilot of the aircraft (WB6BHI) or the back-seat passenger (WD6EWI) could access the 2-meter rig separately and independently.

The remainder of the elementary brick box is quite simple. The speaker output of the transceiver is run to both the headphone jack in the brick box and a wire to the molex plug for external mobile speaker.

Speaker Amplifier

Although this concludes the construction of the elementary brick box, several comments from my fellow hams led to the first major modification of the box. Since my major application of the box was for airborne use and I was feeding the puny 1/2-Watt speaker signal out of the brick into a 10-Watt airborne cabin speaker amp, I never noticed how poor the speaker audio really was. A few tests convinced me that a speaker amp of some sort was in order. Since the most common high-power chip in general use and availability today is the LM383, I chose to use this fine device. Although the design is very straightforward, I recommend that you heat-sink this device to the biggest piece of metal you can find. In fact, if I were going to include this circuit in my own brick box, I would undoubtedly use the metal chassis cover for the heat sink. The tried and proven circuit of the speaker amp is shown in Fig. 5.

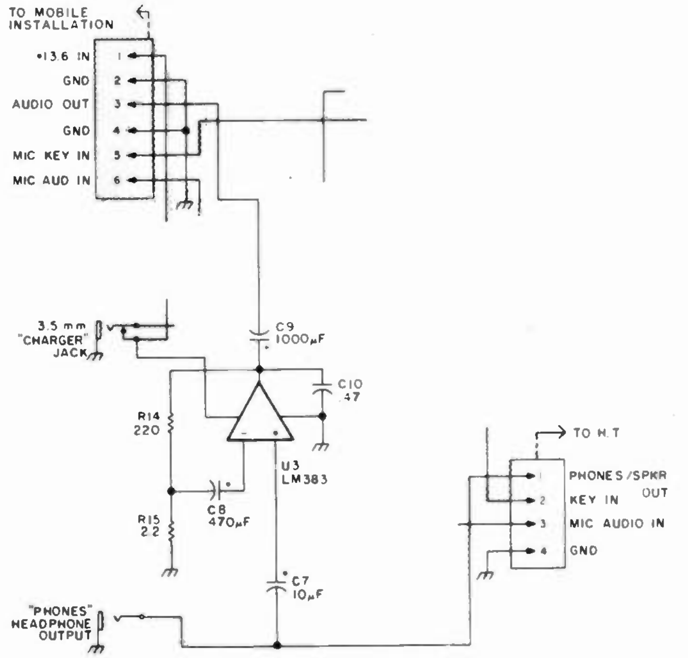


Fig. 5. Adding a high-power speaker amplifier.

Conclusion

The brick box has been in operation for almost a year now with no serious problems. My S1's batteries have always given me the expected service when charged by the box and mobile service has been beyond any hopes I ever had. (You get up to ten thousand feet and call CQ on .52 simplex!) My thanks to WD6EWI for his comments and criticism and N6AUB for his patient on-the-air testing. My additional thanks to the hundreds of hams between Grass Valley, California, and Oshkosh, Wisconsin, who gave us hints and suggestions for improvement during our recent aeronautical mobile cross-country. ■

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Independent Dot & Dash (Full) Weighting	Yes	Yes	Yes
Calibrated Speed, 1 WPM Resolution	Yes	Yes	Yes
Calibrated Beacon Mode	Yes	N/A	No
Repeat Message Mode	Yes	N/A	Yes
Front Panel Variable Monitor Frequency	Yes	Yes	Yes
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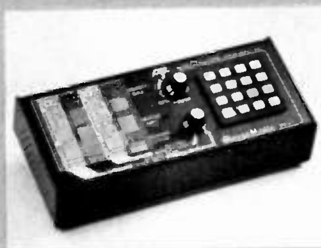
Real-Time Memory Loading Mode	Yes	N/A	Yes
Automatic Word Space Memory Load	Yes	N/A	Yes
Instant Start From Memory	Yes	N/A	Yes
Message Editing	Yes	N/A	Yes
Automatic Stepped Variable Speed	No	No	Yes
2 Presettable Speeds, Instant Recall	No	No	Yes
Automatic Trainer Speed Increase	Yes	Yes	N/A
Five Letter or Random Word Length	Yes	Yes	N/A
Test Mode With Answers	Yes	Yes	N/A
Random Practice Mode	Yes	Yes	N/A
Standard Letters, Numbers, Punctuation	Yes	Yes	N/A
All Morse Characters	Yes	Yes	N/A

MM-2



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D-15	15	22	26.95	22.95
D-10	10	16	25.95	21.95
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PD-4010	40,20,10,15	66	37.95	33.95
PD-8040	80,40,15	130	39.95	35.95
PD-4020	40,20,15	66	33.95	29.95
Dipole shorteners - only, same as included in SD models				
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What?! Another Audio Filter Project?

Yup. And even the most modern receivers benefit from this QRM-crusher.

I got my hands on one of those toy transceivers a few months ago—the kind with a flea-power transmitter and a direct-conversion receiver—and for a while, I had a ball with it.

But slowly, some drawbacks began to manifest themselves—not so much in the rig, but inside my head, where ringing noises refused to go away. The receiver is quite sensitive and has a tremendous dynamic range but it has no agc (automatic gain control), so when you're tuning for weak DX signals and come across a Texas rock crusher . . . Well, I generally don't cherish corona flickering between my ears.

It slowly dawned on me that even my main station receiver, though it has a good agc system for CW, exhibits some other rather nasty habits which it shares with the little plaything receiver. And eventually, I began to think about doing something about it.

Unfortunately, most modern ham-band receivers—even the very good ones—do very little after extracting audio from the product detector, except to amplify it and cram it into a speaker or a headphone output. Many things can be done to audio to make communications a lot better, especially on CW.

The audio unit to be described is my second major effort in that direction. The previous unit, built about 1960, used vacuum tubes and weighed enough to keep my house and shack from blowing away in Hurricane Donna. That unit, described in a long article in *QST*,[1] offered peak clipping, audio selectivity, and volume compression, none of which was available in the receivers of that day—or in most 1981 models. There is one big difference. Modern receivers usually (but not always) have agc systems which work well with SSB and CW.

My new audio processor would have to be all solid state, like the rest of my equipment, and it would have to offer the same features as the original, with suitable improvements.

If you work contests or DX pileups on CW, you know that a 400-Hz passband sounds like you're listening to all outdoors, especially if you have experienced the good selectivity of the 100-Hz-and-under variety.

But selectivity has its trade-offs. Any sort of noise impulse is stretched. Key clicks, which sound like a small-arms fight in some Middle Eastern desert, become a rolling artillery barrage when they're stretched through a sharp filter. So, even with a good receiver agc, you still need to do something about the noise pulses before you introduce selectivity.

And, for those receivers without agc or only a poor agc, audio compression works wonders. Before good agc was developed for SSB and CW, a CW operator had to tune his receiver with one hand on the dial and the other on the rf gain control. Even with that kind of receiver (or with a modern direct-conversion job with no agc), one-handed tuning becomes possible when you use audio compression.

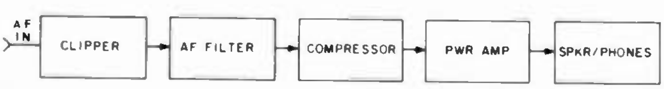

Fig. 1. Audio processor block diagram.

So, I decided my fancy solid-state processor must begin with a peak clipper, followed by a good stage of selectivity, followed by compression, and *then* (finally) by enough power to drive a loudspeaker and phones. It must be connected to the receiver only by a patch cord from the headphone or speaker output to the processor input, so that no modifications need be made to the receiver (see Fig. 1).

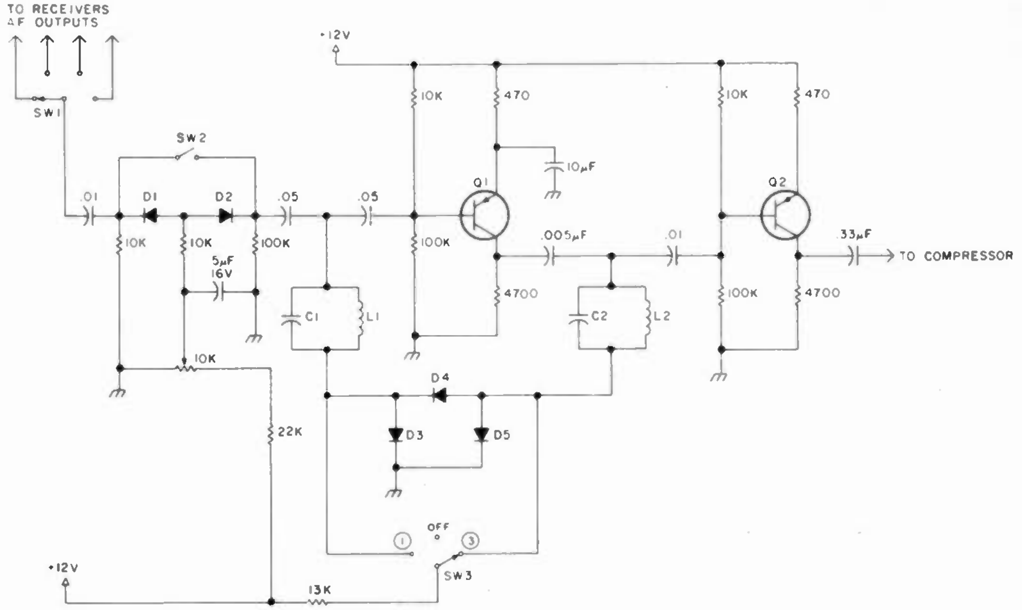

Fig. 2. Clipper-selectivity section of processor. Q1 and Q2 are PNP audio transistors such as the 2N3906. L1 and L2 are 88-mH telephone toroids. See text for C1 and C2.

Clipping

Clipping and compression are terms which are often misunderstood. Clipping, for our purposes, is the process of whacking off any audio signal which exceeds some preset amplitude. The waveform is grossly distorted and lots of harmonics are generated in the process.

The clipping circuit chosen for this application is the familiar full-wave, series peak clipper (Fig. 2). It works like this:

Audio from the receiver is fed through a capacitor to a pair of small silicon diodes (1N914s or similar) in series, anodes connected together. A positive voltage is applied to the anodes, so that current flows through both diodes to ground through load resistors.

As long as those diodes conduct, they look like pieces of wire to the audio signal coming in from the receiver. But the moment a positive audio peak voltage becomes greater than the forward bias, the diode ceases to conduct, and the signal can't get any bigger in that direction. The negative half cycle, though, goes through because it only forward biases the diode even more.

But the other half cycle then collides with the second diode, with reversed polarity, and the other audio peak is clipped off. A good sine wave applied to the clipper comes out looking much like a square wave. Noise pulses, of course, also are clipped. How deeply the signal is clipped depends on how much bias voltage is applied to the diodes by the 10k pot. The voltage can be made so high that no clipping occurs, or so low that no signal gets through at all. The clipper can also be defeated by closing SW2 which shunts the audio around the diodes completely.

In use, the clipping threshold is set at some intermediate point which the operator finds to be comfortable. The setting will be affected, of course, by the audio gain control on the receiver.

Selectivity

The output of the clipper is fed to the selective circuit through a capacitor which blocks dc. Any of a variety of selective circuits could be used here, including the popular bridged-T active audio filters using IC op amps. I chose to use parallel-resonant 88-mH telephone toroids because I can change the resonant frequency simply by changing the values of the parallel capacitors. To change a bridged-T involves three capacitors in each pole of the filter. (See Fig. 2.)

The output of the clipper is applied across one 88-mH toroid tuned to 700 Hz with capacitors totaling 0.57 μF. Another blocking capacitor isolates the toroid from the dc on the base of Q1. The transistor amplifier restores the considerable insertion loss caused by the clipper and the toroid filter. Any handy transistor can be

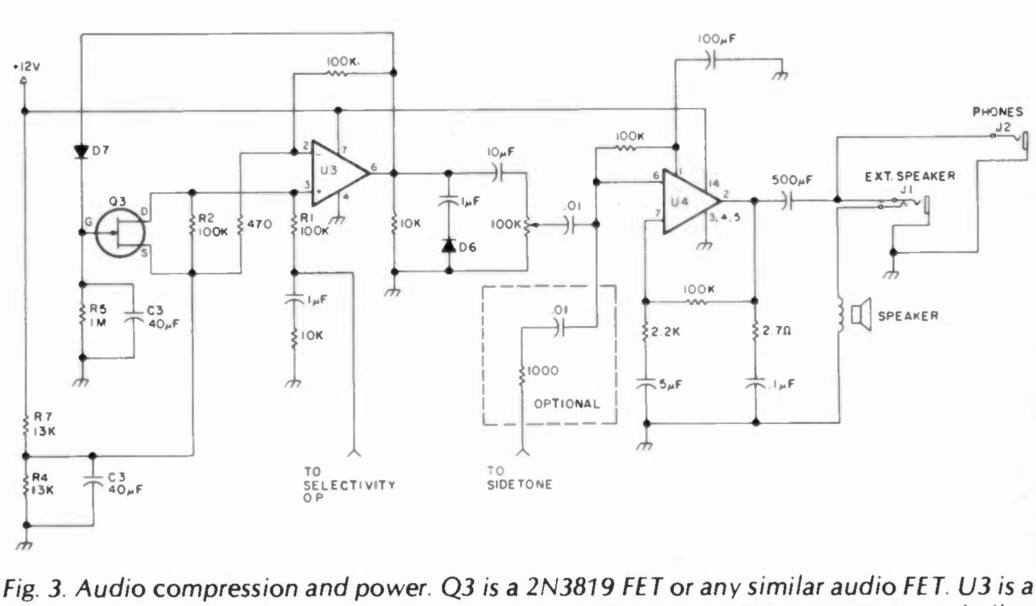

Fig. 3. Audio compression and power. Q3 is a 2N3819 FET or any similar audio FET. U3 is a TL081 FET op amp. U4 is an EC5700, ULN2277, or FE IC27. D1-D7 are 1N914s or similar.

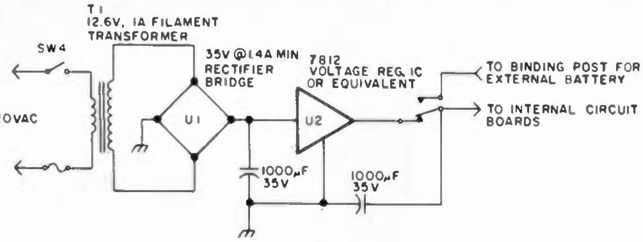

Fig. 4. Power supply suitable for the audio processor.

used, and the ones I used were junk box PNP silicons which were probably refugees from a Radio Shack red-tag sale. If you use NPNs or germaniums, be sure to make the necessary circuit changes, including polarity and bias. Almost any inexpensive audio transistor in a suitable amplifier circuit will do the job.

The output of Q1, taken from the collector, is coupled to the second toroid, tuned to the same frequency as the first, and again the insertion loss is restored by Q2. Actually, it is somewhat more than restored, and the output is ample to drive the next stage.

In operation, you can elect to use both toroids, for maximum selectivity, only one toroid for intermediate sharpness, or neither one, leaving you with only the selectivity of the receiver itself. Switching is done by means of diodes, so that signal leads can be kept on the circuit board, and not run to the front panel. With SW3 in position 2 (Off), neither toroid is in the circuit because its ground return circuit is open.

In position 1, positive voltage is applied to D3, making it conduct and become virtually a short circuit to ground, thus completing the toroid circuit. In position 3, voltage is applied to D5, thus grounding the return for L2. The same voltage turns on D4 which, in turn, turns on D3 so that both toroids are now in the circuit, for maximum selectivity

Compression

Compression is a somewhat misunderstood term. Here it is used to mean automatic control of the audio gain so that the amplifier output remains virtually constant, despite large changes in the input level. The process does *not* distort the waveform of the signal. (See Fig. 3.)

In the circuit I chose,[2] the compression amplifier (U3) is a TL081 FET op amp, inexpensive and readily available. The output of the filter is fed to the non-inverting input of op amp U3, and its output is fed to the input of an audio power amplifier chip, U4.

The output of U3 is also fed to a voltage doubler formed by D6 and D7. This generates a positive dc voltage which is proportional to the audio output voltage of U3, and this dc voltage is fed to the gate of FET Q3.

The FET acts simply as a variable resistor. Note that audio coming out of the filter stage is fed to the top of a voltage divider composed of R1 and R2. The input of the op amp is taken from the midway point on this divider. The bottom half of the divider, R2, is paralleled by the source-drain circuit of the FET.

The ground return of the voltage divider is the center of another voltage divider, formed by R4 and R7, across the power supply voltage. This tap is also the ground return for the 470-Ohm resistor in the inverting input lead. This makes it possible to use only a single power supply for U3, rather than two.

With no signal applied to the input of U3, no output is generated, hence no voltage from the voltage doubler. The FET is biased to "pinch off" by the voltage across R2, which makes the gate negative with respect to the source.

When an audio voltage appears at the input of U3, a positive dc voltage appears across the voltage divider and this is applied to the gate of the FET via D7, opposing the negative bias and allowing the FET to begin to turn on. The more audio out from U3, the more positive bias, and the more the FET turns on, making its resistance lower and lower. The effect is the same as moving the input to U3 further toward the ground end of a volume control; it applies less audio voltage to the input, thus cutting back on the output. The result is excellent volume compression in which the output remains almost constant despite great changes in input level.

Some of the output audio is picked off by the volume control and fed to the audio amplifier IC, U4.

Audio Amplifier

A considerable variety of audio amplifier ICs is available. I used a ULN2277 for U4, which provides two Watts per channel, and I only used one channel. An LM386 could be used and will provide about half a Watt of audio to drive a small speaker beyond endurable volume. It costs about one dollar at ham supply houses.[3]

Power Supply

A regulated power supply (See Fig. 4) is used because the regulator IC provides excellent ripple filtering, not because anything needs a regulated voltage. The rectifier is a small, cheap bridge or it can be made up from discrete diodes rated at one Amp or more at 35 volts or more. The regulator chip will deliver one Amp, maximum, regulated, and that's probably three times the actual demand of the system. The output amplifier chip probably can be run directly from the unregulated output of the power supply, provided this does not introduce noticeable hum in the output.

Construction

Construction is straightforward and non-critical. I built the power supply into a corner of a small aluminum cabinet box, using a small piece of perfboard to mount the components. The board was mounted to the chassis with the small metal mounting lugs obtained by drilling them off old-style tie-point strips. This type of mounting is extremely convenient because it permits standing the boards on edge and provides for easy removal for service or modification.

The IC circuits were built on universal circuit boards.[4] One board was sawed in half, and the compressor and clipper built on one half, the output amplifier on the other.

The toroids were mounted on a piece of perfboard with dabs of five-minute epoxy, leads anchored to tie-points, and then the perfboard was bolted to the edge of another type of universal circuit board on which each cluster of four holes is connected together by a foil pad. This is useful for mounting the transistors and other components by their leads.

Each board was stood on edge and bolted to the chassis with brackets. But these should *not* be used for circuit grounds. Grounding each board directly to the chassis will probably result in ground loops which produce hum, noise,

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oscillation, and all sorts of nasties.

Instead, use a common ground on each circuit board insulated from the mounting feet, and connect the circuit ground with a wire directly to the negative voltage tie-point on the power supply board.

Operation

After the project passes its "smoke test," you're ready to learn to use it. Hook it up to your receiver and hook up the output to a loudspeaker.

Set the volume control about one-fourth open, put the selectivity switch in the Off position, and turn the clipper on. Feed a steady signal into the amplifier. The tone from a 100-kHz calibrator will work fine. Adjust the clipping threshold, noticing that at the clockwise extreme of the pot, you get no signal output at all. At the counterclockwise position you get no clipping and at points in between clipping is apparent because of the change of audio quality of the clipped signal.

Flip in one filter section and notice that the clipped signal suddenly sounds clean again. The harmonics have been filtered out. The second toroid section won't seem to have much effect in this test—but it will in actual operation.

Now find a place on the receiver dial which is fairly clear of signals, turn off clipping and selectivity, and set the receiver volume control until you can just hear the crackle of background noise in the speaker, or to where you can hear a weak CW signal. Leave the volume control set, and tune across the band slowly, stopping to listen to each signal you come to.

Loud signals are no louder than weak ones, but you will notice that the background noise disappears while a strong signal is present. This is because the compression has reduced the overall gain.

Now tune away from the strong signal to a no-signal spot and listen. Notice that after a few seconds, background noise slowly becomes audible, as the compressor increases gain again. It has a fast-attack, slow-decay time constant.

Decay time is set by R5 and C3 in the gate circuit of the FET. Resistor and capacitor values are chosen to give a delay of several seconds so that the amplifier won't "pump" on a strong CW signal. Instead, it reduces gain in proportion to the average strength of the signal and keeps the gain reduced during the brief key-up periods between letters and words and even during brief pauses.

If recovery time were very short, band noise, weak QRM signals slightly off frequency, and other disturbances would appear in the background instantly whenever the desired station released his key—very tiring and disturbing to the receiving operator. Try it if you like, by temporarily replacing C3 with, say, a 0.47-µF capacitor.

Changes to Play With

The overall design of this unit is quite flexible and, since it is built in modules, with each section on its own circuit board, it is quite easy to experiment.

Various degrees of selectivity can be achieved, for example, by shunting the toroids with resistors, to broaden them, or by adding a third toroid for extreme selectivity. Various kinds of active audio filters can be substituted for the toroids. Skirt selectivity of the toroid filters can be improved by insertion of two 1N914s reverse-connected in parallel between the first toroid and the coupling capacitor to the base of Q1 (see Fig. 1). These are silicon diodes which will not conduct at all until forward voltage across the junction exceeds about 0.7 volts. Therefore, the base of Q1 won't "see" any output from the toroid until the voltage rises above 0.7 volts, thus effectively rejecting low-level QRM on the skirts of the filter.

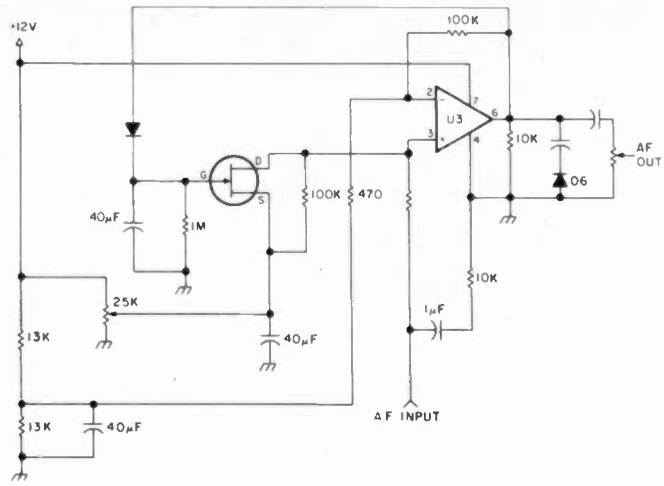

Fig. 5. Compression control modifications.

The compression threshold can be manipulated over a wide range, if desired, since compression does not begin on weak signals until they reach a certain minimum voltage. That's because the FET is pinched off and some of the bias must be overcome before the FET drain begins to conduct at all.

However, if the drain is removed from the R3-C4 tap (leaving the other components attached), and connected to the wiper of a pot, this delay of the attack can be changed at will (see Fig. 5). One end of the pot is connected to +12 V dc and the other end is grounded. When the wiper is grounded, the FET turns fully on, reducing the op-amp output sharply.

When the wiper is moved toward the top of the pot, the source becomes more and more positive. Hence, the gate becomes more and more negative with respect to the source, and more and more compression bias is required from the op amp to turn on the FET. It is possible to set the pot to provide compression on *any* signal, no matter how weak, or to prevent compression of any but the very stongest signals.

An S-meter can be built which will show the relative strength of received signals by measuring the compression bias (see Fig. 6). A simple FET voltmeter reads the bias generated by the op-amp output.

The unit can be muted for full break-in (QSK) CW operation if desired by us-

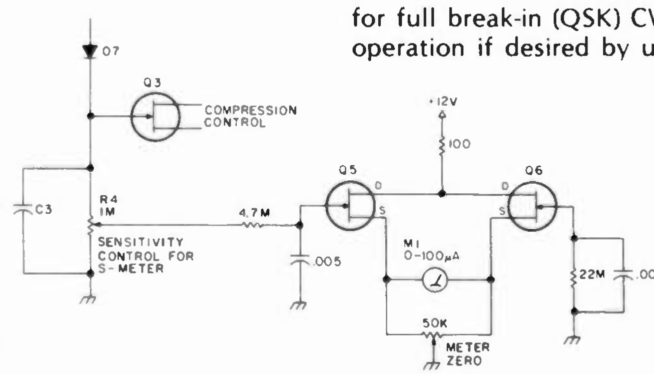

Fig. 6. Optional S-meter circuit.

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ing a transistor switch to clamp the clipper diodes when the key is down. The keying signal for the transistor can be a logic low or high picked off from a solid-state electronic keyer, such as the Accu Keyer, or by the relays of other keyers. See Fig. 7.

When the muting transistor is off, which it always is when the key is up, it has no effect on the operation of the diode clipper, but SW2 must be open for muting to function properly.

When the key is down, the transistor turns on to saturation. This offers a low-resistance path to ground for the dc bias on the diodes, effectively grounding both the diodes and the audio signals passing through them. Because of its lower junction voltage drop, a germanium transistor will work better here than silicon. Even so, muting is not absolute and some signal from the receiver gets through at low level. The circuit does not affect operation of the rest of the audio processor.

Sidetone can be injected into the amplifier when the key is down, making it appear in the same speaker which carries the incoming signals (see Fig. 3). Since the sidetone is injected after the clipping, compression, and selectivity, it is not affected by processor operation and can be set for any convenient pitch or volume.

Several inputs can be provided for the processor, selecting them by switch from the front panel. This makes it possible to use the processor on just about any receiver in the shack.

Auxiliary outputs often come in handy, too, for driving phone patches and similar uses. I provided mine with three front-panel headphone jacks—one of each of the popular sizes of plugs—so that any handy headphones can be plugged in without a hassle.

I built in a little two-inch speaker for convenience in testing and portable operation, but a phone jack is provided for an external speaker. Plugging in the external speaker mutes the internal one. Both speakers can be muted by a front-panel switch, if desired.

A back-panel switch can be added to allow operating the unit from an automobile battery for Field Day or emergency situations. The SPDT switch is connected with the pole to the internal +12-volt lines of the circuit boards. One contact is connected to the output of the 12-volt regulator chip. The other contact is hooked to a back-panel binding post which goes to the external battery. A second binding post should be provided to permit connection to the battery negative.

A 1000-μF 35-volt capacitor is connected from the pole of the switch to ground. It helps with the filtering of the regulator output and, when used on a car battery, it helps to subdue ignition and voltage regulator noises and alternator whine.

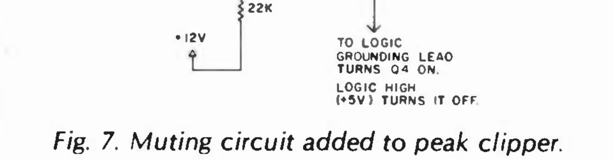

Fig. 7. Muting circuit added to peak clipper.

Troubleshooting

Troubleshooting the processor is as simple as troubleshooting can be. Nothing is critical as to value or adjustment, except that the tuned filter circuits must be on exactly the same frequency. Failure to operate properly will almost always prove to be traceable to a wiring error or a faulty diode, transistor, or IC chip, a solder bridge on a circuit board, or failure to solder a connection. ■

References

1. George Thurston W4MLE, "A Versatile Receiver Audio System," *QST*, May, 1962.

2. C. W. Andreasen N6WA, "The Amazing Audio Elixir," *73*, September, 1979. Note that the diagram in this article has an error. The lead from CR2 to the gate of the FET is *not* connected to the voltage divider or to the source of the FET. What is shown as a connection dot should be a non-connecting cross-over.

3. Suitable audio amplifier chips available from Radio Shack and other suppliers include: LM1877N-9, dual-channel, two Watts per channel, (catalog number 276-702); LM386, one-channel, 400-mW output (276-1731); LM383/TDA2002, one-channel 8-Watts (276-703); BA521, one-channel 5.8 Watts (276-704).

4. The IC board is available from several suppliers, such as Global Specialties Co., 70 Fulton Terrace, Box 1942, New Haven CT 06509, or 351 California St., San Francisco CA 94104, or from Radio Shack, catalog number 576-170, for about $3.00 each. This board is perforated for IC chips and has lands which permit connecting up to four components to each IC pin.

The second type of universal board has a quad land pattern, that is, each cluster of four holes in a square is connected by foil. It is excellent for mounting transistors and other components by their leads. Sold by Calectro (G.C. Electronics), catalog number J4-609, for less than $2.00 each.

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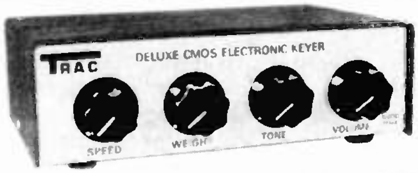

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A Tuner for Antenna Fanatics

Anyone experimenting with antennas needs a darned good tuner. Construct this one and save your finals.

Various antenna tuner networks for the HF bands have come and gone over the years, but two forms have evolved as time-proven favorites—the Pi and T networks. The basis for the durability of these networks is a combination of electrical as well as constructional reasons.

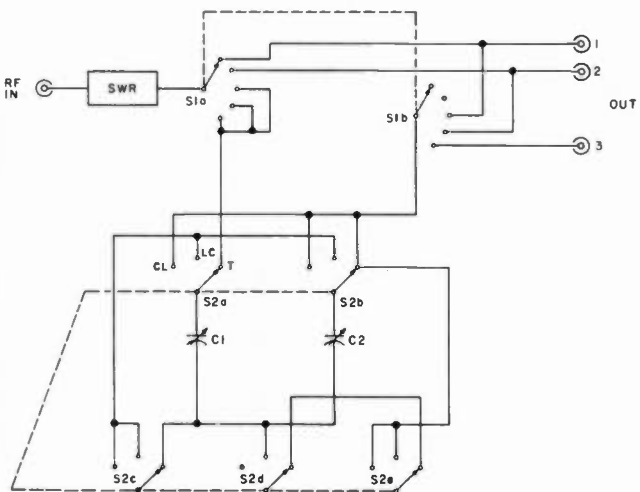

Fig. 1. Tuner circuitry. The S2 switch arrangement may appear complex, but wiring is not complicated nor are long lead lengths introduced, since most of the wiring is between switch lugs. Normally, a two-wafer switch would have to be used, although single-wafer surplus switches having a 5P3T action can be found. C1 and 2—at least 250 pF each, rated at 1.5 kV for 300 Watts, 2 kV for 500 Watts, and 4 kV for 1 kW; L—18 to 28μH, #10 or 12 wire; S1 and 2—Centralab PA-2000 series or similar.

The Pi network will not match an extreme range of impedances, but it is relatively easy to construct and adjust in operation. Its main disadvantage is that it requires considerable amounts of capacitance on the lower frequency bands when working into low-impedance loads. Usually, padding capacitors are required across the variable capacitors on the lower frequency bands when a high-power tuner is being constructed since 1,000- or 2,000-pF variable capacitors rated at 2 to 3 kilovolts are not exactly common items.

On the other hand, the T network does not require extreme amounts of capacitance even on the low-frequency bands when matching into the same or even greater range of load impedances than a Pi network will accommodate. The T network is, however, slightly more tedious to adjust and also to construct since the variable capacitors used must have both their stator and rotor sections above ground. The popular "Transmatch," by the way, is a basic variation of the T network.

But, why not have the best of both networks in a single multiband tuner? This article describes a switchable, multi-network tuner which is designed to optimize the matching possibilities available using commonly-available L/C components of moderate electrical and physical dimensions and, of course, of moderate cost. The tuner can be tailored to handle PEP output powers from 500 to 1000 Watts. The physical dimensions are quite moderate for the power-handling capabilities involved and one easily can add such features as selectable antenna switching and swr monitoring.

The schematic of the tuner is shown in Fig. 1. As shown, it incorporates selectable LC-, CL-, or T-network tuning, input switching direct to any of three loads (one of which can be a dummy load), switching using the tuner network to any one of two selectable antenna loads, and complete, internal swr measurement circuitry. Of course, one can scale up or down the possibilities shown in the schematic in any way desired in order to construct just the basic tuner, expand the antenna switching possibilities, etc.

The reason for having selectable LC- or CL-network tuning (a reversible L network) instead of a simple Pi-network option is to further increase the mileage obtainable out of the components used. Since two variable capacitors have to be used in the design of the tuner, the option is available to use them in a conventional Pi-network manner as tunable input/output capacitors or to parallel them and use them as combined output or input capacitors in a reversible L network. The latter will provide a greater range of impedance-matching possibilities at the expense of only a bit more component switching complexity, and so it was used.

If one uses a conventional input/output tuned Pi network with extremely wide-range variable capacitors, it usually will be found that any load that can be matched using both variable input/output capacitors can also be matched using only *either* a variable input or output capacitors and a suitable value of inductance. However, the capacitance range of a single variable capacitor required will usually be less than the combined capacitance of separate input/output variable capacitors in a Pi network.

The practical construction details of the tuner are not difficult to follow or perform if you approach them on a step-by-step basis. The 500-Watt output-rated version of the tuner is housed in an attractive two-tone blue/gray Radio Shack enclosure (#270-269) measuring 7-7/8" × 3-1/2" × 5-7/8". This aluminum housing is easy to work and you can construct the tuner using basic hand tools.

After you have initially sized-up the placement of components within the enclosure, drill or punch out the necessary mounting holes on the rear panel for the coax connectors, on the bottom of the enclosure for inductor and capacitor mounting, and on the front panel for control shafts, switches, meter, etc. Generally, the following sequence of mounting and wiring and components will make the tuner go together easily:

1) Mount the front-panel network changeover switch and the rear-panel coax connectors.

2) Mount the two variable capacitors. These capacitors have to be "above" ground. There are numerous ways to achieve a suitable mounting. The simplest is probably through the use of plastic #6 mounting screws/nuts with 1/4" spacers to keep the capacitor rotors above ground. If such material is not readily available, a 1/4"-thick piece of Plexiglas™ or bakelite can be used to raise the capacitors above the enclosure bottom using metal hardware.

3) Wire up the network changeover switch to the capacitors with leads extended to where the inductor and antenna selector switch will be mounted.

4) Mount the variable inductor and the swr measurement circuitry (if used).

5) Mount the antenna selector switch to the back panel (using 1/2" to 3/4" standoff hardware) and wire it up.

6) Mount the insulated shaft couplings on the variable capacitors, extension shaft to the antenna selector switch, etc.

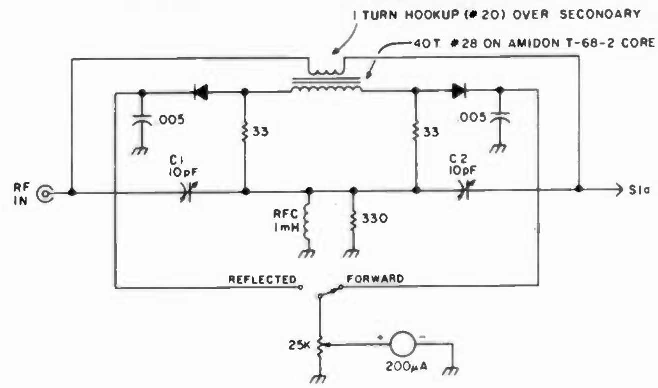

Fig. 2. The swr circuitry is simple but sensitive and needs no shielding inside the tuner enclosure. With a 50-Ohm carbon resistor on the S1 side and the meter switch to reflected, adjust C1 for minimum meter reading. Do the same with C2 when the resistor is connected to the rf in side and rf is fed into the S1a side of the circuit.

Of course, you can vary the location of the components in a variety of ways, but you should more or less plan out the construction of the tuner in the manner illustrated above. It really takes less time to complete than is involved in even assembling a commercial kit which often has rather laborious point-to-point wiring instructions.

Another swr bridge circuit was constructed using a toroid-core transformer and it worked very well. The circuitry of the bridge is shown in Fig. 2. The components are mounted on a small piece of perforated board stock; there is no need to etch a board for the few components involved and they can be wired together directly.

The board is mounted inside the rear panel of the tuner directly by the input coaxial connector. No shielding is required since the toroid is largely self-shielding. The sensitivity allows for measurements with 10 to 20 Watts of transmitter output power even on the low-frequency bands. The only thing that you must do, however, is to balance out the stray capacitances in the circuitry as noted in the caption for Fig. 2. The procedure is simple but it cannot be neglected if proper readings are to be obtained on 10 and 15 meters.

The meter used happened to be a surplus CB one that had an swr scale, but any inexpensive meter with a 200-mA or more sensitive movement will suffice. There is no real need to calibrate the meter since it normally is used only to adjust the tuner for a minimum reading in the reflected switch position once the meter has been adjusted for a full-scale reading in the forward switch position.

A minor point, by the way, about the meter switch used: It is spring-loaded, so it must be pushed down to read forward and will snap back to its reflected position (labeled SWR). This small refinement makes it rather easy to adjust the tuner since the way the switch and meter adjustment control are placed on the front panel the index finger on one hand can be used to depress the switch while the thumb and middle finger are used to adjust the control. The other hand is free to adjust the tuning controls.

Speaking of controls, there is no turns indicator on the rotary inductor. Regular turns counters take up a lot of enclosure space and are not all that necessary unless you insist on extremely fast control presetting. In reality, if you note the setting of all the other controls for the band/antenna being used, it is a simple matter to rotate the inductor for approximate minimum swr and then finish up the tuning by going back and forth between the inductor and capacitor tuning controls.

It's no secret that it generally only makes sense to home-brew a tuner if one can find the components necessary at reasonable prices. If you built a 500-Watt version of this tuner using all new, off-the-shelf parts, the parts cost could easily run around $120. On the other hand, using surplus or new surplus parts, the cost could be as low as $25. Simply hunt around for the parts needed at the right prices. Fair Radio Sales (1016 E. Eureka, Box 1105, Lima OH 45802), for instance, which frequently advertises in *73*, often has very good buys on transmitting-type variable capacitors and inductors.

The tuner has been labeled as a "Universal Coupling Unit." That euphuistic name was only the result of having a limited selection of words available in a rub-on lettering set. No tuner will, of course, couple to absolutely all loads. The tuner described will couple a 50-Ohm output transmitter to just about any reasonable antenna load; the same as can be done by commercially available tuners which use the same type of circuitry and component dimensions. ■

Digital Basics

This is no time to be a digital illiterate. Part III reveals the secrets of multivibrators, shift registers, and other notorious devices.

Joseph J. Carr K4IPV
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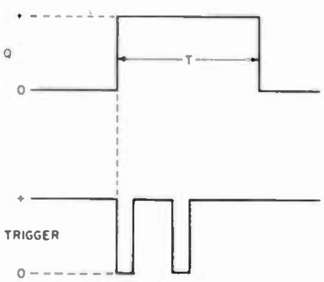

Fig. 1(a). One-shot multivibrator. Trigger pulse causes output to go HIGH for period T. The second pulse has no effect.

The first two parts of this three-part series led you step by step into the digital electronics swimming pool. We now can wade in past the ankle-deep water of the kiddies' pool and venture into knee-deep water. Thus far, we have discussed the various digital IC logic families, assorted types of gates, and a variety of flip-flops. We now will turn to the subjects of multivibrators and counters.

Multivibrators

A multivibrator is basically a pulse-producing circuit. There are three basic forms of multivibrator: *monostable*, *bistable*, and *astable*. It takes little imagination to detect that these designations refer to the *stable output states* that are possible for each type of circuit.

The monostable multivibrator has but one *stable state* (usually the state in which Q = LOW . . . but not always). Triggering the monostable multivibrator causes the Q to go HIGH for a time, but since this is not a stable state, Q will drop LOW again when a pre-determined time period has elapsed. Monostable multivibrators are also called *one-shot* circuits and also (erroneously, albeit graphically) *pulse-stretcher* circuits. The latter label is a misnomer because the circuit does not actually stretch a pulse but generates a *new* pulse that has a longer period.

The bistable multivibrator has two stable states. It can remain in either state (i.e., Q = LOW or Q = HIGH) indefinitely. The RS flip-flop is an example of a bistable multivibrator.

The astable multivibrator has *no* stable states. It is in-

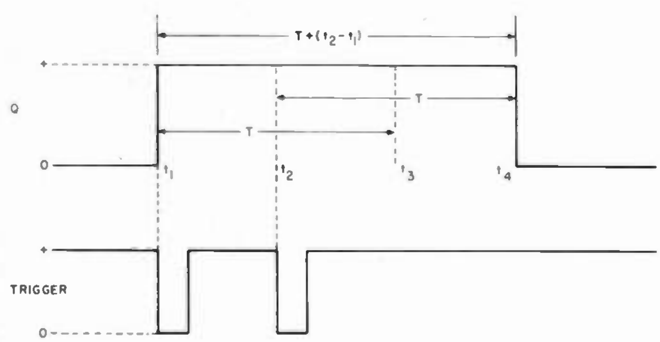

Fig. 1(b). A retriggerable monostable multivibrator can be retriggered while the output is still HIGH. Note that the total duration of the HIGH state is not 2T.

capable of remaining in either Q LOW or Q HIGH states. The Q output of the astable multivibrator will flip back and forth between the HIGH and LOW states, producing a square-wave pulse-train output signal. For this reason, the astable circuit is usually used to produce the clock pulses found in digital circuits.

There are several ways to produce each of these types of multivibrator. Space prevents us from considering all of them. We will examine a few circuits built from discrete gates and the integrated circuits. Some IC devices, like the 555 timer, will operate in either the monostable or astable mode.

When we speak of bistable multivibrators, we actually are talking about the RS flip-flop. Recall from the earlier sections of this article that the RS FF can remain happily in either the Q = LOW or the Q = HIGH states indefinitely.

Most monostable multivibrators will not respond to further input trigger pulses until the period of the output pulse has "timed out," i.e., the output has returned to its stable state. Monostables that will not respond to further trigger commands until the output duration has expired are *nonretriggerable* monostables.

Some one-shot circuits, however, are *retriggerable*, meaning that they will respond to further input trigger commands while the one-shot is in the unstable state (i.e., before it has timed out). Consider Fig. 1 to see how this works. Fig. 1(a) shows the operation of the regular nonretriggerable one-shot multivibrator. The first trigger pulse causes the output to go HIGH and it remains HIGH for period T. A second trigger pulse has no effect on the one-shot because it occurs before T expires.

Now consider Fig. 1(b). This is a timing diagram for the retriggerable monostable multivibrator. The output goes HIGH when the first pulse arrives. But before T expires, a second trigger pulse is received. This second pulse causes the one-shot to retrigger, so the output will remain HIGH for an additional period T. Note that the total duration of the HIGH state is not 2T, but T plus the portion of the first period that expired prior to the second trigger, or $T + (T_2 - T_1)$.

An example of a monostable multivibrator built from a CMOS type-D flip-flop is shown in Fig. 2. Recall the rules for the type-D FF: (1) Since D is HIGH, a HIGH will be transferred to the Q output when the *CLK* line goes HIGH, and (2) when the *clear* line goes HIGH, the Q output is forced LOW. The operation of the one-shot circuit in Fig. 2, then, is as follows:

a) When the circuit is at rest, Q is LOW and any charge on capacitor C1 is drained off through diode D1.

b) When a trigger pulse is received by the *CLK* input, Q goes HIGH. When Q is HIGH, capacitor C1 will charge through resistor R1.

c) When C1 has charged to a potential of approximately 2 volts, the *clear* input thinks it is HIGH, so the FF will force Q LOW.

d) The period that Q was HIGH, i.e., the period of the one-shot, is determined by the time constant of R1C1 and the potentials of the Q output and the point at which the *clear* input thinks that it is HIGH instead of LOW.

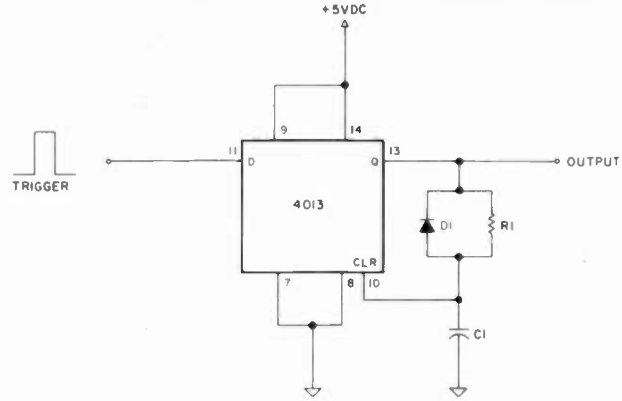

Fig. 2(a). A CMOS flip-flop is the basis for this monostable multivibrator. R1 and C1 determine the length of the pulse. D1 allows the flip-flop to be retriggered immediately after clearing.

The circuit in Fig. 2(a) uses a diode (D1) across the timing resistor (R1) to discharge C1 during the period when Q is LOW. This diode is not strictly necessary but serves to speed up the circuit considerably. Without D1, the charge on capacitor C1 would bleed off through R1. But this would require another R1C1 time constant (or so) before the voltage across C1 would discharge enough to permit retriggering of the one-shot. The purpose of D1 is to discharge C1 rapidly so that retriggering can occur almost immediately after Q drops LOW—see the waveform in Fig. 2(b).

The use of D1 creates a little problem, however.

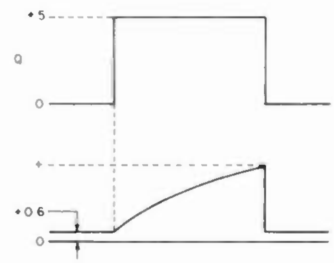

Fig. 2(b). The potential across C1 never drops below 0.6 volts because of the presence of D1.

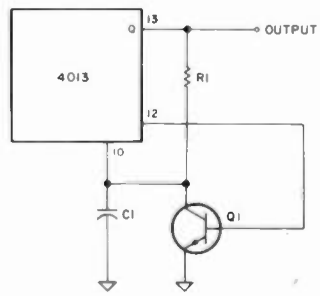

Fig. 3. Monostable multivibrator. The diode in Fig. 2(a) is eliminated by using Q1 to discharge C1.

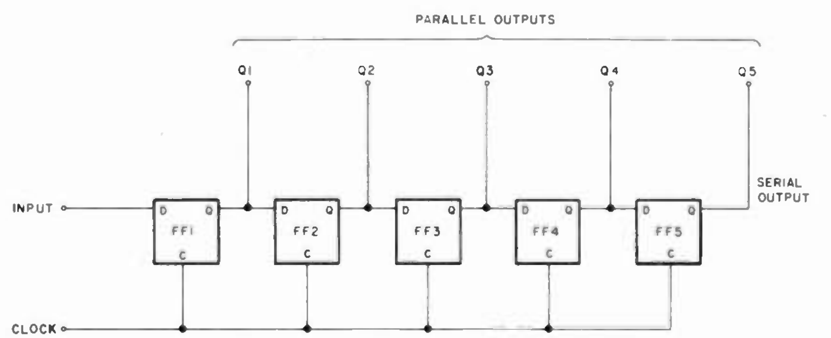

Fig. 4. Flip-flops can be combined in series to form a register which can store several bits of data. This version has serial input and either serial (SISO) output or parallel (SIPO) output.

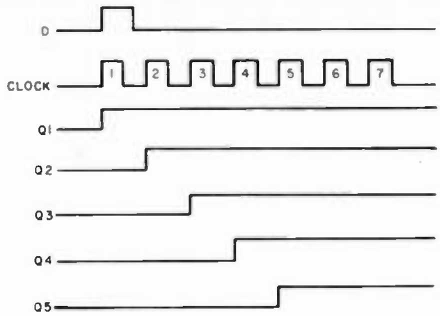

Fig. 5. The data bit (0) is transmitted through a five-stage SISO shift register by clocking the register five times.

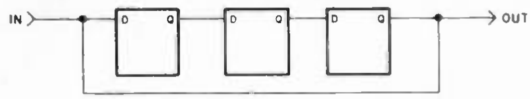

Fig. 8. A recirculating shift register automatically couples the output data back to the input. This is something like a dog chasing its tail.

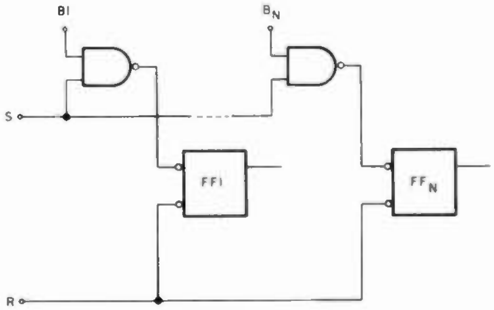

Fig. 6. Data is entered into this parallel-entry shift register via $B1$-B_n. Before entry, the register is reset via R. The data is then loaded by bringing the set line (S) HIGH.

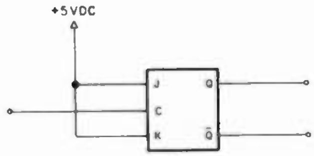

Fig. 9(a). The core of most frequency counters is the J-K flip-flop configuration. In this case, the J and K inputs are both tied HIGH.

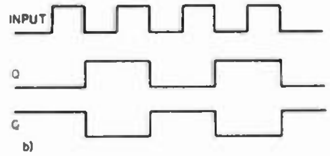

Fig. 9(b). A single J-K flip-flop is a divide-by-two counter.

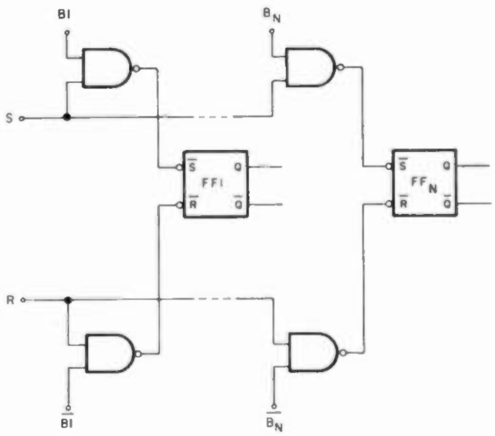

Fig. 7. The jam parallel-input shift register eliminates the need to clear the registers.

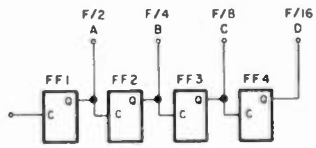

Fig. 10(a). By cascading several J-K flip-flops, the division ratio increases by powers of two.

The charge potential across C1 cannot drop lower than the function potential of the diode (200 to 300 millivolts in germanium types and 600 to 700 millivolts for silicon types). Fig. 3 shows the circuit for a modified version that uses switching transistor Q1 to discharge C1. The base of transistor Q1 is driven by the NOT-Q output of the 4013 flip-flop.

Shift Registers

A flip-flop is able to store a single bit of digital data. When two or more flip-flops are organized to store multiple bits of data, then they constitute a *register*. Most registers are merely specially-connected arrays of flip-flops.

There are several different circuit configurations that one would call a register, and we classify them according to the manner in which data is input and output to and from them. We have, for example, *serial-in-serial-out* (SISO), *serial-in-parallel-out* (SIPO), *parallel-in-parallel-out* (PIPO), and *parallel-in-serial-out* (PISO).

Fig. 4 represents both SISO and SIPO shift registers. The only significant difference is that the parallel output lines, used on the SIPO register, would be absent on the SISO register.

The SIPO shift register consists of a cascade chain of type-D flip-flops that have their clock lines connected together. Recall the rules for type-D flip-flops: Data can be transferred from the D input to the Q output only when the clock input is HIGH. The input can change at will and the output will remain the same as long as the clock line is LOW. But if the clock line goes HIGH, the Q output will follow the D input. The Q output will retain the last valid data present before the clock dropped LOW again.

This rule can be applied to the situation shown in Fig. 5, where we show the transmission of a single bit of data from left to right through a SISO shift register. At the occurrence of the first clock pulse, the input line is HIGH. This point is the D input of FF1, so a HIGH, which is applied to the D input of the second flip-flop (FF2), remains after the clock pulse disappears.

When the second clock pulse arrives, FF2 sees a HIGH on its D input and FF1 sees a LOW on its D input. This situation causes a LOW at Q1 and a HIGH at Q2.

The third clock pulse sees a LOW condition on the D inputs of FF1 and FF2 and a HIGH at the input of FF3. The third clock pulse, then, causes Q1 and Q2 to be LOW and Q3 to be HIGH.

Note that the SISO input remains LOW after the initial HIGH during clock pulse number 1. This means that the single HIGH condition will be propagated through the entire SISO shift register, one stage at a time. The HIGH bit will shift one flip-flop to the right each time a clock pulse arrives.

If the data at the input had changed, then the bit pattern at that input would be propagated through the shift register.

The shift register in Fig. 4 is a five-bit, or five-stage, register (any bit length could be selected). On the sixth clock pulse, therefore, the HIGH is propagated out of the register, so all flip-flops are now LOW.

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The SISO shift register can be made into a SIPO device by adding parallel output lines at Q1, Q2, Q3, Q4, and Q5.

One use for the SIPO register is serial-to-parallel binary-code conversion. For economic reasons, digital data usually is transmitted as a serial stream of bits, i.e., the bits of the digital word are sent over a communications link. But most computers and other digital instruments use a parallel form of data entry. Parallel data transfer is more expensive but is considerably faster than serial transmission. If, for example, we have an eight-bit system, we would need an eight-stage SIPO shift register to convert the serial code to parallel form. The code is entered into the SIPO register one bit at a time so that after eight clock pulses the first bit will appear at Q8 and the last bit at Q1.

Parallel-entry shift registers are faster to load than serial-input shift registers. This is because a single bit can be changed, if needed. In the serial type, to change a single bit of data requires us to ripple through the entire contents.

There are two basic forms of parallel data entry: *parallel* and *jam*. In parallel entry, shown in the partial schematic of Fig. 6, the register must first be cleared (i.e., all bits set to zero) by bringing the *reset* line momentarily LOW. The data that is applied to inputs B1 through B_n can be loaded into the register by momentarily bringing the *set* line HIGH.

The jam entry circuit shown in the partial schematic of Fig. 7, is also able to load data from bits B1 through B_n. While jam entry may not look superior at first glance, it is, because IC shift registers using this technique have internal inverter stages at the complement inputs. These have their inputs connected to the non-complemented inputs, eliminating the need to clear the register before loading.

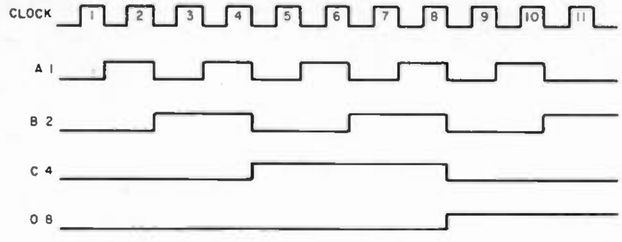

Fig. 10(b). A modulo-16 ripple counter has four outputs.

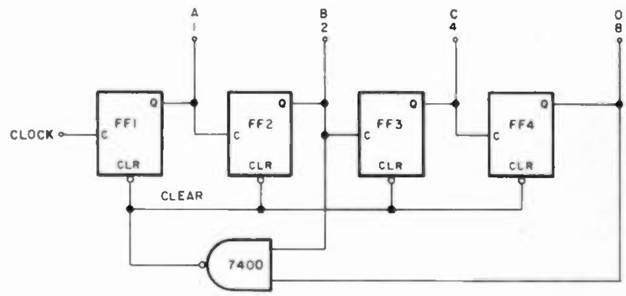

Fig. 11(a). A counter can have something other than a divide-by-two ratio when the flip-flops are forced to reset. The 7400 turns a divide-by-sixteen counter into a divide-by-ten circuit.

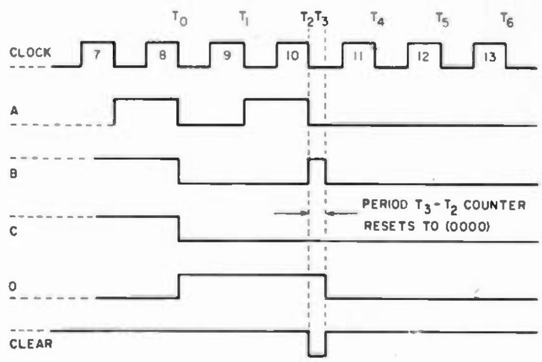

Fig. 11(b). After ten pulses, the counter resets. The result is a decimal-based counter.

A recirculating shift register is shown in Fig. 8. Since the output of a serial shift register allows the outside world to see only one bit at a time, we must empty the entire contents of the shift register in order to read these contents. But that would ordinarily destroy the data, because the input would be HIGH or LOW during the entire operation. A single-read operation, then, would fill up the register with all ones or zeros. The recirculating shift register connects the output (serial output) back to the input, so that a read operation would automatically rewrite the data back into the shift register.

Digital Counters

A *digital counter* is a device or circuit that operates as a *frequency divider*. The most basic digital counter is the J-K flip-flop connected with the *J* and *K* inputs tied HIGH (i.e., placed in the clocked mode). This makes the output produce one output pulse for every two input pulses. It is, then, a binary or divide-by-two counter.

Those fancy digital frequency/period counters are nothing more than digital divide-by-10 counters connected so that the binary-coded output is converted to a decimal display.

There are two basic classes of digital counter circuits, serial and parallel. The serial counters are called ripple counters because a change in the input must ripple through all stages of the counter to its proper point. Parallel counters also are called synchronous counters.

In a ripple counter, the data is transferred serially, which means that the output of one stage becomes the input of the next stage.

The basic element in most counters is the J-K flip-flop. See Fig. 9(a). Note in the figure that the *J* and *K* inputs are permanently tied HIGH, so they will remain active.

A timing diagram for this divide-by-two circuit is shown in Fig. 9(b), and it shows the action of the circuit. J-K FF outputs change state on negative-going transitions of the clock pulse. In Fig. 9(b), the first negative-going transition causes the Q output to go HIGH. Q will remain HIGH until the input sees another negative-going clock pulse. At that time, the output will drop LOW. The action required to make a complete output requires two clock pulses, so this J-K flip-flop is dividing the input frequency by two.

We can make a binary ripple counter by cascading two or more stages, as shown in Fig. 10(a). This particular circuit uses four J-K FFs in cascade. Any number, however, could be used.

The major problem with this type of counter is that only those division ratios that are powers of two can be accommodated. In the four-stage circuit shown, the possible division ratios are 2, 4, 8, and 16.

Frequency division is one major use for a counter circuit. In some electronic instruments, for example, we may want to prescale a fre-

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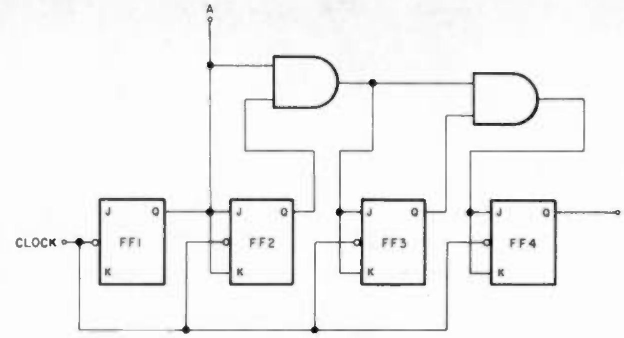

Fig. 12. By feeding the clock inputs in parallel, a synchronous counter becomes much faster than the ripple version.

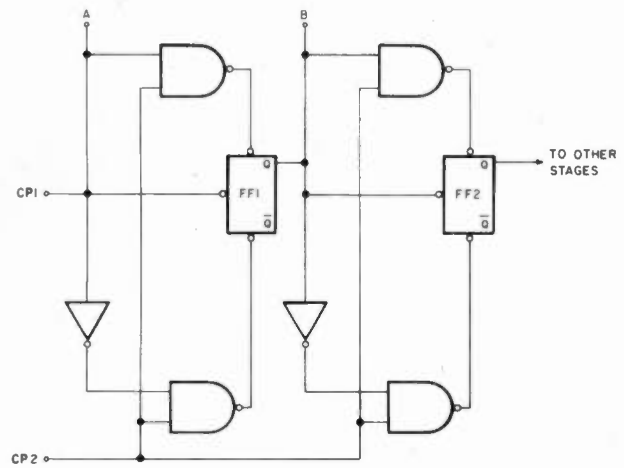

Fig. 13. A preset counter can be made by using a jam input. When CP2 is raised HIGH, a preset bit pattern is entered.

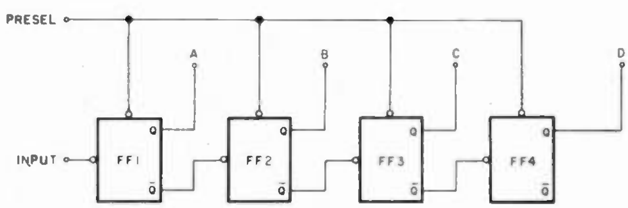

Fig. 14(a). A counter can count down by toggling each flip-flop with the preceding stage's $\overline{Q}$ output.

quency, i.e., divide it from some other frequency to a lower frequency that can be handled by a digital counter or other digital instrument.

But this is only one application for the counter circuit. One of the most common applications, alluded to in the last paragraph, is to *count*, i.e., tell us the total number of pulses that passed. Consider again the circuit of Fig. 10(a) and the timing diagram of Fig. 10(b). Outputs A, B, C, and D are coded in binary, with A being the least significant bit and D the most significant. These are weighted in a 1-2-4-8 code system to represent decimal digits 0 to 9 or hexadecimal digits 0 to 15. These are the normal weights of the binary number system.

Consider the timing diagram of Fig. 10(b). Note that all B output changes occur following the arrival of a pulse. After pulse number one has passed, the Q_A line is HIGH and all others are LOW. This means that the binary word on the output lines is 0001_2 (i.e., 1_{10}); one pulse has passed.

Following pulse number 2 we would expect 0010_2 (i.e., 2_{10}) because two pulses have passed. Note that Q_B is HIGH and all others are LOW. The digital word is, indeed, 0010_2.

The counter in Fig. 10(a) is called a *modulo-16*, or *base-16*, counter, or a hexadecimal counter (all meaning the same thing). The output of a *hexadecimal* counter can be decoded to drive a display device that indicates 0 through 9 (i.e., decimal) or 0 through F (hexadecimal). In most applications where a real, live, human is to read the display, a *decimal* readout is provided.

Decimal Counters. A decimal counter operates in the *base-10*, or *decimal*, number system. The most significant bit of a decimal counter produces one output pulse for every ten input pulses. Decimal counters are also sometimes called *decade counters*. The decimal counter forms the basis for digital *event*, *period*, and *frequency* counters. Thus, the hexadecimal counter in Fig. 10 is not suitable for decimal counting unless it is modified for base-10 operation.

Fig. 11 shows a TTL hex counter modified by adding a single TTL NAND gate. Recall that a TTL J-K FF uses inverted inputs for the clear and set functions. As long as the clear input remains HIGH, the flip-flop will function normally, but when the clear input is momentarily brought LOW, then the Q output of the FF goes LOW.

The decade counter in Fig. 11(a) is connected so that all four clear inputs are tied together to form a common clear line. This line is connected to the output of a TTL NAND gate (i.e., one section of a 7400 device). Recall the rules of operation for the TTL NAND gate: If either input goes LOW, then the output goes HIGH, but if both inputs are HIGH, then the output goes LOW.

The idea behind the circuit of Fig. 11 is to clear the counter to 0000 following the tenth input pulse. Let's examine the timing diagram in Fig. 11(b) to see if the circuit does the correct thing. Up until the 10th pulse, this diagram is the same as for the base-16 counter discussed previously.

The output of the NAND gate will keep the clear line HIGH for all counts through 10. The inputs of this gate are connected to the B and D lines. The D line stays LOW, forcing clear HIGH up until the 8th input pulse has passed. At that time—T_0 in Fig. 11(b)—D will go HIGH and bit B drops LOW, so the clear line remains HIGH for the 9th pulse.

The clear line will remain HIGH until the end of the 10th pulse. At that point (T_2) both B and D are HIGH, so the NAND gate output drops LOW, clearing all four flip-flops (i.e., forcing them to the state where all four Q outputs are LOW). The counter is therefore reset to 0000.

The reset counter produces a 0000 code, so the B and D outputs are now LOW, forcing the clear line HIGH again. The entire reset cycle occurs during period $T_1 - T_2$). This period has been expanded greatly for graphic illustration purposes in the figure, but actually takes only nanoseconds or microseconds.

The 11th pulse will increment the counter one time, so the output will be 0001_2. The count sequence, in decimal, then, is 0-1-2-3-4-5-6-7-8-9-0-1 . . . etc. The output code is a ten-digit version of four-bit binary (hexadecimal) and is called *binary-coded decimal*, or BCD.

Synchronous Counters. Ripple counters suffer from one major problem: *slow speed*. The counter elements are wired in cascade, so an input pulse must ripple through the entire chain before it affects the output.

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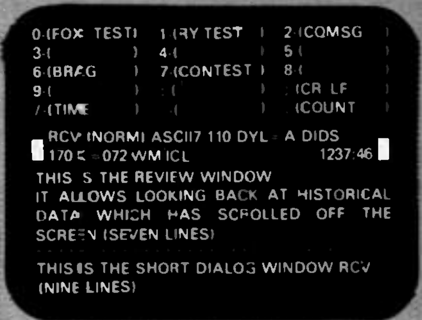

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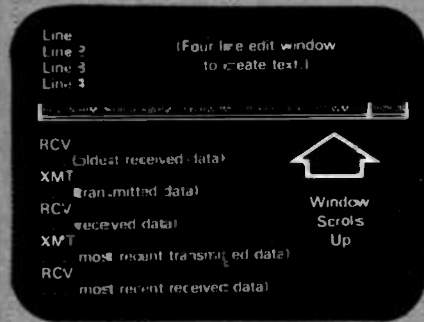

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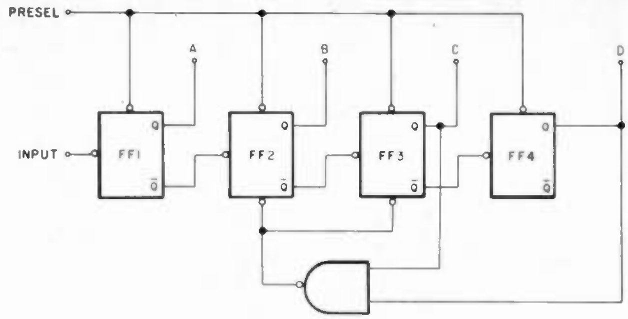

Fig. 14(b). This decade counter counts down, starting at the binary state 1001.

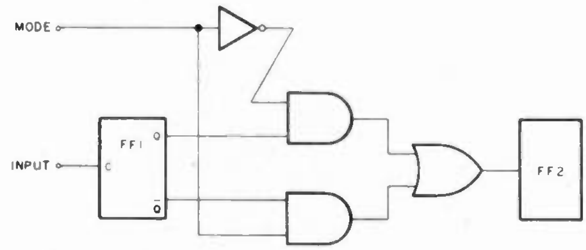

Fig. 15. A counter can offer the choice of up and down modes by adding logic.

A synchronous counter feeds the clock input to all flip-flops in parallel, and this results in a much faster operation.

Fig. 12 shows a partial schematic for a *synchronous binary* counter. We accomplish synchronous operation by using four flip-flops, with clock inputs tied together, and a pair of AND gates.

One AND gate is connected so that both Q1 and Q2 are HIGH before FF3 is active. Similarly, Q2 and Q3 must be HIGH before FF4 is made active. On a clock pulse, any of the four flip-flops scheduled to change will do so simultaneously. Synchronous counters attain faster speeds, although ripple counters seem to predominate in most applications.

Preset Counters. A preset counter increments from a preset point other than 0000. For example, suppose we wanted to count from 5_{10} (0101_2). We could preset the counter to 0101 and then increment from there.

Fig. 13 shows a common method for achieving preset conditions for the *jam* input. Only two stages are shown here, but adding two additional stages will make it a four-bit counter. Of course, any number of stages may be connected in cascade to form an *n* but preset counter.

In Fig. 13, the preset count is applied to points A and B, and both bits will be entered simultaneously when clock line CP2 is brought HIGH. Line CP2 is sometimes called the enter or jam terminal. Once the preset bit pattern is entered, the counter will increment from this with every transition of clock line CP1.

Down Counters. A down counter decrements, instead of incrementing, the count for each excursion of the input pulse. If the reset condition is 0000, then the next count would be 0000 −1, or 1111 (it would have been 0001 in an up counter).

We use basically the same circuit as before but toggle each FF from the NOT-Q rather than Q of the preceding FF. An example of a four-bit binary down counter is shown in Fig. 14. Note that the outputs are taken from the Q outputs of the FFs but that toggling is from the NOT-Q.

The preset inputs of the flip-flops are connected together to provide a means to preset the counter to its initial (i.e., 1111) state. This counter is also called a *subtraction counter* because each input pulse causes the output to decrement by one bit.

A decade version of this circuit is shown in Fig. 14(b). As in the case of the regular decade counter, a NAND gate is added to the circuit to reset the counter following the 10th count. We detect the states where outputs C and D are HIGH, and then clear the two middle FFs. This action forces the output to 1001_2 (i.e., 9_{10}). The counter then decrements from 1001 in the decimal sequence 9-8-7-6-5-4-3-2-1-0-9 . . . etc.

Up/Down counters. Some counters will operate in both up and down modes, depending upon the logic level applied to a *mode* input. Fig. 15 shows a representative circuit in which the first two stages of a cascade counter are modified by the addition of several gates. If the mode input is HIGH, then the circuit is an up counter, but if the mode input is LOW, then the circuit operates as a down counter.

Conclusion

This three-part series has offered you the basics of digital electronics. With this information, you should be able to conduct a large number of experiments, build most of the simple-to-moderate-difficulty digital projects published in this (and other) magazines, and even design a few circuits. From here, let me recommend that you begin to study microprocessors and microcomputers. From the radio amateur's point of view, interfacing is very important. ■

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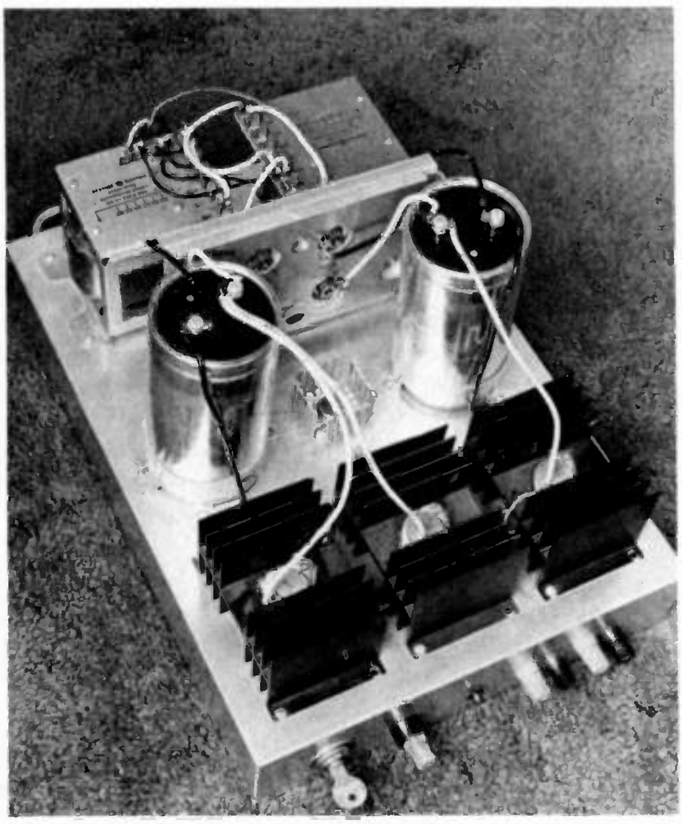
SK Electronics
10672 Woodbury Rd.
Garden Grove CA 92643

The Money-Maker Power Supply

Need 12 volts for your transceiver? Save half the cost of a commercial unit by assembling this 25-Amp monster.

Since the advent of solid-state transceivers, there has been the need for a simple high-current 12-volt power supply. The power supply described in this article will produce 13.8 volts at up to 25 Amps continuous duty. All the parts should be readily available.

First of all, you will need to determine how much current your transceiver draws, and at what voltage. Look up the current drain during transmit in your owner's manual. For a 100-Watt radio, this may be about 20 Amps. Most transceivers, whether they be small two-meter radios or large multiband 100-Watt HF ones, will have a voltage rating of 13.8 volts. This seems to be an industry standard. Thus, if you were to build a 12-volt supply, you probably would not achieve the full rated power output.



The completed 13.8-volt, 25-Amp supply includes overvoltage protection.

Once the voltage and maximum current are determined, you may choose a transformer. If it is not possible to find one of the proper ratings locally, then try requesting catalogs from the following three companies. They all seem to have a large stock of transformers at good prices.

- Delta Electronics
  PO Box 2
  Amesbury MA 01913
  (617)-388-4705
- Fair Radio Sales Co.
  PO Box 1105
  Lima OH 45802
  (419)-227-6573
- Meshna
  PO Box 62
  Lynn MA 01904
  (617)-595-2275

A minimum of 13.3 volts rms must be supplied to the filter for a regulated output of 13.8 volts. This is equal to the desired output voltage plus five volts divided by 1.414. The current rating, of course, must be greater than or equal to the desired output current. In my case, the required current was 22 Amps at 13.8 volts. Thus, the transformer should have a current rating of at least 22 Amps and the secondary rms voltage should be *at least* 13.3 volts (13.8 + 5)/1.414. I chose, from the Meshna catalog, a 15-volt, 15-Amp autotransformer. The stock number was T-658 and the price was eight dollars. I bought two of them to put in parallel for a total of 30 Amps. Meshna provides instructions to convert these autotransformers to regular transformers. This just involves rewiring of the attached terminal board.

While you are looking through the catalogs, keep an eye out for some high-current rectifiers, large heat sinks for both the rectifiers and the pass transistors, and some "computer-grade" capacitors. See the parts list for the values. Also, please note that in most cases, the values in this power supply are not very critical. As long as they are close, they should work. Most of the smaller parts are available at Radio Shack. In these cases, the part numbers are shown as RS numbers.

Circuit Description

The circuit is a full-wave bridge rectifier with a linear regulator. See Fig. 1. The voltage regulator consists of an LM317 which provides base drive for the pass transistors. The LM317 is an adjustable three-terminal voltage regulator that when supplied with 27 volts on its input can provide an adjustable 1.2-to-25 volts at 1.5 Amps. In this case, we will be inputting 15 volts times 1.414 or 21.2 volts (peak) from the rectifier/filter combination. The regulator output voltage must be 13.8 volts plus the base-emitter drop of the pass transistors. This will be 13.8 volts + 0.7 volts, or 14.5 volts.

Three pass transistors are used and they share the output current equally. There are several options for overvoltage protection and these will be discussed towards the end.

Circuit Blocks

Each section in the block diagram will now be described. When doing the actual construction, build one block at a time and test it as you go. This will save debugging time and may prevent burned out parts. Build them in this order:

1) Power transformer, rectifiers, filter capacitors, and 117-V ac input circuit.

2) Voltage-regulator circuit (LM317).

3) Pass-transistor circuit.

4) Output-protection circuit.

Note that the power supply can be used without any protection circuit, but you must be *very* careful of short circuits. It is possible to lose the supply *and* the radio with one mistake!

Transformer Circuit

The transformer circuit consists of the line cord, fuse, pilot lamp, transformer, rectifiers, and filter capacitor. See Fig. 2. Get yourself a heavy-duty line cord for this power supply as you may be drawing 3 to 4 Amps on the transformer primary. A three-wire cord is preferred and the green or ground wire should be connected to the power supply chassis.

Use a 5- to 10-Amp fuse for the primary circuit and a small neon lamp with built-in series resistor for the pilot lamp. I used a key lock for the On-Off switch to prevent "unauthorized" use.

First, mount and wire the transformer(s) and line cord to the chassis. Connect the switch, pilot lamp, and fuse to the primary circuit. Then mount the rectifiers to the rectifier heat sink and mount the assembly near the secondary side of the transformer. Use at least number 12 or, better, number 10 house wiring to wire all the secondary circuits, rectifiers, and pass transistors. The rectifiers must have mica insulators so they won't short out through the heat sink. Also, a layer of silicone thermal grease should be applied between the rectifiers and the heat sink. Extra grease should be wiped off after the rectifiers are bolted down. The rectifiers will have a voltage drop of about one volt at 25 Amps, so the power they must dissipate will be: 1 volt times 25 Amps at a 50% duty cycle = 12.5 Watts each. Make sure the heat sink is a large one.

Next, mount the filter capacitor(s). Use heavy gauge wire for the capacitor(s), too. Now, recheck all wiring against the schematic. Make sure that the switch is off and plug the line cord into the wall socket. Be careful of any primary transformer connections as there will be 117 V ac there. Connect a voltmeter set on the 50-volt scale to the filter capacitor terminals and turn the power on. You should measure an unloaded voltage of about 15 volts times 1.414 = 21.2 volts dc. Record your voltage reading, as we will be using it for some power calculations later. Make sure the On-Off switch works and that the pilot light works with the switch. Note that since there is nothing connected to the filter capacitor terminals to bleed off the voltage stored there, it might be wise to connect a 1000-Ohm, 1/2-Watt resistor across the terminals before continuing. Turn the power off and use your voltmeter to verify that the voltage is near zero.

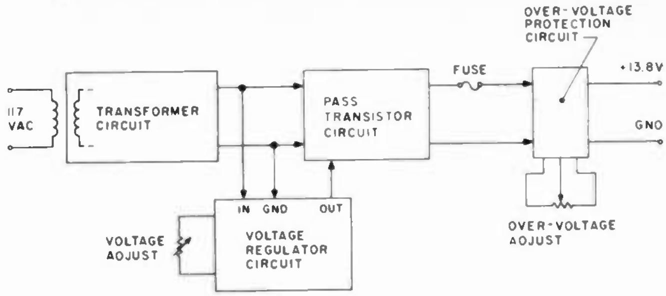


Fig. 1. Block diagram of the complete power supply. Each section is discussed separately. There are three options for the overvoltage protection circuit.

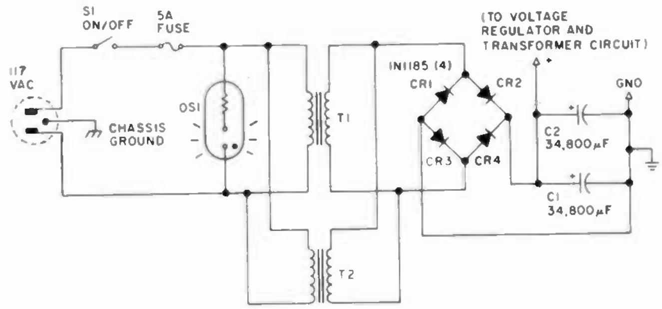


Fig. 2. Schematic diagram of the transformer section. The transformers are rated 15 volts at 15 Amps.

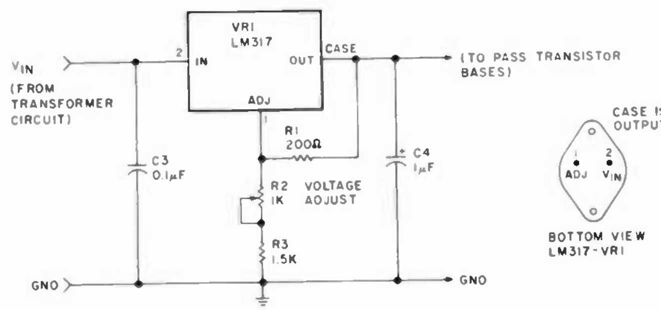


Fig. 3. Schematic diagram of the voltage regulator. R1 can be 200 to 250 Ohms. All resistors are rated at 1/2 Watt. C3 is a ceramic and C4 is electrolytic. Both should be mounted as close to VR1 as possible.

Voltage Regulator Circuit

Now start construction of the voltage-regulator circuit. See Fig. 3. Mount the LM317 regulator to the chassis using a small TO-3 heat sink. Use some silicone

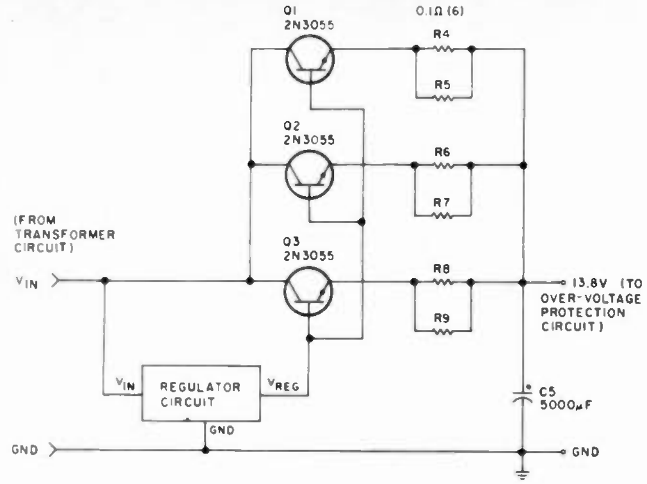


Fig. 4. Schematic diagram of the pass transistor section.

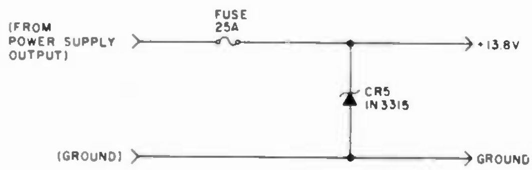


Fig. 5. Option 1 overvoltage protection circuit.

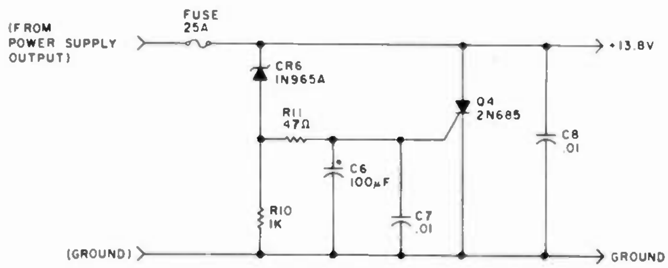


Fig. 6. Option 2 overvoltage protection circuit.

grease and be sure to use a mica insulator because the regulated output voltage is connected to the case. To determine the power dissipation of this regulator, take the unloaded voltage reading you took earlier and subtract 14.5 volts. Then multiply by 1.5 Amps. In my case, the power dissipated was: (21.2 volts minus 14.5 volts) times 1.5 Amps = 10 Watts. The heat sink must be large enough to dissipate this power.

Mount the voltage control pot on the top or the front of the chassis. Finish wiring the regulator circuit using point-to-point methods. Here, you can use smaller gauge wire since the highest current will only be 1.5 Amps. Now connect the regulator input to the positive terminal of the filter capacitor. Make sure that the negative terminal of the filter capacitor is grounded to the chassis.

Temporarily connect a 10- to 50-Ohm, 10-Watt resistor across the voltage regulator output to act as a load. Connect a voltmeter across this load resistor and set the voltage control to the midway point. Turn on the power and verify that you are getting about 11 to 17 volts as the voltage-control pot is adjusted. If the output does not vary with the control, double-check the wiring to the LM317.

Pass Transistor Circuit

If everything is OK so far, the next step is to mount the pass transistors. See Fig. 4. Use large TO-3 heat sinks and mount the transistors using mica insulators and silicone grease. Be sure to drill holes in the chassis for the wires to the transistors. Use rubber grommets.

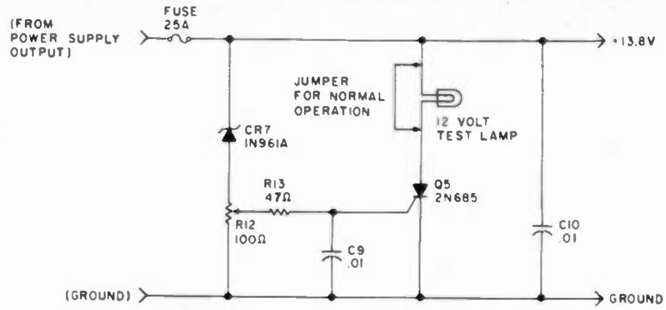


Fig. 7. Option 3 overvoltage protection circuit. This version has an adjustable voltage-limit point.

To determine the maximum power dissipation of the pass transistors, you will need the unloaded voltage you measured across the filter capacitor. Take this voltage and subtract 13.8 volts. Then multiply this by one third of the total output current. In my case, the power dissipated in each transistor was (21.2 volts minus 13.8 volts) times (22 Amps/3) = 54.3 Watts. Make sure that the heat sinks are large enough to dissipate this much heat. I found that a finned heat sink of about 3″ times 4″ times 2″ was alright.

After the transistors are mounted to the chassis, connect all the bases together and run a wire from there to the voltage-regulator output. Small gauge wire is OK. Connect two 0.1-Ohm, 5-Watt resistors in parallel and solder one end of this to one of the emitters. Connect the other four resistors likewise. Finish the rest of the pass-transistor sections using 10- or 12-gauge wire for the emitter and collector terminals, the connections to the filter capacitors, and to the output terminals of the power supply.

Verify all wiring completed so far and then connect a 1- or 2-Ohm, 200-Watt resistor across the power supply output (you'll probably have to combine several resistors to get one of these). Connect a voltmeter across this load resistor. Turn the voltage control to minimum. Stand back and turn the power on! If all goes well, you should see a voltage of about 10 volts. If you are using a load resistor of 1 Ohm, then it is drawing 10 volts/1 Ohm = 10 Amps. Try adjusting the voltage control and record the minimum and maximum voltages. These limits should bracket the required 13.8 volts. Make sure that the maximum power supply voltage will not exceed the trip-point of the overvoltage protection circuit. Otherwise, it will trip and you will lose a fuse. If you choose not to install a protection circuit, you may lose a radio!

Output-Protection Circuit

It is surprising how many commercial power supplies, including those of various ham manufacturers, do not incorporate some form of overvoltage circuit. The following are three options that will work. All use some method of sensing an overvoltage condition and then clamping or "shorting" the power supply output, thus blowing a high-current fuse.

The first and simplest option is to use a zener diode directly across the output. See Fig. 5. Choose a zener voltage of about two volts over the normal power supply voltage. The current rating should be greater than that of the power supply so

the fuse, rather than the zener, will blow. The current rating of the fuse should be between the power supply output current and the zener current rating. For example, for this power supply, choose a 25-Amp fuse and a 16- or 17-volt, 50-Watt zener.

The disadvantage of this circuit is that it is not adjustable and there still may be a chance that the zener will blow first before the fuse. This will still protect your radio, because when zeners fail, they usually stay shorted and this will reduce the overvoltage to near zero.

The second option is also not adjustable. It is an SCR (silicon-controlled rectifier) crowbar circuit. This circuit was published by Tom Lawrence WB4QLW in *73 Magazine*, August, 1977. This is the one I used for my power supply because it is fairly simple and the parts are readily available. See Fig. 6.

Here is how it works: As the power supply output starts to increase from normal and reaches the zener voltage, the zener will start to conduct current. This current will produce a voltage drop across the 1000-Ohm resistor and trigger the gate of the SCR. When the SCR becomes triggered, it will latch on and short the power-supply output, thus blowing the fuse. It is really not necessary to heat-sink the SCR since the shorted condition will last only as long as it takes for the fuse to open. Make sure that the maximum adjustable output voltage is less than the zener voltage rating.

The third and last option is similar to the previous except that the crowbar voltage is adjustable. See Fig. 7. This circuit was published by Joel Eschmann K9MLD in *73 Magazine*, August, 1979.

The operation is the same, except the trip-point can be adjusted from the zener voltage rating upwards. To test this circuit, break the connection between the anode of the SCR and the positive output line. Insert a 12-volt lamp in series as shown. Adjust the voltage control for maximum voltage and adjust the overvoltage control to maximum (wiper all the way toward the ground end).

Turn on the power supply. The test lamp should be off. Start turning the overvoltage control until the lamp just turns on. Now turn the control about 1/8 to 1/4 turn back in the other direction. This will add a small buffer zone. The lamp should still be on. Now turn the power supply off and then on again. The lamp should stay off. If the lamp is still on, try the adjustment again.

Try turning the voltage-adjust control from maximum to minimum and then back to maximum. The lamp should remain off. If so, all is well. Note that to turn off the lamp it is necessary to reset the SCR by momentarily turning off the power supply. When the crowbar is adjusted correctly, remove the lamp and reconnect the anode of the SCR back to the positive output. Now, when the overvoltage reaches the trip-point, the SCR will turn on and blow the fuse.

Parts List

Item	Qty.	Item	Buy at	Approximate Cost
C1, C2	2	34,800 μF, 50 V ea., or equiv.	Meshna	$ 5.00
C3	1	0.1 μF	RS272-0135	$ .39
C4	1	1 μF	RS272-1055	$ .89
C5	1	4700 μF, 25 V	RS272-1022	$ 3.59
CR1-4	4	1N1185, 150 V, 35 Amp	Meshna	$ 4.50
DS1	1	Neon lamp w/series resistor	RS272-0706	$ 2.19
Q1-Q3	3	2N3055 or equivalent	RS276-2020	$ 5.97
R1	1	200 to 240 Ohms, 2 W	RS271-0135	$ .89
R2	1	1000-Ohm potentiometer	Meshna	$ 1.00
R3	1	1.5k, 1/2 W	RS271-0025	$ .19
R4-R9	6	0.1-Ohm, 3 W, or equivalent	Meshna	$ 1.00
S1	1	SPST switch, 5 A contacts	RS275-0603	$ 1.49
T1, T2	2	15 V, 15 A transformer or equivalent	Meshna	$16.00
		Option 1 Parts		
CR5	1	16 V or 17 V, 50 W zener (1N3315)		
		Option 2 Parts		
C6	1	100 μF, 35 V	RS272-1016	$ 0.79
C7, C8	2	0.01 μF	RS272-0131	$ 0.29
CR6	1	15 V, 400 mW zener (1N965A)		
Q4	1	50-100 V, 16 A SCR (2N685, 2N1844, 2N4441)		
R10	1	1000 Ohms, 1/2 W	RS271-0023	$ 0.19
R11	1	47 Ohms, 1/2 W	RS271-0009	$ 0.19
		Option 3 Parts		
C9, C10	2	0.01 μF	RS272-0131	$ 0.29
CR7	1	10 V, 400 mW zener (1N061A)		
Q5	1	50-100 V, 16 A SCR (2N685, 2N1844, 2N4441)		
R12	1	100-Ohm potentiometer		
R13	1	47 Ohms, 1/2 W	RS271-0009	$ 0.19

Conclusion

This completes the construction of the basic power supply. If you wish, you may add a voltmeter and an ammeter. You also may wish to make and install a cover to dress up the chassis.

The voltage adjust and overvoltage-protection adjust controls may be placed anywhere out of the way. If you plan to use this supply in a dedicated application, the controls, once set, may be left alone.

If you will be using the supply at various voltage levels, I would suggest option 1 or 2 for your protection circuit. That way, there will be less chance to misadjust the overvoltage control and, consequently, less chance of blown fuses.

So, enjoy your new power supply and, at the same time, observe normal precautions while using its high-current capabilities. Also, if you have a well-stocked junk supply, just think how much you will have saved over a commercial supply! If you have any questions, please send an SASE for a reply. Have fun! ■

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TVRO Q & A: Part III

LNAs are expensive, but rolling your own is a losing proposition.

Ken Rae WB0POP
737 South Clarkson
Denver CO 80906

What is the purpose of an LNA?

The purpose of an LNA is to amplify the signal collected by the feedhorn (approximately 4 microvolts) to a usable level without adding any appreciable noise.

Are all 120-degree LNAs the same?

No, they are not. Some manufacturers meet the specifications by just a bare margin, and other manufacturers give you a 100-degree LNA yet call it a 120-degree LNA because it's sort of a stepping stone; you buy either a 100 or 120. There are some indications that manufacturers will include a 105-degree LNA as a step in progression of degrees Kelvin.

Is the LNA's bandwidth important?

A few years back it was said that the bandwidth of many LNAs was too wide for TVRO application. Since then most of the manufacturers have installed bandpass filtering to narrow down the amount of outside noise that could come in. We don't want the whole world walking through the LNA. We would like to amplify the TVRO frequencies exclusively.

Should I buy or build an LNA?

I recommend that you buy your first LNA. I've seen only 10% of the people who try to construct an LNA actually succeed and build something that is worth having. The disasters are horrible, so if you build an LNA, do it after you have bought one. Buy one, put your system up, get it running, and then go back and construct a low-noise amplifier for your own use and education. Then you can sell your commercial LNA for the same price you paid for it.

How hard is it to build an LNA?

An analogy would be if you went down and got plate-glass sheets and tried to grind your own zoom lens for a 35mm camera. You can just imagine the precision required to do this and to add optical coating that you would have to put on for color pictures. Well, you're trying about the same thing when building an LNA.

What is the most misunderstood thing about building an LNA?

That it is much like HF work or the old tube work clear back into the fifties, where you could simply insert a tube or transistor and turn the machine on to see it run. GaAsFETs have a very critical LC reactive component to their nature, and if these parameters are not met the transistor will not perform. Meeting these parameters is difficult and takes a lot of time and meticulous work. There are people who claim that they can throw transistors into a stripline design and learn the recipe for creating a low-noise amplifier. In some cases this does work. But as a general rule, the misconception is that you can put it together, turn it on, and it will run for you. I have never seen this first try, first serve situation.

Why are LNAs so expensive?

Profit is one reason, but in past years they've been extremely expensive because 20% of the LNA cost is materials and the rest is labor, much of which is because a design engineer or a microwave engineer has to sit and tune the LNA for proper specifications. This is extremely expensive at the rate of pay for engineers. The common laborer on a construction test bed is not able to bring a low-noise amplifier to specifications by simply plugging in the transistor, soldering it down, and shipping it out. It has to be tuned with precise instruments. The prices are dropping now, however, and they have come down almost two-thirds in the last 3 years.

Will the open-end LNA work with no feedhorn?

Yes, it will. You can take the common commercial LNA with the open mouth and omit the feedhorn; this works exceptionally well for a .3 to a .4 dish. Now, if you go much larger than a .45 or .5 dish, where they're flatter, then you'll want some sort of a funneling device on the front of your horn such as a square-flanged horn or a funnel to create a more directional beam from the focal point to the dish.

Is a 60-dB LNA better than a 30-dB LNA?

No, I wouldn't say so, not in natural use if the mixer is within the vicinity of the low-noise amplifier. If you're going to put your mixer inside the house and run 60-80 feet of coax or heliax to the mixer, then you need some extra dBs from your LNA and gain to pump the signal down the coax, but in effect they're equal in quality. A lot of people will think a 60-dB gain is better than a 30-dB gain. As far as the noise level goes, that is established by the first transistor amplifier of the GaAsFET LNA, and therefore stages added behind it do not improve the noise figure. They improve the ability of the low-noise amplifier to push the rf further down the coax without getting back down to an unworkable level at the other end of the coax.

My LNA works all right at night, but is very noisy during the day; why is that?

It sounds like you have a heat problem inside the LNA where the chip capacitor is separating and/or closing due to the heat and expansion of the circuitry. Normally the day and night transition is not noticeable on a TV screen unless you're a very particular person and see more sparklies during the day than you do at night. But if this is the case, it's usually due to the temperature of the LNA, and its circuitry is failing during the day. The other type of interference that comes during the day is unassociated with temperature, light, or conditions of the sunspot cycles. The satellite noise figure is due to its position relative to the sun on its receiving antennas and whether it's charging its batteries or not. And all these parameters influence noise during the day.

One of the biggest clues to terrestrial interference is the fact that it's usually more predominant during the day than at night due to the fact that telephone traffic is a lot heavier during the day. The deviation is higher due to the volume of FM traffic that is coming out of the terrestrial interfering signal and deviates further into the video portion of the band of the particular channel that you're watching. Therefore, you'll notice the interference is heavier during the day than it is at night. If around 9 or 11 o'clock at night, when telephone volume drops off, the TV gets more and more clear, then you can suspect that you have terrestrial microwave interference, and I would go look for it with a spectrum analyzer at that point.

What is a dc block and is it really needed?

Yes, most of the commercial LNA manufacturers require that the dc power for the LNA be fed through the coax from the center conductor—this being a plus 15 to a plus 28 volts in some applications. In order to put the dc onto the coax going up to the LNA and at the same time have the rf from the LNA coming down that coax, you must divorce the two from each other at the mixer. A dc block is simply a capacitor, usually in the neighborhood of 1000 pF, inserted into the signal path allowing the rf to go through but keeping the dc on the LNA side of the stripline. An rf choke in the neighborhood of 5.6 or 10 millihenries is used to divorce the rf from the dc bias line that comes from the house. This enables you to have just one cable going to the LNA.

Do holes in the waveguide hurt anything?

It depends on how large the holes are. If they're no larger than one-eighth to one-quarter inch, they don't have very much effect if there are only one or two in the waveguide. I have quite a few holes in the home-built waveguides that I've used and I can see no difference whether I leave them open or cover them.

Do waveguide flanges have to be airtight?

The only reason that you would need an airtight or sealtight flange between waveguide joints is to make sure that you don't interfere with another system. If you have a high-power oscillator feeding down one of these waveguides or if you were receiving side interference from terrestrial microwave or something of this nature, then airtight flanges are needed. At the low level of signal that we are talking about, the normal, compressed, bolted-together waveguides are extremely efficient. The amount of enhancement gained by goldplating, sealing, soldering, and shimming the flanges is nearly useless. Moisture seepage or air seepage might be another consideration if you're having condensation problems inside your waveguide, but most waveguides are open. My waveguide is open and has been for three years.

How much gain is necessary for a "perfect" picture?

For a perfect picture, something in the neighborhood of 30-36 dB is usually needed. The LNA output must be sufficiently strong to drive the mixer stage. The mixer diodes, if not driven properly, will add appreciable noise to the system. This dictates about 33-dB minimum.

Why do some people use round horns and others use square horns?

A long time ago it was understood that you get an easier impedance match and less loss with a square horn. I'm not sure whether that is true, but square horns do have one distinguishing factor: The pick-up probe and the impedance matching tend to be consistent in single-mode operation. Hence the square waveguide is heavily used in military and commercial applications.

Circular waveguides collect an equal amount of E and H fields, these being perpendicular to each other. That is, when the wave enters the dish, the E and H fields are perpendicular. The E field is the electrostatic field and the H field is the magnetic field; therefore, in getting the maximum power transfer, you must have an equal amount of these two properties.

The circular waveguide more readily matches the configuration of the circular parabolic dish, the spherical dish, and also the wavefront you are trying to receive. The circular waveguide is therefore more receptive to the incoming wave than the square waveguide. In summation, the circular waveguide outdoes the square waveguide by approximately 1 to 1.5 dB. However, the transition that you use may cause a loss of .5 to 1 dB, so you may not gain anything by going from circular to square, depending on how well your transition works.

Why use a horn instead of a dipole?

The dipole by itself does not have the gain. What you are trying to do is focus the waves onto the probe in the rear of the waveguide. This gathering of the waves is extremely valuable when you're working with small signal levels of TVRO.

What is a scalar horn?

A scalar horn is simply an rf choke that keeps the signal from going over the outside of the waveguide or feedhorn and traveling back out toward the satellite. It also represents a sort of yagi antenna; a scalar horn's ribs re-radiate the wave toward the center of the waveguide, acting as an electrical funnel that catches and shoves the wave into the mouth of

✓See List of Advertisers on page 130

the waveguide. The scalar horn applies most readily to a deep dish—low focal-distance-to-diameter ratio (F/D). The horn must "look" at a wider angle. The funnel-shaped horns are more directional and are used with a flat dish.

Why is the spherical-dish horn so much larger?

The focal point of a spherical dish is quite a long distance from the surface of the reflecting spherical and therefore a larger area has to be gathered in. It is as if you are traveling 12, 14, or even 32 feet away from the spherical antenna to catch the microwave signal. You're sort of like a catcher in a baseball game; you want to use a large glove to catch that little ball. The further away you are, the more directional you want your view of the antenna. Therefore, the broader the horn is, the narrower the beam is. So you want to catch this narrow beam, making the horn appear much larger in physical size. The diameter of the mouth is much broader than for a parabolic dish.

What horn do you use on a .3-F/D dish?

On a .3 you would use a wide-angle horn such as a sawed-off waveguide, a sawed-off piece of 2-inch pipe, or a rectangular commercial 229 waveguide. The waves spread very rapidly as they leave the mouth of the horn. This leads us to use the scalar horn as the best choice.

Is a gold- or silver-plated horn better than a copper one?

Gold or silver is better, but for all the cost of having the gold plating or the silver plating done, you will probably increase the signal only a tenth of a dB. So it's cost prohibitive to do this type of thing.

Are there any surplus horns?

"Surplus" is not really the word because you can go to any plumbing shop and find a 2-inch diameter circular piece of downspout copper tubing—and that is your "surplus" waveguide. There are square and rectangular waveguides. An abundance of them are being thrown out every month by AT&T into scrap yards where they're sold for scrap copper. (They knock off the brass fittings on the ends of the flanges for brass scrap.) There are probably tons of this lying around all over the United States.

How thick should the walls of the horn be?

Thick enough to withstand abuse such as from dropping it or from wild weather. In mounting it, you might bang into it, so you don't want it to distort readily with normal handling. Something like 24-gauge or 28-gauge copper is the thinnest you should use to make it rigid.

Can you use PC material for the horn?

I don't like to use PC board material because you solder to only one side at a time, leaving only thin copper to hold the corners together. Bracing it on the outside takes extra work such as putting brackets around it to hold it together. Generally speaking it will work reasonably well, although I think there's easier material to work with.

Where can I buy a horn?

That, I wouldn't know. Most horns can be built readily out of sheet copper drawn out on the kitchen table, cut with a pair of tin snips, folded, and soldered together, just as you would fold up cardboard to make a box for Christmas wrapping. Most of the amateur enthusiasts construct their own horns. ■

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The Sound of Silence

Beep!! Your TS-180 is off the air, Charlie.

Tony Ruepp HB9BLU
Ifangstr. 73
CH-8153 Ruemlang
Switzerland

The TS-180 contains a very effective swr protection circuit. If ever the swr exceeds a given limit, this circuit immediately cuts off your transmission and lights the LED. This state is held until you (or the VOX) release the transmit button.

When transmitting CW, I very seldom watch the rig. I rather "see" the letters and words passing by while staring at a hole in the air. Several times I did not realize my transmission had been cut off, but I learned it immediately when I returned to receive and heard my partner in another QSO wondering where I might have gone. My 40m and 80m antennas swing in the wind and often exceed the swr limit for a moment.

The following very simple modification guarantees gaining your immediate attention whenever the protection circuit has fired. It simply steals the sidetone and even recycles the protection circuit if you're operating in the VOX mode. It's an easy job to do (takes about 15 minutes and costs less than a dollar) if you follow the instructions carefully:

Prepare a diode (1N4148 or equivalent) and a piece of insulated wire (length about 50 cm). Strip one end and pre-tin it.

1) Remove the eight screws which secure the top cover.

2) Lift the cover slightly and unplug the speaker.

3) Remove the cover entirely.

4) Locate the protection-circuit LED above the digital frequency display. This LED is mounted on the LED unit. The leftmost pin on it is labeled PRL and a blue wire is soldered to it.

5) Make sure no other wires are touching that pin, then solder the prepared wire to it.

6) Bend the wire 1.5 cm behind the pin to the left. Bend it to the rear again after another 3 cm and follow the edge of the PLL assembly to the rear of the rig.

7) Bend it to the right again and cut it 2 cm from the CW key jack.

8) Strip ¼ cm and tin it.

9) Now carefully place the wire in its proper position and tape it close to its end to the chassis.

10) The CW key jack has 5 soldering lugs. Locate the one with the brown wire. (This wire leads to the STS pins of the i-f assembly.)

11) Solder the anode of the diode to the lug with the brown wire and the cathode (ring) to the added wire.

This completes the modification. ■

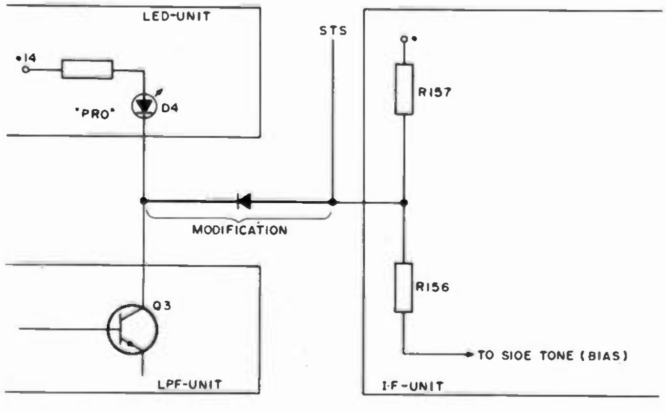

Fig. 1.

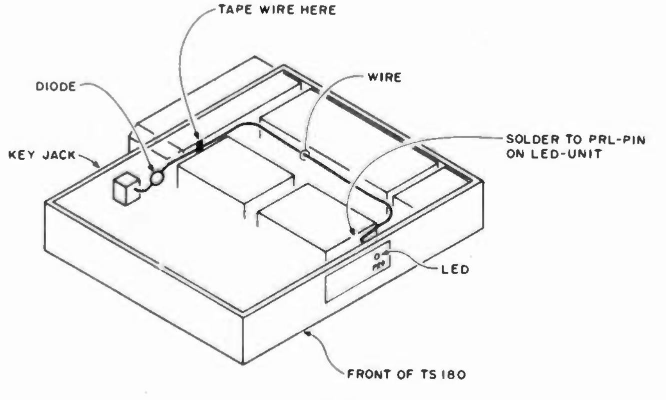

Fig. 2.

Reader Service for facing page ✓15→


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Build the Re-Fuser

It's a self-replacing fuse.
Why blow one when you can blow two?

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I am sure that many technicians have made a trip to a remote, unattended electronic installation to restore some piece of equipment to service only to find that the problem was an open fuse. When the fuse was replaced, everything was normal; no other defect was apparent.

This article describes a circuit which will detect the open-fuse condition, give the load and/or supply time to recover, replace the open fuse with a good one, and announce the fact that the reserve fuse is now in service.

Fig. 1 shows the general circuit for a dc-powered unit. So long as the regular fuse, F1, is good, the heater element of the time-delay device is shorted out by it. Should F1 open, the heater appears in series with the load. After a delay period for the thermal device to operate, the TD switch contacts close and power is applied to the gates of SCRs 1 and 2. SCR1 conducts and places F2 in the main load line. If the load now is capable of proper operation, F2 will hold, restoring the equipment to service. The TD heater is again short-circuited, so it resets.

SCR2 may be used to activate a small oscillator, e.g., a Sonalert™ or other type. This modulator can be made to signal, via an rf carrier, that the main fuse has failed and that the system is in the backup condition.

The modulating system may be a periodic beep or a continuous tone. The Sonalert device can give local aural notice, as well as providing electrical modulation.

A relay arrangement might also be employed, with the relay coil across the main fuse. ■

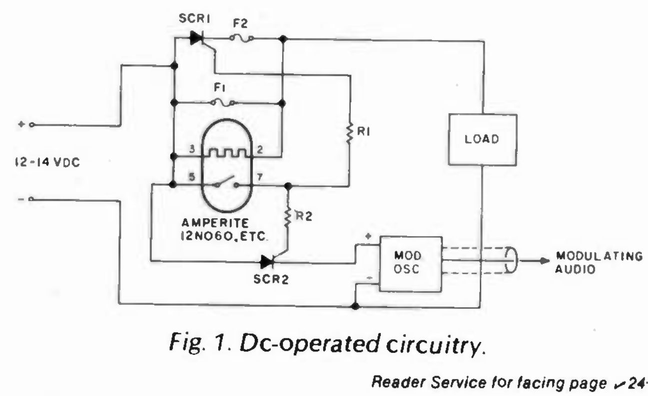

Fig. 1. Dc-operated circuitry.

Reader Service for facing page ✓24→

No Smoking in the Ham Shack

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Seattle WA 98105

This two- or three-component addition to a power supply will give the experimenter a visual indication of an over-voltage condition and do it for much less than the cost of a meter (see Fig. 1). All that is required is a low-power zener diode, an LED, and (possibly) a low-wattage resistor.

For example, in Fig. 1, the unregulated voltage is 18 volts. Since a voltage-regulator failure could occur if there were a collector-emitter short, there conceivably could be 18 volts at the power supply output. Suppose the load can't safely operate at that potential for very long. By choosing the right zener, the experimenter can have an inexpensive visual indication of this condition. The mathematics are simple!

Remember Ohm's Law? E = IR. For this example, a zener is chosen which will reduce the 18 volts by the 1.5 to 1.7 volts which are used to turn on the LED: $V_{zener} = 18 - 1.7 = 16.3$ volts. In a normal output voltage condition, the zener will not conduct and the LED will not turn on, but if the output rises to the breakdown value plus the LED conduction value, the LED will light. But suppose you don't have (in this case) a 16-volt zener. Maybe you only have a 13-volt zener. What then?

Well, 18 V − (13 V + 1.7 V) = 3.3 V. What is going to drop that 3.3 volts? Remember that resistor? Now you can use it. The resistance must equal that 3.3 volts divided by the current through the conducting LED, in this case .02 Amperes. Using Ohm's Law we get: R = E/I, or R = 3.3 volts/.02 Amps = 165 Ohms. This value of resistance is then placed in series with the LED and zener to drop the excess voltage (see Fig. 2).

If the voltage is required to be monitored exactly, then a meter is the better choice. But if an absolute over-voltage value is the only concern, then this circuit could be utilized for around $1.00. It could be a bargain. ■

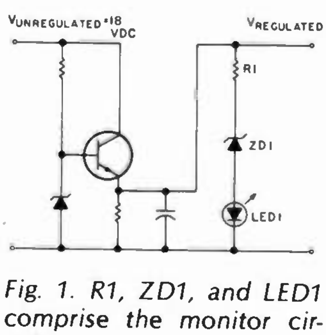

Fig. 1. R1, ZD1, and LED1 comprise the monitor circuit.

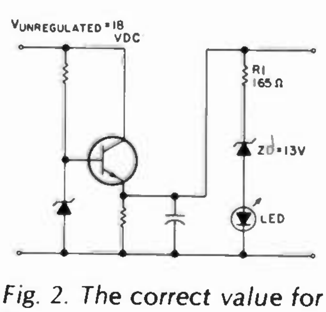

Fig. 2. The correct value for R1.

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Tempo MARSer

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Fig. 1. The Tempo S-1 transceiver.

The Tempo S-1, introduced about two years ago, remains as one of the most popular VHF synthesized transceivers. This is because of its compact size, durability, reliability, and performance. This article will show that with some simple modifications, the radio's bandwidth can be extended to 140-155 MHz, thus covering MARS, mobile telephone, fire, police, etc. Although some degradation of performance occurs on the band extremes, no measurable degradation was observed within the amateur band. The few components and items needed are listed in the box.

The techniques presented here can be applied to similar transceivers such as the Icom IC-2A, but are much more complex with microprocessor-control radios such as the Kenwood TR-2400 and Santec HT-1200. Although the unit is capable of transmitting in the commercial band after the modifications, only authorized persons should do so. In addition, the modifications are not FCC-approved.

S-1 Background

The block diagram of the S-1 is shown in Fig. 2. The master oscillator is in a phase-locked-loop configuration so that only a single base crystal (6.82666 MHz) is used for the reference oscillator. This oscillator is fed through a programmable divider chip (NIS-103). Initially, this divider spans N = 800-1600, giving the S-1 144-148-MHz capabilities. For example, the following divisions give the divider outputs and operating frequencies shown:

Division	Output (MHz)	Frequency (MHz)
N=800	1.33	144
N=1000	1.66	145
N=1200	2.00	146
N=1400	2.33	147
N=1600	2.66	148

NIS-103 does not directly divide the reference oscillator because NIS-105 contains other circuitry. The output signal is then mixed with the 43.1-MHz crystal oscillator. If the output of these two signals is summed and is fed through the vco consisting of the 2SK61 and then tripled via the 2SC1764, the output of the vco becomes 134.30 MHz. The vco generates the sum signal directly producing a clean signal as opposed to tapping the signal off the mixer

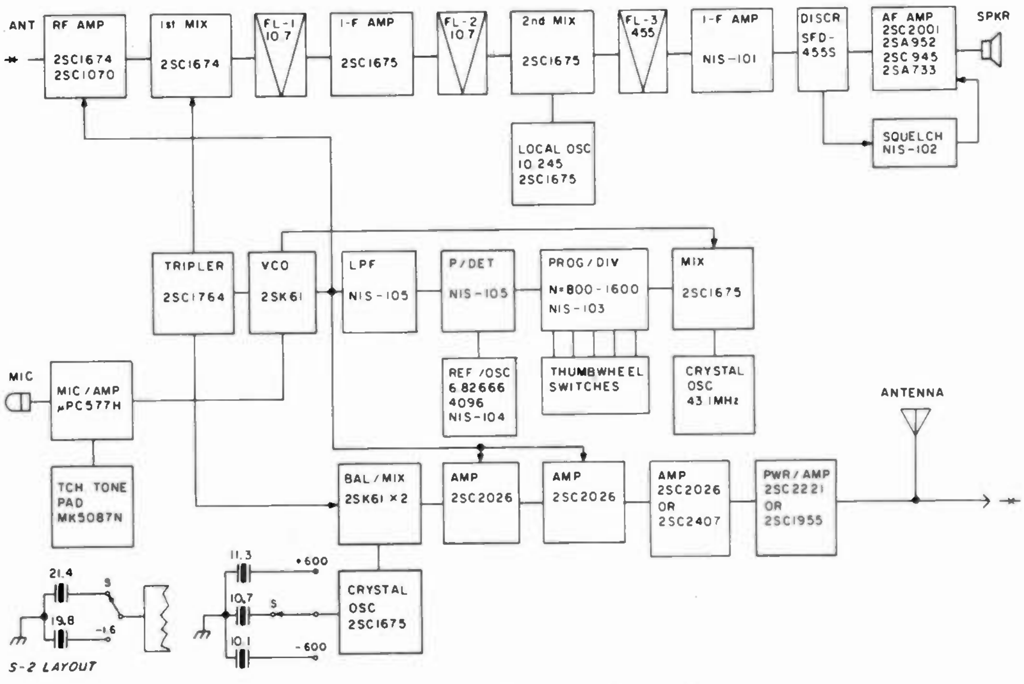

Fig. 2. Block diagram of the S-1.

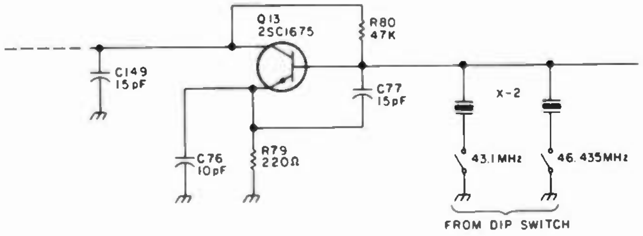

Fig. 3. Wiring configuration showing the switching of the two crystals.

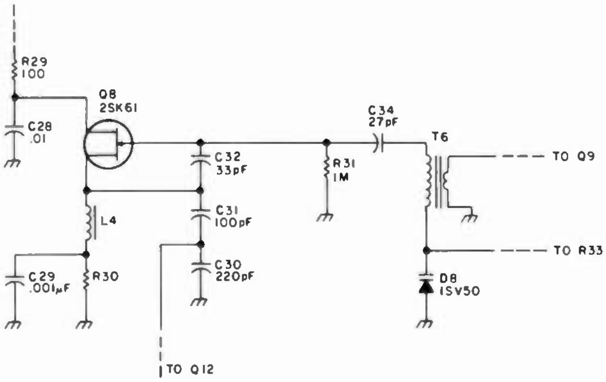

Fig. 4. Schematic of the vco. The only point at which the varactor diode can be connected is between C31 and C30 since the dc voltage will not disturb the circuit.

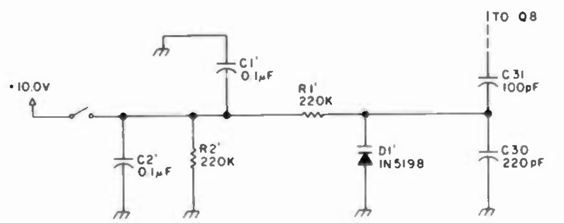

Fig. 5. Hookup of the varactor diode and how it is switched in and out of the circuit.

Fig. 6. Mounting of the varactor diode, C1', and R1' on the receiver board.

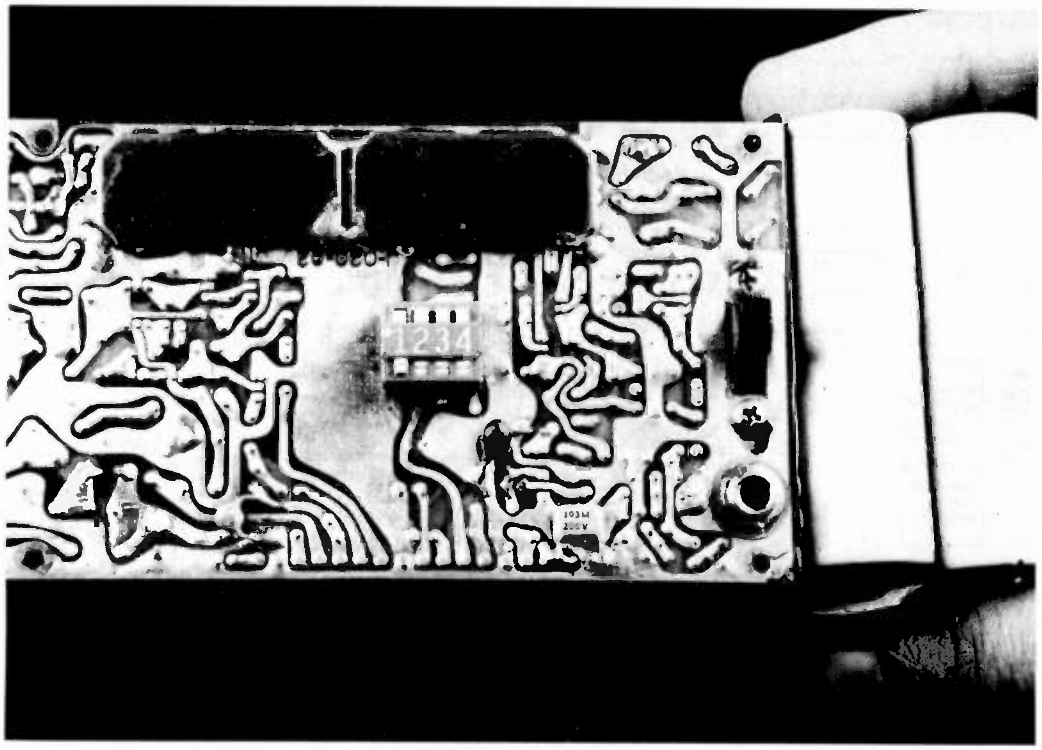

Fig. 7. Four-position switch mounted on the back of the transmitter board.

Fig. 8. The back of the transceiver showing the placement of the DIP switch.

(2SC1675), which will have spurious products within the band of operation. The two signals are compared by NIS-105 and a correction voltage is sent back to the vco. (More on phase-locked-loop techniques can be obtained from Floyd Gardner's *Phaselock Techniques*, John Wiley and Sons, New York NY, 1966.) The signal is then fed either to the transmitter or receiver where 10.7 MHz is added on to it to obtain the 144.00 MHz shown in the example given above. For transmit offsets of +600 kHz, the crystal is 11.3 MHz, and for −600 kHz, the crystal is 10.1 MHz.

Extension to 140-150 MHz

The S-1 can easily be extended for operation from 140-150 MHz with minimum effort and no extra components. The programmability of NIS-103 is capable of N=0-2000. What prevents this action is not the electronics but the mechanics. Henry Radio is obligated to allow the radio to transmit only in the amateur band. This is done by placing rubber stoppers on the MHz section of the thumbwheel switches. With the unit removed from the housing, the three-section switch separates easily. On the switch furthest to the left, there are two rubber stoppers. Remove these and repack the switch. Coverage is now available from 140-150 MHz. Because of the varactor-tuned circuits in the transmitter and receiver, degradation in performance is minimal. With a dummy load into a Bird wattmeter, transmit power is still 1.5 Watts, and sensitivity is below 1 uV at the new band edges. No degradation was measurable within the amateur band.

Generally speaking, there is limited activity below 144 MHz, but from 148-150 MHz there is military, MARS, paging, and other action.

Extending the S-1 to 155 MHz

Most people would agree that 148-150 MHz is not where the major activity occurs. However, from 150-155 MHz, there are mobile telephone, paging, fire, police, ambulance, and other activities. A practical method of alternating the frequency is to change the 43.1-MHz oscillator crystal (X-2) to 46.433 MHz. This crystal will switch the synthesizer range to 150-160 MHz with direct readout. Unfortunately, the vco is capable of locking up only to 155.00 MHz. (This limit will vary from unit to unit.)

To switch the two crystals in and out of the circuit, remove X-2 and place it where the private line (PL) circuitry normally would go. Using RG-178 B/U (or RG-174, which is bulkier), connect one end to the receiver while the other end goes to the two crystals (43.1 or 46.433 MHz). For switching, a 4-position SPST DIP switch can be used. Since the crystal is grounded on the other end, it is best to disable the crystal by ungrounding it. Fig. 3 shows the wiring configuration. With the new


DRAKE

crystal switched in, it was found that locking of the vco extended only to 152 MHz. The range can be extended to 155 MHz by tuning T6, but the lower portion of the 2-meter band would not lock. This is an uncompromising situation, especially with the new repeater subband and fire and law enforcement between 153 and 155 MHz.

Is it possible to have the best of both worlds? Yes. This is the reason for the 4-position DIP switch rather than a two-position one. In order to extend the lock range of the vco, a varactor diode was incorporated.

Some general rules must be clarified before proceeding to any physical modifications. First, removing any components is out of the question. This is because the S-1 uses flow-through solder. The risk of damaging other components is high. Second, the varactor diode must be connected to a point where the dc voltage is isolated since the diode must be controlled by a dc voltage. The schematic for the vco is shown in Fig. 4. The node between C30 and C31 is the only point at which a varactor diode could be placed.

The 1N5148 varactor diode was chosen because of its range, 47 pF (no voltage) and 14.7 pF (minimum value), with about 10-volts reversed bias across it. A 220k (1/8-Watt) resistor was tied to Vcc to reverse-bias the diode. An additional resistor must be used to discharge the diode when the voltage is removed. Bypass capacitor C1′ was placed next to R1′ to prevent rf interference, and C2′ was installed next to R2′. The final configuration appears as shown in Fig. 5.

In the 150-155-MHz area, the switch is closed, which reduces the capacitance on the varactor diode. In the 140-150-MHz region, the switch is opened. The two additional resistors should be 1/8-Watt to conserve space, but there is room for 1/4-Watt resistors. C1′, D1′, and R1′ are placed at the bottom printed circuit board under the shield plate in parallel with C30, as shown in Fig. 6. This method is preferable to minimize lead inductance. R2′ and C2′ were mounted next to S3 since its lead inductance is not important. It is recommended that a frequency counter and rf generator be available so that T6 can be optimized for maximum bandwidth.

The uncommitted switch on the 4-position DIP switch can be used for subaudible tone or tone burst if desired. Mounting of the DIP switch is done on back of the transmit board, as shown in Fig. 7. A square hole is made on the back of the S-1 to access the switch, as shown in Fig. 8. Be sure to define the position of the hole carefully so that the position of the hole will match the position of the switch.

Useful Hints

Because the S-1 is so compact, rf tends to feed back into the critical sections of the transceiver. It was found that bypass capacitors (0.1 uF) installed in the supply leads in both the receiver and transmitter boards improved the PLL stability. As a general rule, do not solder the crystal case to ground. This can break the vacuum seal on most crystals and shift its frequency, and at times it may stop oscillating altogether. However, clamping the crystal to ground is permissible and is recommended. Also, placing a sheet of aluminum foil around the battery and then grounding it eliminates rf feedback into the touchtone™ pad.

Results

The original specifications of the S-1 are unchanged. In the low extreme (140 MHz) sensitivity is still below 1 uV, while at 155 MHz it was observed to be 1.5 uV, more than adequate for most applications. The vco lost lock at 156 MHz but was extremely stable below 155 MHz. By tuning T6, the upper or lower frequency extremes can be extended but the overall bandwidth is about 15 MHz. On transmit, at least 1.5 Watts was available at all frequencies. (Remember: A dummy load must be used when testing on unauthorized frequencies.) While switching from 140-150 MHz to 150-155 MHz, the unit must be turned off while the crystal is switched and then turned on again. This is because once the vco locks to a certain frequency, it is difficult to break lock and relock again when there is a 3-MHz difference between the two oscillator crystals.

The author would like to thank Glen Toth of Signetics for the photographs. ■

Items Needed

1—Crystal (same as for the AR-22C—X-3, 46.433 MHz)
1—4-position DIP switch
6″—RG-178 B/U coax or equivalent (RG-174 can be used but it is bulky)
1—Varactor diode, 1N5148
2—1/8-Watt, 220k resistors
2—0.1-uF bypass capacitors

The Tempo S-1 service manual can be obtained from Henry Radio, 2050 S. Bundy Drive, Los Angeles CA 90025, for $7.50

The crystal may be obtained from Ace Communcations, Inc., 2832-D Walnut Avenue, Tustin CA 92680, for $2.00

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AM-431

Mike Richardson N5MR
5467 Plantain Circle
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CW and the Apple II

The simplicity of BASIC plus the speed of machine language equals a near-perfect Morse keyboard.

There are many good programs floating around for the Apple II microcomputer which will let one touch-type Morse code. However, CW isn't nearly as effective coming out of the Apple's itty-bitty speaker as it is coming out of your antenna. This article describes a very simple (and cheap!) interface for the Apple which should key most rigs.

The key to this interface is the neat little game I/O connector that Apple has so thoughtfully included with your computer. This connector is an ordinary 16-pin DIP socket with the layout shown in Fig. 1.[1]

Although there are 16 pins on this connector, only three of them are needed for this interface. These are: pin 1 for +5 volts, pin 8 for ground, and pin 15 as the keying output.

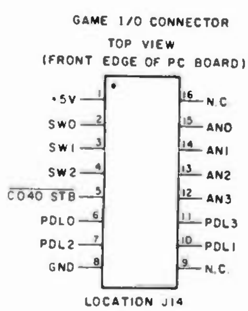

Fig. 1.

I next took an ordinary 16-pin solder-tail DIP IC socket (16¢ at James Electronics) and soldered wires to pins 1, 8, and 15 on it. I use this socket as a male plug, and plug it into the game paddle I/O socket whenever I get in the mood for CW.

Pin 15 is designated output AN0 by Apple, and is driven by chip F14, a 74LS259. The Apple manual suggests buffering this output, and Fig. 2 shows the buffering circuit I used to key my Ten-Tec Triton IV transceiver.

U1 is a single AND gate from a 74C08 CMOS quad AND gate (49¢ at Radio Shack). Q1 is a 2N2222 NPN utility transistor (10¢ at Radio Shack).

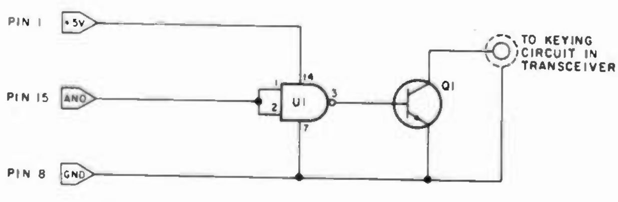

Fig. 2.

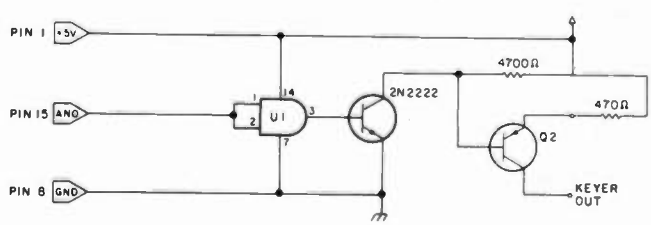

Fig. 3.

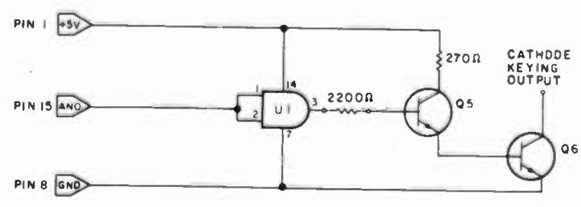

Fig. 4.

There are other combinations of parts that work which may even be cheaper than this circuit. However, these are the first ones I ran across in my junk box, and, as the old proverb says, "If it works, don't fix it."

One word of caution: If you use a quad CMOS chip, as I did, be sure to ground the inputs to the unused gates—otherwise the chip may malfunction. Thus, for the 74C08, you should ground pins 4, 5, 9, 10, 12, and 13.

My Triton IV is an all-solid-state rig employing low keying voltages that a 2N2222 can handle with ease. If your rig uses grid-block keying, a slightly different circuit should be used—see Fig. 3.

Q2 can be substituted, but should have a V_{ce} greater than the keying voltage employed in your rig. The 2N5401 and the 2N4888 can handle up to about 300 volts.

For a cathode-keyed rig, the circuit in Fig. 4 can be used.

Q5 is a 2N4123, and Q6 is a high-voltage, high-current silicon NPN power transistor such as the Delco DTS-801, -802, or -804.

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The connoisseur of keying circuits may find the latter two of these circuits very familiar. They are borrowed from Jim Garrett's (WB4VVF) excellent article on the Accukeyer.[2]

Well, so much for the hardware end—the rest is free! (I spent 75¢ for parts for my interface. Add an extra buck or two if your rig requires one of the latter two circuits.) The only thing remaining is to add statements to your CW program which will tell it to turn the AN0 output on and off at the right times.

By POKEing a 0 into location −16296 (hex $C058), AN0 is set to zero volts. Conversely, by POKEing a 0 into memory location −16295 (hex $C059). AN0 is switched to +5 volts.

CW programs can vary greatly, but probably all of them, whether written in BASIC, assembly language, or machine language, will have one subroutine to send a dit and another subroutine to send a dah. If your program is in BASIC, then the statement POKE −16296, 0 should be added to your program as the first statement in both the dit-forming and dah-forming subroutines. Likewise, add the statement POKE −16295, 0 as the last statement in each subroutine. Also, it is a good idea to add the statement POKE −16296, 0 as one of the first statements in your program, so that output AN0 will be initialized to zero volts each time the program is run.

If your dit- and dah-forming subroutines are in assembly or machine language, the following commands will work. Insert the command:

AD 59 C0 LDA $C059

immediately before the command which starts the code element sounding. Likewise, insert:

AD 58 C0 LDA $C058

immediately after the command, which stops sounding the code element.

As a final example, here are a few details from my own CW program, which is based on "The Morse Master," *73 Magazine*, January, 1979, p. 114. A BASIC listing of the pertinent parts of my program is shown in Fig. 5.

The Morse code is held in an array A$(P), where 3s stand for dahs and 1s stand for dits. As each letter is typed on the Apple keyboard, the corresponding value in the array is returned. For example, when C is pressed, the value 3131 is returned from the array. The subroutine at 1000 then peels off the digits one by one from the left. If a 3 is present, the dah subroutine at 1300 is selected. If a 1 is present, the dit subroutine at 1200 is selected.

My dit and dah subroutines are almost identical. They each call the same machine-language subroutine at memory location 16002. This subroutine is listed in machine and assembly form in Fig. 6. In hex, 16002 is written as $3E82.

This machine-language program is almost identical to the tone-generator program shown on pages 43-45 of the Apple Reference Manual. Each time before it is called, two values must be POKEd into memory. The first is variable PP, which determines the frequency of the output tone through the speaker. This can be any number between 0 and 255 (I prefer 96) and this number is POKEd into memory location 16000 (hex $3E80). The second number required by the subroutine tells it how long the code element should be sent. In the dit subroutine, this is variable X, and, in the dah subroutine, I used variable T. This second number is POKEd into memory location 16001 ($3E81 hex). (I use X = 10 and T = 40 for a code speed of about 30 wpm.)

```
   6  GOSUB 32000
   7  POKE - 16296,0
  10  HIMEM: 15999
 199  REM—MORSETYPER MAIN PROGRAM
 200  GET K$
 220  P = ASC(K$)
 225  REM—PRINTS LETTER TO BE SENT ON SCREEN
 230  PRINT CHR$(P);
 240  GOSUB 1000
 250  REM—ADDS SPACE AFTER EACH LETTER
 260  FOR Q = 1 TO SP ; NEXT Q
 300  GO TO 200

 999  REM—MORSE SENDING SUBROUTINE
1000  L = LEN( A$(P) )
1005  FOR I = 1 TO L
1010  R$ = MID$( A$(P) , I , 1)
1015  IF R$ = "1" THEN GOSUB 1200
1020  IF R$ = "3" THEN GOSUB 1300
1025  NEXT I
1030  RETURN
1199  REM—DIT SUBROUTINE
1200  POKE 16000, PP: POKE 16001,X : CALL 16002
1201  FOR L = 1 TO X : NEXT L
1202  RETURN
1299  REM—DAH SUBROUTINE
1300  POKE 16000,PP : POKE 16001, T : CALL 16002
1301  FOR L = 1 TO X : NEXT L
1302  RETURN
```

Fig. 5. BASIC listing.

Notice that the first statement in the assembly-language program is LDA $C059, which sets the game I/O output AN0 to 5 volts. When the code element has all been sent, the program branches to $3E99 where the command LDA $C058 is given, which resets AN0 to zero volts before returning to the main BASIC program.

Fig. 7 shows a BASIC listing which will POKE the machine-language subroutine in Fig. 6 into memory at location 16002 (hex $3E82). One of the first statements in my main BASIC program calls this subroutine before any other action is taken by the program.

3E82	AD 59 C0	LDA $C059
3E85	AD 30 C0	LDA $C030
3E88	88	DEY
3E89	D0 05	BNE $3E90
3E8B	CE 81 3E	DEC $3E81
3E8E	F0 09	BEQ $3E99
3E90	CA	DEX
3E91	D0 F5	BNE $3E88
3E93	AE 80 3E	LDX $3E80
3E96	4C 85 3E	JMP $3E85
3E99	AD 58 C0	LDA $C058
3E9C	60	RTS

Fig. 6.

Well, that's it in a nutshell. If anyone has any problems, send me an SASE and I'll try to help. ■

References

1. *Apple II Reference Manual*, January, 1978, p. 25.
2. *The Radio Amateur's Handbook*, ARRL, 1977, p. 364-5.


```
32000 POKE 16002,173: POKE 16003,89  : POKE 16004,192
32005 POKE 16005,173: POKE 16006,48  : POKE 16007,192
32010 POKE 16008,136: POKE 16009,208: POKE 16010,5
32015 POKE 16011,206: POKE 16012,129: POKE 16013,62
32020 POKE 16014,240: POKE 16015,9   : POKE 16016,202
32025 POKE 16017,208: POKE 16018,245: POKE 16019,174
32030 POKE 16020,128: POKE 16021,62  : POKE 16022,76
32035 POKE 16023,133: POKE 16024,62  : POKE 16025,173
32040 POKE 16026,88  : POKE 16027,192: POKE 16028,96
32050 RETURN
```

Fig. 7. BASIC subroutine for POKEing machine-language subroutine into memory at location 16002 (hex $3E82).

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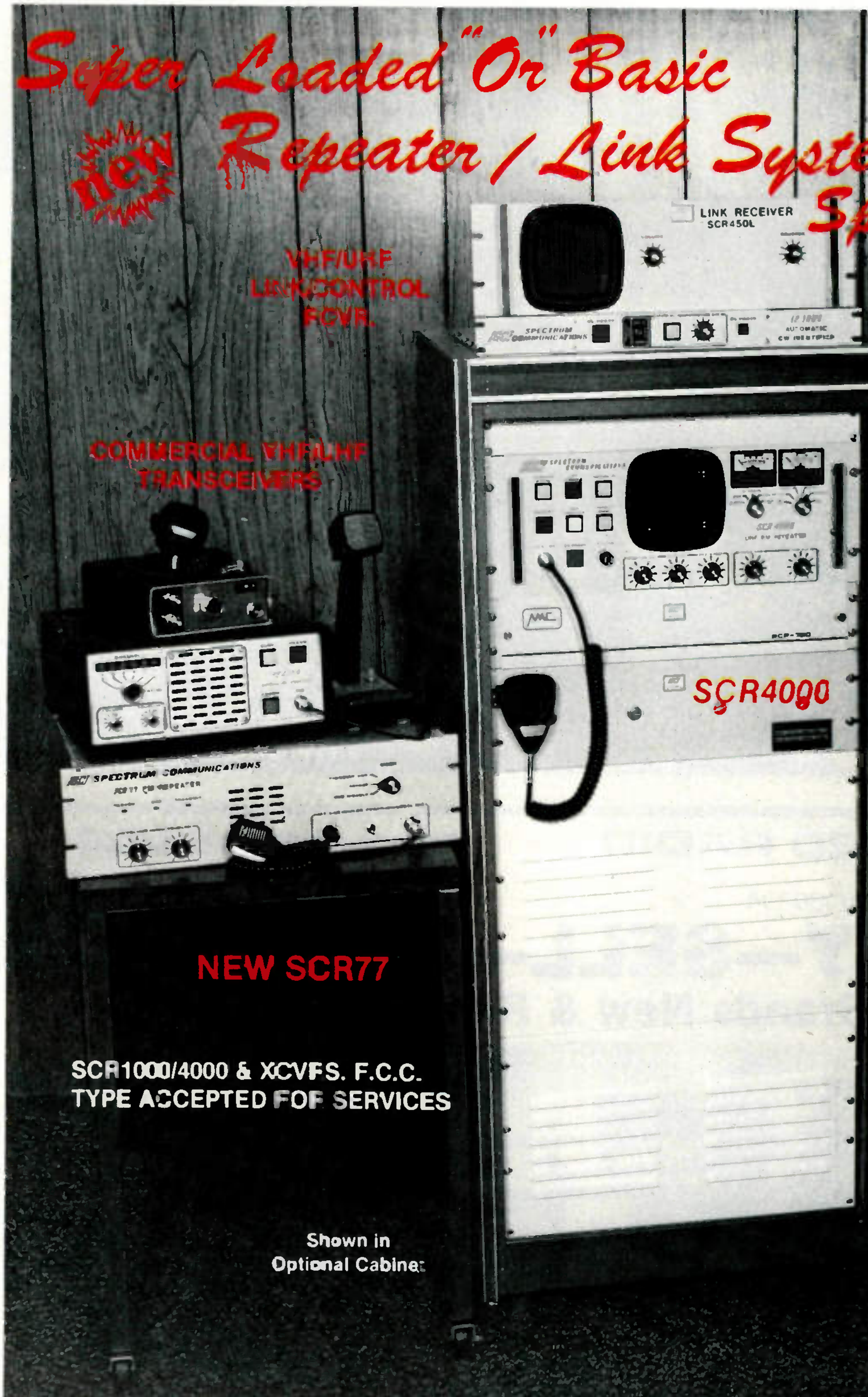

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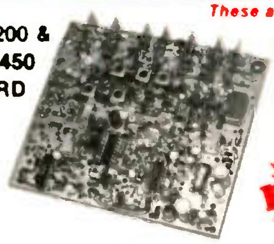

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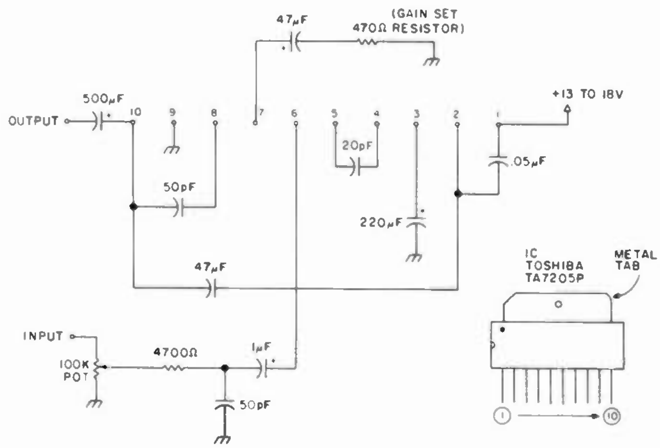

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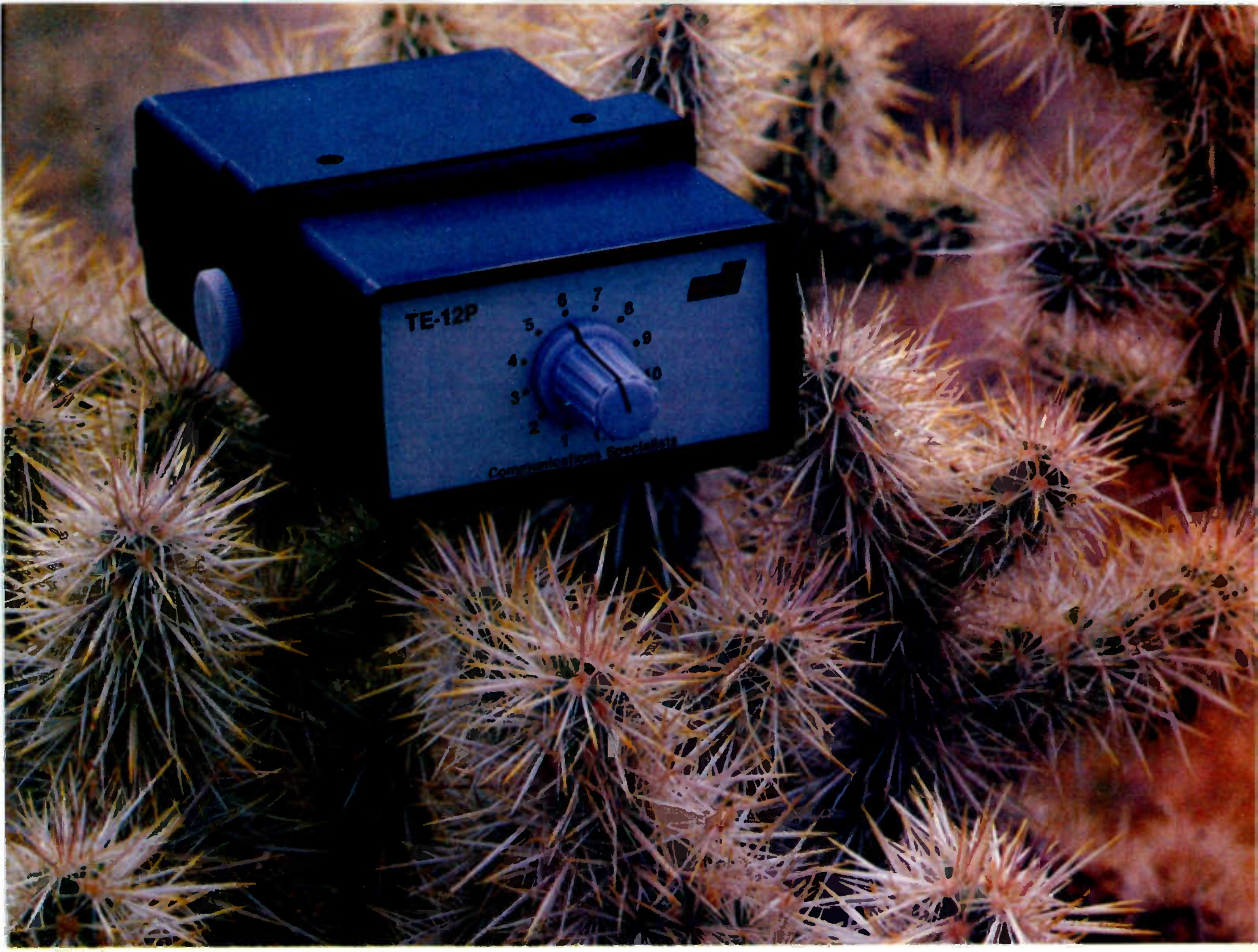

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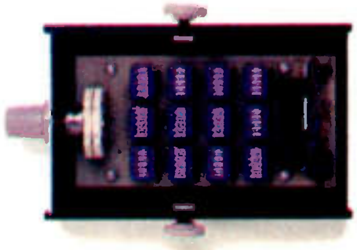

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Robert W. Baker WB2GFE
15 Windsor Drive
Atco NJ 08004

Award-Winning Program

Certificate hunters, cut your paperwork down to size. Let your Pet track your quest for excellence.

Here's a simple program for the Pet that was designed to keep track of what states have been worked on what bands for 5BWAS. For each state, the program records the callsign of the station worked on each band (80, 40, 20, 15, and 10 meters). You can display the entries, just the totals for one particular band, or the totals for all bands combined (mixed). The data is stored in a data file on cassette tape and takes about two minutes to load, save, or verify. The program also provides a way of changing or deleting any entry, if required.

The program was written to be flexible enough that it could be used for other awards records such as Worked All Zones (WAZ) or Worked All Continents (WAC). To change the program for another award, simply modify the values in lines 180-200 as required:

AW$ = The 3-letter award name (WAS, WAZ, WAC, etc.)

NE = The number of entries for the award—must be 50 or less due to the current Pet display limitations. (WAS = 50, WAZ = 40, WAC = 6, etc.)

IE$ = Entry input question used in line 770:
For WAZ you could use:
IE$ = "ZONE (01-40)".
For WAC you could use:
IE$ = "CONTINENT (NA, SA, EU, AF, AS, OC)"

K$ = The string of entry names each 2 characters long:
For WAZ you would use:
190 K$ = "010203......20",
200 K$ = K$ + "212223......40".
For WAC you would use:
190 K$ = "NASAEUAFASOC"
200 (deleted—not used!)

Program listing.

```
100 REM ******  5BWAS-RECORDS  *******
110 REM
120 REM BY - ROBERT W. BAKER, WB2GFE
130 REM          15 WINDSOR DRIVE
140 REM        ATCO, NEW JERSEY 08004
150 REM
160 REM *******************************
170 :
180 AW$="WAS" : NE=50 : IE$="STATE (2-LETTER ABBREV)"
190 K$="ALAKAZARCACOCTDEFLGAHIIDILINIAKSKYLAMEMDMAMIMNMSMOMTNENV"
200 K$=K$+"NHNJNMNYNCNDOHOKORPARISCSDTNTXUTVTVAWAWVWIWY"
210 :
220 POKE 59468,12 : DIM D$(NE),T(6) : NH=INT(NE/2) : E$=".........."
230 :
240 REM DISPLAY MENU
250 :
260 PRINT"";SPC(10);"";AW$;" - AWARD RECORDS"
270 GOSUB 1410 : CLOSE 1 : PRINT"   0 = DONE"
280 PRINT"   1 = LOAD DATA FROM TAPE"
290 PRINT"   2 = SAVE DATA ON TAPE"
300 PRINT"   3 = VERIFY DATA ON TAPE"
310 PRINT"   4 = INITIALIZE DATA"
320 PRINT"   5 = ENTER DATA (ADD,CHANGE,DELETE)"
330 PRINT"   6 = DISPLAY DATA"
340 PRINT"   7 = DISPLAY TOTALS" : GOSUB 1410
350 PRINT"ENTER COMMAND:  ";
360 GET R$:IF R$="" THEN 360
370 IF R$="0" THEN PRINT R$ : END
380 N=VAL(R$) : IF N<1 OR N>7 THEN 360
390 PRINT R$
400 IF IL<>0 THEN ON N GOTO 460,540,610,700,760,990,1260
410 ON N GOTO 460,420,420,700
420 PRINT"INITIALIZE OR LOAD DATA FIRST!" : GOTO 350
430 :
440 REM LOAD DATA FROM TAPE
450 :
460 PRINT"INSERT ";AW$;" INPUT TAPE"
470 OPEN 1,1,0,AW$+".DATA" : PRINT"READING DATA!"
480 FOR N=1 TO NE : INPUT#1,D$(N) : IF ST=0 THEN NEXT
490 IF ST=64 AND N=NE THEN PRINT"*** DATA LOADED ***" : IL=1 : GOTO 270
500 GOTO 660
510 :
520 REM SAVE DATA ONTO TAPE
530 :
540 PRINT"INSERT ";AW$;" OUTPUT TAPE"
550 OPEN 1,1,1,AW$+".DATA" : PRINT"WRITING DATA!"
560 FOR N=1 TO NE : PRINT#1,D$(N) : NEXT
570 PRINT"*** DATA SAVED ***" : GOTO 270
580 :
590 REM VERIFY DATA ON TAPE WITH MEM
600 :
610 PRINT"INSERT ";AW$; " TAPE TO VERIFY"
620 OPEN 1,1,0,AW$+".DATA" : PRINT"VERIFYING DATA!"
630 FOR N=1 TO NE : INPUT#1,C$ : IF ST=0 AND C$=D$(N) THEN NEXT
640 IF ST=64 AND N=NE THEN PRINT"*** TAPE DATA VERIFIED ***" : GOTO 270
650 IF C$<>D$(N) THEN PRINT"DATA MIS-MATCH!" : GOTO 270
660 PRINT"TAPE READ ERROR!  ST = ";ST : GOTO 270
670 :
680 REM INITIALIZE ALL ENTRIES
690 :
700 PRINT"CLEARING ALL ENTRIES!"
710 FOR N=1 TO NE : D$(N)=E$+E$+E$+E$+E$ : NEXT
720 PRINT"*** DATA INITIALIZED ***" : IL=1 : GOTO 270
730 :
740 REM ADD, CHANGE, DELETE ENTRIES
750 :
760 PRINT""
770 PRINT"";IE$;"   ";  : INPUT R$ : IF R$="" THEN 260
780 N=0 : FOR Z=1 TO (2*NE)-1 STEP 2 : N=N+1
790 IF R$<>MID$(K$,Z,2) THEN NEXT : GOTO 770
800 INPUT"BAND (80,40,20,15,10)   ";R$ : IF R$="" THEN 770
810 I=-1:IF R$="80" THEN I=0
820 IF R$="40" THEN I=10
830 IF R$="20" THEN I=20
840 IF R$="15" THEN I=30
850 IF R$="10" THEN I=40
860 IF I<0 THEN 800
870 PRINT"CURRENT ENTRY = ";MID$(D$(N),I+1,10)
880 INPUT"CALL (D=DELETE)   ";C$ : IF C$="" THEN 770
890 IF LEN(C$)>10 THEN 880
900 IF C$="D" THEN C$=E$
910 C$=LEFT$(C$+E$,10) : B$=C$+RIGHT$(D$(N),40)
920 IF I<1 THEN 950
930 B$=LEFT$(D$(N),I)+C$
940 IF I<40 THEN B$=B$+RIGHT$(D$(N),40-I)
950 D$(N)=B$ : GOTO 770
960 :
970 REM DISPLAY DATA BY BAND/MIXED
980 :
990 INPUT"BAND(80,40,20,15,10,M=MIXED)   M";B$
1000 I=0 : IF B$="80" THEN I=1
1010 IF B$="40" THEN I=11
1020 IF B$="20" THEN I=21
1030 IF B$="15" THEN I=31
1040 IF B$="10" THEN I=41
1050 IF (I=0) AND (B$<>"M") THEN 990
1060 PRINT" ";AW$;" " : PRINT"RECORDS" : PRINT"____________"
1070 PRINT"BAND:"
1080 IF I=0 THEN PRINT"MIXED"
1090 IF I>0 THEN PRINT B$;" MTRS"
1100 PRINT"____________";
1110 FOR N=1 TO 25 : IF N>NH THEN PRINT TAB(9);"I"; : GOTO 1150
1120 IF I=0 THEN 1190
1130 PRINT TAB(9);"I  ";MID$(K$,2*N-1,2);" ";MID$(D$(N),I,10);
1140 PRINT" ";MID$(K$,(2*N)+NE-1,2);" ";MID$(D$(N+NH),I,10);
1150 IF N<>25 THEN PRINT
1160 NEXT N
1170 PRINT"DEPRESS"
1180 PRINT"ANY KEY" : PRINT"  TO" : PRINT"CONTINUE" : GOTO 1390
1190 FOR X=1 TO 41 STEP 10 : C$=MID$(D$(N),X,10) : IF C$=E$ THEN NEXT
1200 PRINT TAB(9);"I  ";MID$(K$,2*N-1,2);" ";C$;
1210 FOR X=1 TO 41 STEP 10 : C$=MID$(D$(N+NH),X,10) : IF C$=E$ THEN NEXT
1220 PRINT" ";MID$(K$,(2*N)+NE-1,2);" ";C$; : GOTO 1150
1230 :
1240 REM ADD BAND TOTALS
1250 :
1260 PRINT"ADDING BAND TOTALS!"
1270 FOR X=1 TO 6 : T(X)=0 : NEXT X
1280 FOR N=1 TO NE : T(0)=0 : FOR I=1 TO 5
1290 IF MID$(D$(N),10*I-9,10)<>E$ THEN T(0)=1 : T(I)=T(I)+1
1300 NEXT I : T(6)=T(6)+T(0) : NEXT N
1310 PRINT"       ";AW$;" TOTALS      "
1320 PRINT SPC(11);"80 METERS: ";T(1)
1330 PRINT SPC(11);"40 METERS: ";T(2)
1340 PRINT SPC(11);"20 METERS: ";T(3)
1350 PRINT SPC(11);"15 METERS: ";T(4)
1360 PRINT SPC(11);"10 METERS: ";T(5)
1370 PRINT SPC(9);"MIXED BANDS: ";T(6) : PRINT : GOSUB 1410
1380 PRINT"    DEPRESS ANY KEY TO CONTINUE!"
1390 GET R$ : IF R$="" THEN 1390
1400 GOTO 260
1410 PRINT"________________________________________" : RETURN
```


Reader Service for facing page ✓5→

Once these three lines have been changed, the rest of the program should not have to be modified.

The remainder of the program is very straightforward. Line 220 ensures that the Pet is in the upper-case/graphics mode and defines the data (D$) and totals (T) arrays along with the blank entry value (E$). Lines 260-340 display the program "menu" which allows the user to select the desired program function from those available. Lines 350-380 get the number of the desired function and check that a valid selection was made. Lines 400-420 then branch to the routine to perform the selected function, but the data must first be initialized or loaded from tape before any other function can be performed. This ensures that the data matrix (D$) has been set correctly before attempting to use any values contained within it. Each of the available functions is then performed by one of the routines in the remainder of the program.

The first time you use the program, initialize the data to clear all entries. Then enter each callsign for the appropriate QSO on each band for each state. You make the entries by first specifying the state to be entered. If you hit "RETURN" without making an entry, the program will return to the menu selection. If the state is not found (incorrect 2-letter code), you will be asked again for the band (80, 40, 20, 15, or 10 meters). If "RETURN" is entered without any data, you will be asked for the state again. If an incorrect band is entered, you will be asked for the band again.

When a correct state and band have been entered, the current entry for that state and band will be displayed. If you enter "RETURN" without any data, the current entry will be unchanged and you will be asked for the next state. If you enter a "D" followed by "RETURN", the current entry will be deleted (set back to periods). Any other data entered followed by "RETURN" is assumed to be the callsign to be entered for that state on that band. If the callsign is longer than 10 characters, you will have to reenter the callsign. All callsigns entered will have periods appended to make them 10 characters long before they are stored. The five callsigns for each state are stored together as one 50-character string to save memory space.

When all entries have been made, display the data on each band and check if correct. If required, go back and make any corrections. You also can display the totals and check for the correct number of states on each band. Before stopping the program, make sure that you save the data on tape. It's also a good idea to take the extra time to verify the data file, to make sure it was correctly saved. You might even want to save more than one copy on tape while you have everything in memory. Now you simply load the old data file the next time you want to add, correct, or examine anything. If you make any changes, don't forget to save the new data on tape. For those who want to go even further with their award records, you could keep separate data files for each mode (SSB, CW, RTTY, SSTV, etc.).

To answer the question before it's asked, for anyone too lazy to type in the program, I'll be happy to supply copies on tape for $2.00 each. However, *please send all requests directly to me and not through the magazine.* ■

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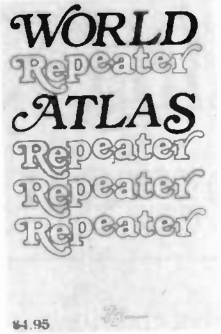

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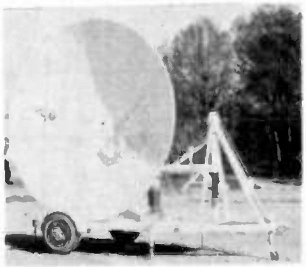

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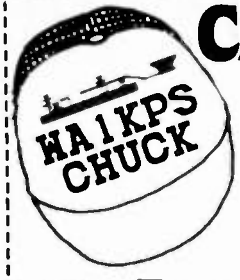

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Speed Demon

How fast was that? Find out with this wpm display for Heath's 1410 keyer.

Jerry Wayne Campbell K4ZHM
Rte. 4, Box 126 Barkley
Nicholasville KY 40356

In the following, I will describe a digital display I added to my Heath 1410 keyer to display the wpm setting of the keyer. The same principle can be applied to other keyers.

First, let's look at what we need to calculate the words-per-minute speed of the keyer. The *ARRL Handbook* gives the following formula for calculating code speed:

words/min = dots/min/25 =
2.4 × dots/sec

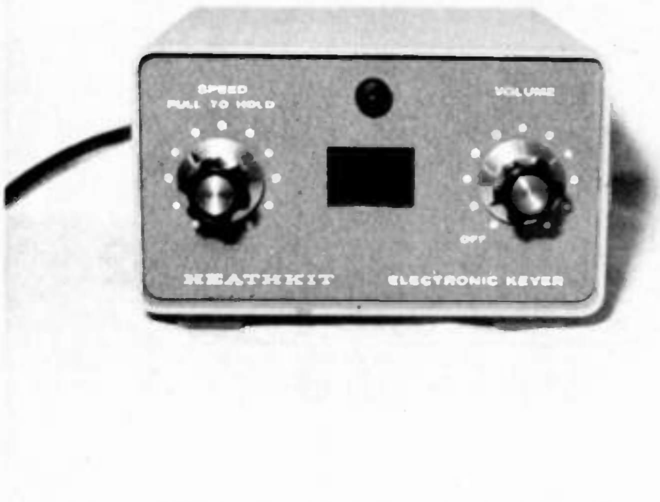
From the Heath 1410 keyer manual, we see that for each dot generated (space included), the clock in the keyer generates two pulses. The clock pulse rate is twice the dot rate. If we measure the clock pulses instead of the dots, the formula becomes:

words/min =
1.2 clock pulses/sec

Multiplying the clock pulses/sec by 1.2 is the same as measuring the clock pulses for 1.2 seconds. 1.2 seconds is 72 cycles at the 60-Hz power-line frequency; therefore, if we count the clock pulses for 72 cycles of the line frequency, we are effectively multiplying our keyer clock pulses/sec by 1.2. Thus, by counting the clock pulses from the keyer for 1.2 seconds, we can read the code speed directly on the seven-segment displays.

Referring to the timing diagram in Fig. 1, we see that by dividing the 60-Hz line frequency as shown (first by 6, then again by 6, then by 2, then finally by 2; see Fig. 2) we obtain a 1.2-second gating pulse. We now have the means to time the keyer clock pulses for 1.2 seconds and the count will update each 1.2 seconds. The reset pulse clears the counters 0.6 seconds prior to the counting interval. Send dots and/or dashes for over 2.4 seconds, and the readout will display for 0.6 seconds the speed at which the keyer is set.

Power, the 60-Hz line frequency, and, of course, the keyer clock pulses are all taken from the keyer. Refer to Fig. 3 and the Heath 1410 keyer manual for the fol-



The assembled keyer with the counter modification.

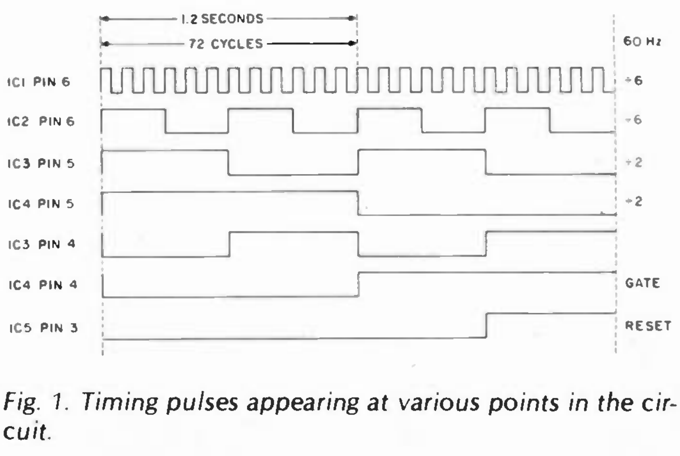
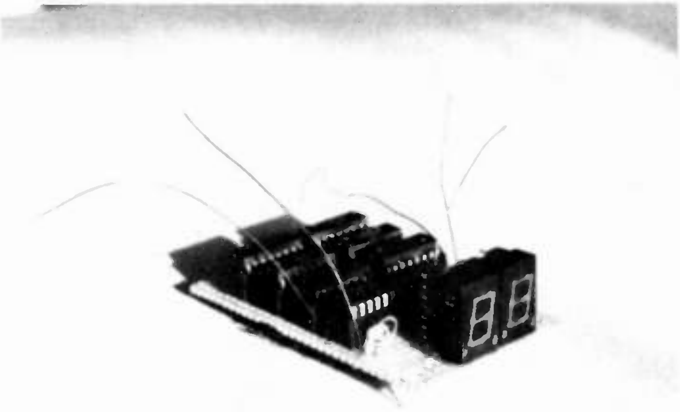
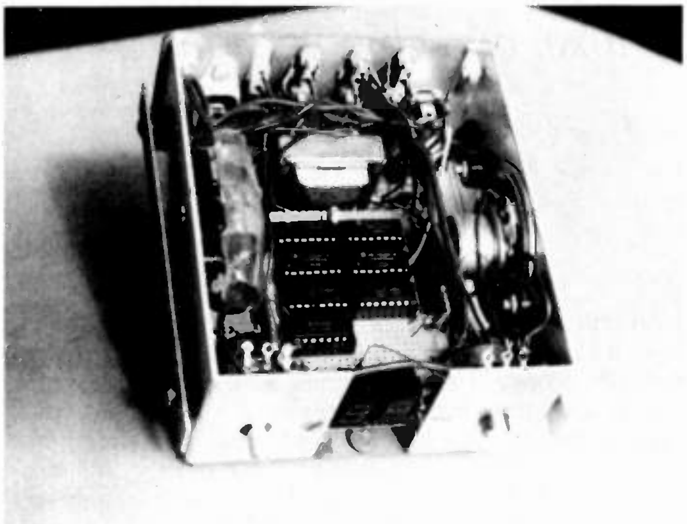


Fig. 1. Timing pulses appearing at various points in the circuit.



The completed counter board before mounting in the keyer.



The counter board is mounted using right-angle brackets and the mounting holes for the removed paddles.

lowing connections. The keyer clock pulse is obtained from point D on the keyer speed control. The 60-Hz signal is obtained from either side of the secondary of the power transformer and ground. The resistor values shown, R1 and R2, are for the Heath keyer. A convenient source for the 5 V dc is the speaker lead that is connected to the 5 V dc supply.

I replaced the neon on-off indicator lamp with an LED. I then connected the inputs of the remaining 1/4 IC5 to pin 12 of IC3 in the keyer, and the output to the LED; see Fig. 2. The LED lights up on the mark portion of the code character.

When sending code, the display of the speed will vary. You are seeing the average speed at which you were sending in that 1.2-second interval.

There are several methods of housing the display. I use a Bencher paddle with my keyer, so I removed the keyer paddles from the keyer and took out the center post. I then mounted a red lens over the opening. The display and circuitry are then mounted behind the lens using the mountings for the removed paddle assembly. ■

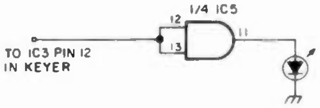


Fig. 2. LED mark indicator for keyer output.

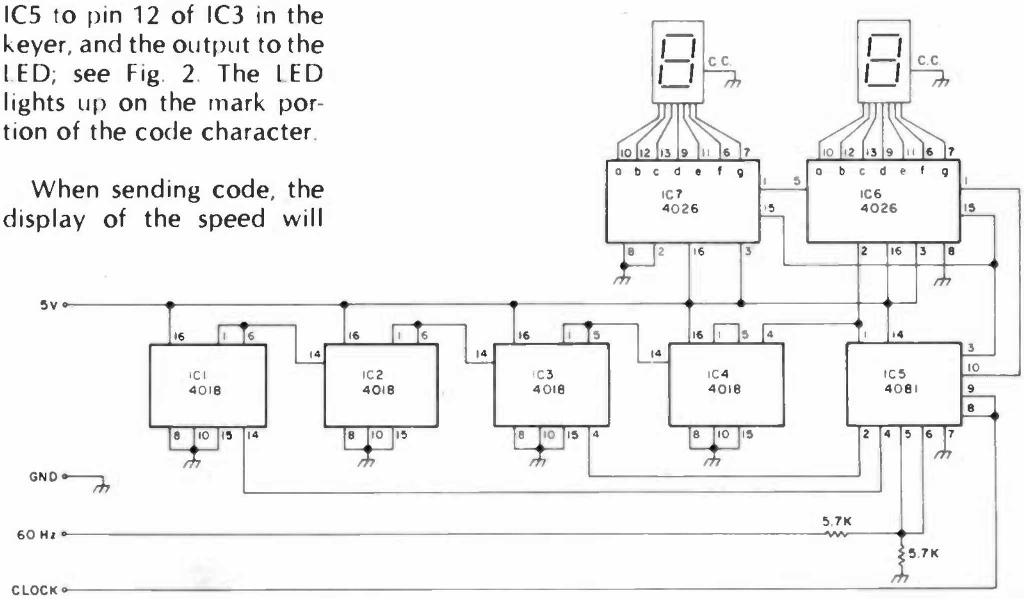


Fig. 3. Code-speed reader for the Heath 1410 keyer.

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Keyer on a Shoestring

Hams are cheap and so is this keyer.
Big spenders will build the deluxe, two-chip version.

Joel R. Donaldson WB5PPV
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Most great keyers aren't very cheap, and most cheap keyers aren't particularly great. However, here's a fair-to-good one you can build for around $10.00 using all new parts. If you've got any sort of junk box at all, it should cost you quite a bit less. It's not iambic or self-completing, it lacks contest memories, weight control, and a few other bells and whistles, but it is simple, draws very little current, fits nicely into a small package, and is capable of sending good, clean CW. A keying transistor and floating ground make it usable with just about every modern rig, and a sidetone circuit can be added easily if your rig lacks one. In short, it makes a good first keyer or a nice second circuit for the vacation or QRP set.

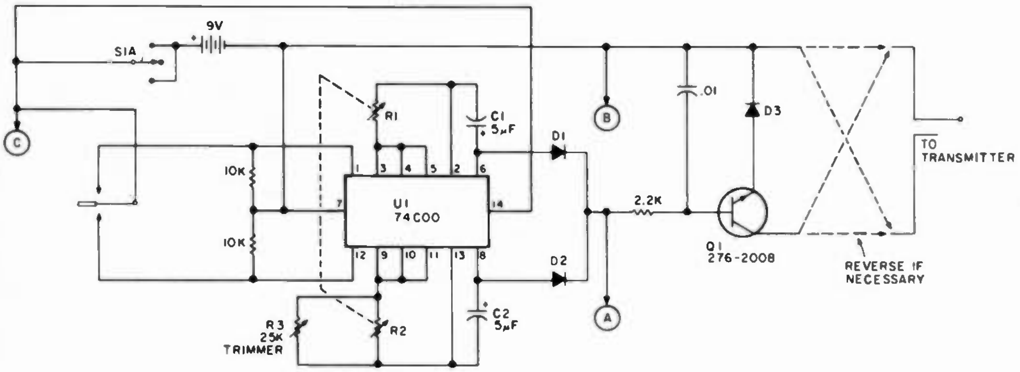


Fig. 1. One-chip keyer circuit. The entire circuit must be isolated from the enclosure. R1, R2—30k or 50k "stereo" linear taper dual pot. D1, D2, D3—any silicon diode. Q1 shown is a Radio Shack part number.

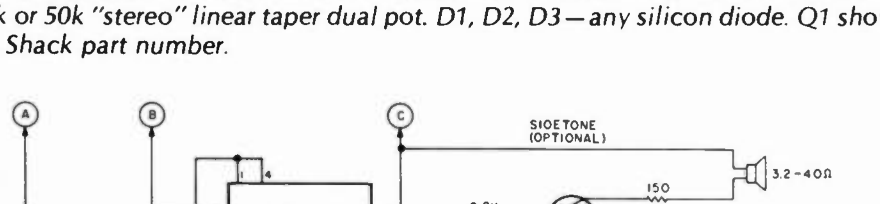


Fig. 2. Optional sidetone circuit connects to the keyer at points A, B, and C.

As shown in Fig. 1, the whole keyer is built around a 74C00 quad NAND gate which is connected to form two independent oscillators. The frequency of each oscillator is dependent upon a capacitor (C1 for one, C2 for the other) and a resistor (R1 for one, R2 for the other). By simultaneously varying R1 and R2, both oscillators can be sped up or slowed down, and a third resistor (R3) makes one of the oscillators run a fixed percentage faster than the other, thereby providing a definite dash-to-dot ratio. The output of both oscillators is connected to the sidetone (if used) and to Q1, the keying transistor, through D1 and D2, which prevent one oscillator from interfering with the other. Q1 conducts whenever either oscillator is in the "on" state, thus keying the transmitter in step with the oscillators.

The sidetone circuit (Fig. 2) also consists of a 74C00 connected as an oscillator, but with R and C values changed so as to produce an audio-frequency tone. The output of this oscillator is switched by Q2, which provides enough drive to power a small speaker. The pitch of the sidetone may be changed by using a slightly different value for R4. The sidetone circuit connects to the keyer at points A, B, and C.

I mentioned earlier that this circuit has a floating ground. As shown on the schematic, no connections are to be made to the keyer cabinet. This eliminates expensive and hard-to-find reed relays, lowers power consumption, and sidesteps the need to modify the keyer whenever a different transmitter is used. Also, it is suggested that you stick to a battery to power your keyer unless you are certain that your power supply is isolated from ground. When connecting the keyer for the first time, it may be necessary to reverse the two keyer output leads to prevent the transmitter from being keyed all the time (wrong polarity to Q1). After the correct way has been found, a connector can be soldered on.

Adjustment consists of merely trimming R3 until the dits are about one-third as long as the dahs. Once this has been done, it will probably never have to be done again, since this ratio stays about the same over a fairly wide range of keying speeds and battery voltages. However, if it is anticipated that several operators of widely varying proficiencies will be using the same keyer, it might be better to make R3 a front-mounted control or at least provide a hole in the cabinet for quick screwdriver adjustments.

It seems kind of pointless to blow a considerable amount of money on a keyer paddle when the actual circuitry costs so little, so I would like to suggest a rather unoriginal but appropriately frugal alternative. It consists of a short piece of steel packing strap or hacksaw blade sandwiched between two telephone switch or relay contacts. The packing strap or blade is scraped clean of all paint in the contact area, and a piece of paddle-shaped Plexiglas™ which protrudes through the front of the cabinet is bolted to one end. When the paddle is moved in either direction, the strap touches one of the contacts. The strap need not make a perfect connection for the keyer to operate, since the CMOS oscillators will operate even with several thousand Ohms of contact crud. The strips of phenolic that insulated the switch or relay before modification are used in the same application; they make sure that neither the strap nor the contacts make an electrical connection with the cabinet. Fig. 3 shows one possible arrangement for the entire keyer, including the paddle.

Rf shielding for this circuit is not too critical; the prototype worked fine with no case at the 100-Watt level. I used a 1- by 1½-inch piece of perfboard for the keyer circuit, and the sidetone was added as an afterthought on another small piece of board. A center-off switch was used to control both the keyer power and sidetone, as the HW-101 already has a sidetone built in.

With the cost of amateur radio equipment what it is today, CW just has to offer one of the best potentials for having a lot of fun without spending a lot of money. Vintage CW rigs abound on the used market, and a good QRP rig can be purchased new without going too far into debt. Costing about as much as a cheap microphone, this circuit reflects the same spirit of fun on a shoestring. Use and enjoy. ■

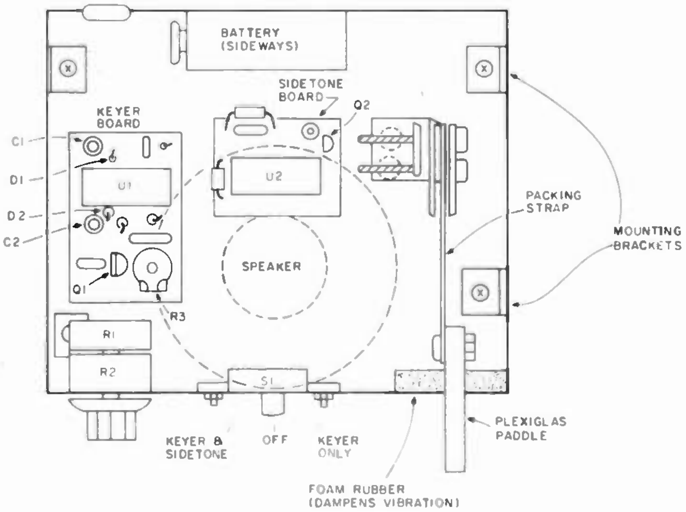


Fig. 3. Typical arrangement of circuit boards, controls, and paddle.

✓See List of Advertisers on page 130

Paul M. Danzer N1II
2 Dawn Road
Norwalk CT 06851

I Got My Ticket! Now What?

A look at what Elmer forgot to tell you.

For many recently licensed hams, trying to operate a new ham station is just as difficult as learning the code or studying for the written exams. Anyone who has ever been involved in a licensing class knows people who have gotten licenses and set up stations, but never quite made any contacts on the air. New hams have many questions about operating. The following are some of the more common ones.

Local Time	80	40	Band 20*	15	10
6:00 am					
9:00 am			DX		
Noon			DX	DX	
3:00 pm	Local		DX	DX	DX or Local
6:00 pm	Local/ Ragchew	Local/ Ragchew	DX	DX	DX or Local
9:00 pm	Crowded	Crowded	DX/ Crowded	DX	Local/ Ragchew
Midnight	Ragchew	Crowded	DX/ Crowded		

***If allowed by license class**

Fig. 1. "Best bet" operating frequencies for a newcomer (1981-82).

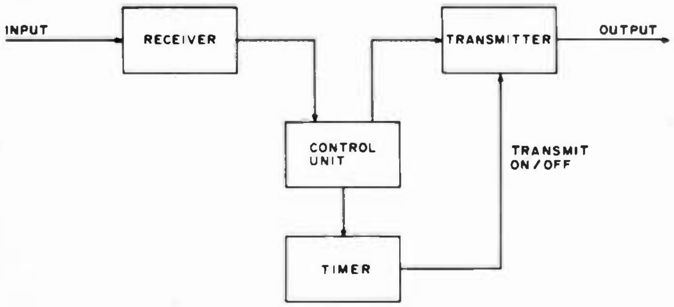


Fig. 2. Typical repeater.

I have had my station set up for a month and have managed to make just one contact. How come?

Let's assume your rig is working. The problem could be where and when you are trying to operate. For example, on a Friday or Saturday night, 80 and 40 meters (Novice band) are jammed and just about everyone has a problem. If you try 10 meters and the band is closed, you still won't work anybody. The trick is to pick a band and a time when there are a number of stations on, but the QRM is not overwhelming. Try 40 meters in the late afternoon, 15 in the early evening, or 10 on a Sunday afternoon (see Fig. 1).

Should I call CQ or just listen?

Use common sense. If you tune around for a few minutes and don't hear anyone calling, you can try a CQ, but pick a quiet frequency and limit your CQ.

Why limit it? I thought the traditional 3×3 or even a 3×4 was a good idea.

Look at it from the listener's point of view. If I hear you calling CQ for a long period of time and get tired of listening to you call, I won't want to reply to you. If you are that boring with a CQ, think how boring you would be in a QSO. With today's equipment, just call "CQ CQ CQ de WA1WTB WA1WTB," repeat once, and then K. If there is no answer, you can always try again.

You said to pick a quiet frequency. How can I tell if no one is using it?

Assuming you don't hear anything, just send QRL or IE. On voice, say "Is this frequency in use?" If there is no reply, you are perfectly correct to assume you can transmit without bothering anyone.

Am I better off operating CW or SSB to start with?

I am not sure what you mean by "better off." Assuming license class is not a consideration (you have more than a Novice license), try operating both and see what you like. Sideband initially takes less effort to operate but the frequencies are more crowded during prime operating hours. You usually can do better with DX on CW without fighting everyone's kilowatt.

FREQUENCY	TRANSMITTER Preselect or Driver	Plate	Load	TUNER/MATCHBOX Input Cap	L	Output Cap
3700						
3750						
3800						
7000						
7050						
7100						
7150						
7200						
21000						
21100						
21200						

Fig. 3. Sample tuning chart.

What if I want to join a QSO that is already under way?

Let's be very blunt about it. In some cases, you won't be welcome. Hams are a cross section of people, no more and no less. However, on CW, a simple "BK" is enough to be invited in. On SSB, "May I join you? This is WA1WTB" or any English language equivalent is acceptable. Be careful of using "Break."

What is the problem with "Break?"

It used to be the normal and accepted way to break in but recently, especially on repeaters, "Break" or "Break Break" is used to indicate an emergency situation when you want to transmit in a hurry.

Is repeater operation different from other types of QSOs?

Yes. Almost every area or repeater is slightly different. It is a good idea to listen for a while before you get on a new repeater. Almost all are equipped with a timer which will cut you off if you talk for more than 1, 2, or 3 minutes, depending on the setting.

What controls the timer? I really don't want to get cut off in mid-sentence.

Some timers reset as soon as the repeater's receiver no longer receives a carrier. Others reset as soon as the repeater's transmitter shuts off. Some repeaters transmit a beep tone when the timer has been reset (see Fig. 2).

Why limit the time for transmitting?

The primary reason is to force a pause between transmissions, and to do so often enough to allow anyone who wants to join the QSO time enough to transmit his call. In addition, it allows mobile stations to get into the repeater without having to wait any longer than a minute or two.

Do mobile stations have a priority?

Usually yes—both on repeaters and elsewhere. First, they are limited by their motion as to how long they will stay in range. Second, they are more likely to have seen an emergency situation or to need directions or other aid. Good procedure again follows common sense—let a mobile in quickly to find out if he has a problem.

I hear a lot about "kerchunking" repeaters. What is the story here?

Kerchunking is a very common practice of pressing your mike button to see if your transmitted signal is strong enough to bring up a repeater. Since it is a transmission without identification, it is technically illegal but it is also generally a worthless test. Quite often you can be on the fringe area of a repeater and be able to bring the repeater up but be too noisy to copy.

Is there a better way?

Sure. Key your mike and identify by saying, "This is WB1AJG—is anyone around?" If you don't make the repeater, nothing is lost. If you do make the repeater and no one answers, it doesn't make any difference since you won't have anyone to talk to!

When I identify myself on a repeater, should I use phonetics?

With a little experience you will know the answer to that question for your own call. If it contains an F, S, or other easily confused letter, you can use phonetics, but it is not usually done unless the station you are talking to does not repeat your call correctly. The same holds true for signal reports—they are not usually given unless asked for or you wish to indicate a problem.

Which signal reports are usually given on repeaters? Q5 S9 does not seem appropriate.

Since the signal strength you are receiving is due to the repeater and not due to the station you are talking to, the best you can do is tell if you are copying OK ("full quieting") or noisy. Some hams will say "50% quieting" which indicates they are copying half noise and half signal, but this non-technical use of "quieting" is a wild guess at best.

What about reports on other bands or when you are not using a repeater?

I suggest telling the truth. On CW, if you had a transmitter problem and your tone was not T9 or perfect, wouldn't you want the other guy to tell you? The

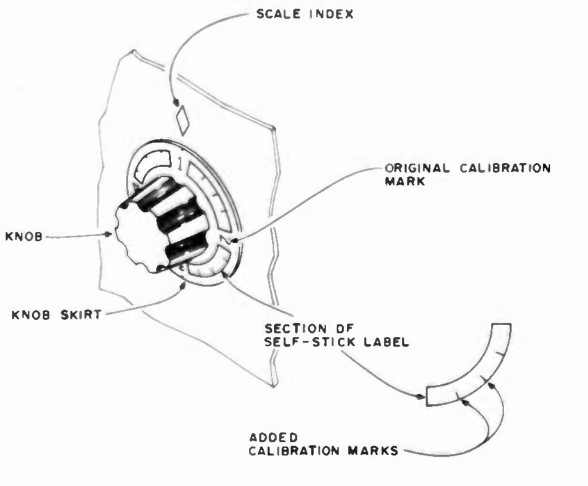


Fig. 4. Adding calibration marks to a skirt-type knob.

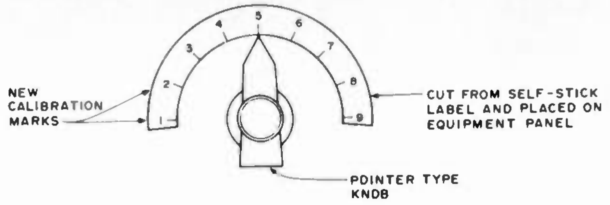


Fig. 5. Adding calibration marks to a pointer-type knob.

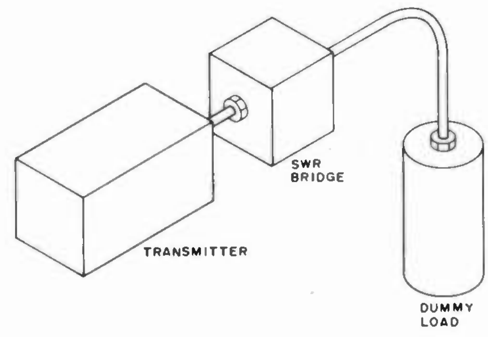


Fig. 6. Step 1: Tune up the rig into a dummy load.

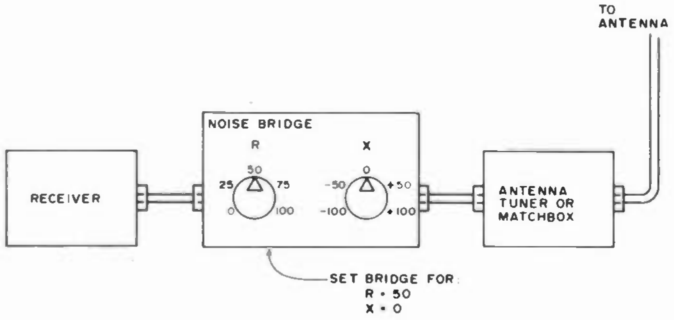


Fig. 7. Step 2: Adjust tuner to provide a 50-Ohm load.

same holds for asking the other ham to QRS or slow down.

Frankly, I was hesistant to ask. Won't a request to QRS brand me as a beginner?

Possibly, but we were all beginners once. Besides, what is the sense of sending "R" (I have solid copy) when you don't have the foggiest idea what the other station was talking about? I would rather be considered a ham who just is not too fast on CW than the character who sends: "R R R solid copy here OM please repeat your name, QTH, and my report." Besides, there are real ways to be branded a beginner.

For example?

Break into an emergency net when you cannot contribute anything. Keep making unsolicited, helpful suggestions to the station controlling the situation. An experienced ham would say nothing and listen carefully. If the net control station wants help, he will ask for it specifically.

Any other common things to avoid?

Sure. If you want to sound silly in the middle of a QSO, give out with an extended "H-E-L-L-O-O-O-O" to check your plate current or output power. Think how you must sound on the other end. If you feel absolutely compelled to make a check in mid-QSO, simply say to the other guy, "excuse me," put your rig in tune, and make a quick check. However, putting out a carrier for an extended period of time is a great way to be unpopular and cause unnecessary QRM. Besides, it's pretty rough on your finals.

I guess I don't understand. If I have to tune my rig and match it to the antenna, I have to transmit a carrier.

Yes, but you don't have to transmit it for very long. There are at least two ways to handle this problem. The first is to make up a tuning chart for your rig (and antenna tuner if you use one). Record the dial readings as you tune up every 50 or 100 kHz. Now, when you change frequency from one end of the band to the other, just set your knobs to the chart and you will only have to tweak them slightly to tune up, which can be done in 2 or 3 seconds (see Fig. 3).

Some of the knobs on my rig have calibration marks every quarter of a revolution. Is this good enough to allow me to preset them?

Probably not, but you can ink-in additional lines on the knob or use sections of self-stick labels. Place a small piece of self-stick label on the knob skirt (Fig. 4) or on the panel (Fig. 5) with the additional calibration marks inked in. Plain white paper fastened with rubber cement is also durable and easily removed later. If you draw lines on the paper or labels, you can protect them with artist's fixative or varnish.

What is the second way of tuning up without transmitting a carrier for an extended period?

Actually you can tune up without transmitting a carrier at all. It takes three pieces of equipment: your swr bridge, a dummy load, and a noise bridge. First, connect your rig (Fig. 6) through the swr bridge to a dummy load, and at the frequency you want to operate, tune up your rig into the dummy load. Then, connect the noise bridge as shown in Fig. 7 and set the resistance control on the noise bridge to 50 Ohms and the reactance control to zero Ohms. Next, tune your antenna tuner or matchbox for a minimum noise as heard in your receiver. If you have a transceiver, be very careful not to transmit with the noise bridge in the line or it will go up in a very rapid puff of smoke.

Now, remove the noise bridge and reconnect the transmitter through the swr meter to the antenna tuner, and you are ready to operate. What you have done is tuned your transmitter to its design condition of maximum power out into a 50-Ohm load, and you have made the antenna tuner and antenna look like a 50-Ohm load. Connect the two (Fig. 8) and you are ready to transmit, with maximum power out. You can also use this technique to make up a tuning chart so that you have to go through the procedure only once for each 50- or 100-kHz band segment you like to operate in. ■

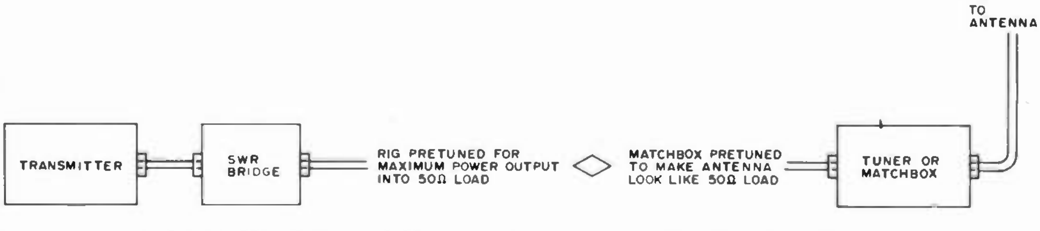
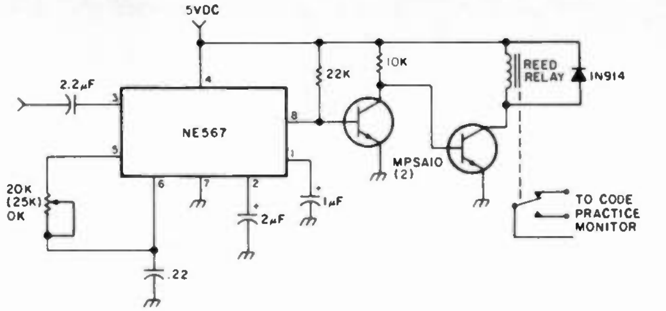


Fig. 8. Tuned up—without ever transmitting through the antenna.

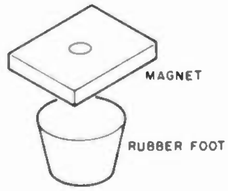
CIRCUITS

Do you have a technique, modification, or easy-to-duplicate circuit that your fellow readers might be interested in? If so, send us a concise description of it (under two pages, double-spaced) and include a clear diagram or schematic if needed.

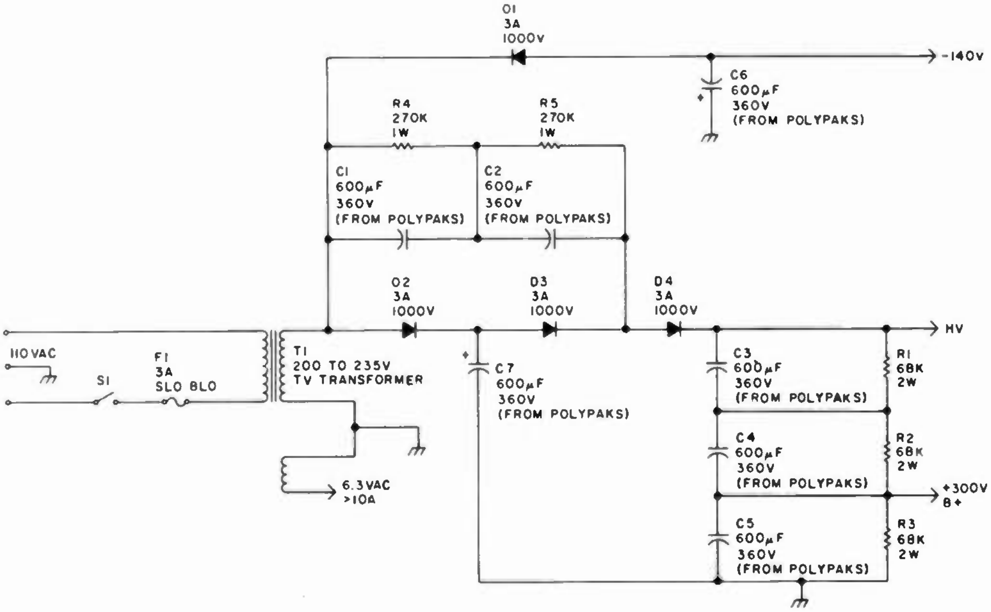
In exchange for these technical gems, 73 offers you the choice of a book from the Radio Bookshop*, to be sent upon publication. Submit your idea (and book choice) to: Circuits, Editorial Offices, 73* Magazine, *Peterborough NH 03458. Submissions not selected for publication will be returned if an SASE is enclosed.*



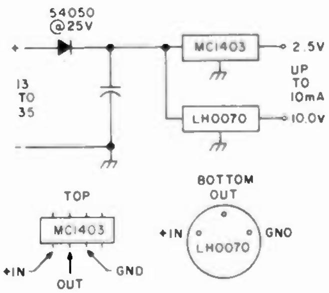
CW FILTER: This filter features a 40-Hz bandwidth and no ringing. To use it, tune your receiver so that the code-practice oscillator duplicates the signal you want to copy.—Ronald Folkert, Benton Harbor MI.



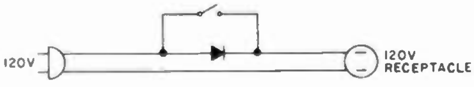
REMOVABLE MAGNETIC FEET: Gear such as Drake's TR-22C is fine for mobile or portable use but often lacks refinements like rubber feet that make it suitable for use in the shack. My solution to this deficiency was to epoxy several small magnets to some rubber feet and then stick them to the bottom of the radio. When the rig goes portable, just remove the feet. If you don't have any magnets handy, you can remove some from the magnetic cabinet latches sold in hardware stores.—Thomas Hart AD1B, Westwood MA.



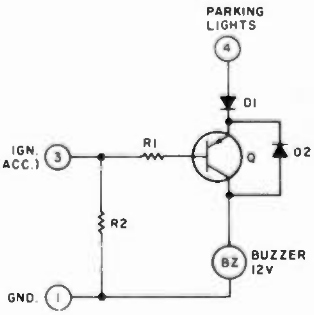
SUBSTITUTE TRANSFORMER FOR HEATH GEAR: The power transformer found in many newer TV sets can be used with a voltage-doubler circuit to provide up to 450 volts dc, as well as bias and filament voltages. I used this approach to replace the transformer in a Heathkit HX-10; it also should be suitable for the SB and HW series of Heath radios. (Note: Your rig's wiring may need to be modified if it has 12-V filaments.)—Terry Martin, Carrollton GA.

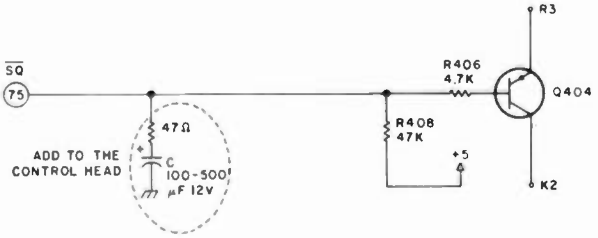


SIMPLE VOLTAGE STANDARD: This circuit gives you a voltage standard to check your VOM or electronic voltmeter. The MC1403 will deliver 2.5 volts while the output of the LH0070 is 10 volts. Both sources are accurate to one percent or better. You can get other voltages by using different members of the MC140X and LH007X precision regulator series. The diode can be anything rated over 40 mA and 60 volts piv.—J. T. Miller N6BM, Yucaipa CA.



HEAT CONTROL FOR A SOLDERING IRON: This handy circuit allows you to reduce the temperature of a soldering iron. Just place a diode in series with one side of the ac line. You can easily switch the control in and out by shorting the diode. The polarity of the diode doesn't matter. I used a 1N2070 diode rated at 400 volts, 0.75 Amperes. Any similar diode will do.—H. H. Hunter W8TYX, Columbus OH.





SCAN DELAY FOR THE AZDEN 2000: By adding a capacitor and resistor to the Azden 2000's control-head circuitry, you can have a delay before the receiver resumes scanning. There is approximately one second of delay for each 100 uF of capacitance added.—Hiam Sandel KB2IV, Flanders NJ.

HEADLIGHT REMINDER: If your headlights or parking lights are on, there will be 12 volts on terminal 4. If the ignition is off, terminal 3 will be at ground. When these two conditions are met, the transistor is turned on and the buzzer sounds. KA5CRI/9 suggests that this circuit can be built into a surplus seat-belt buzzer.—Steve Stout KA5CRI/9, Palatine IL.

FUN!

John Edwards KI2U
78-56 86th Street
Glendale NY 11385

CW REMEMBERED

Like it or not, we are witnessing the twilight of the CW era. After more than a century as a mainstay of electrical and electronic communication, CW is on the way out.

I make this statement purely as a rational observation. Nobody (including Wayne) has forced me to this conclusion. Just look at the facts. Thanks to microelectronics, radiotelephone transceivers need be no larger in size than CW-only rigs. Computer generated digital communication has now reached a point where it is inexpensive and portable. It's also faster and more reliable than code. CW—except as a means of personal enjoyment—is washed up.

Apparently, the FCC agrees with this point of view. Shortly you'll see the Commission remove the CW requirement from the Tech license. After that, it's just a matter of time (the year 2000 sounds good) before the feds eliminate all code requirements. In an age of 1s and 0s, dits and dahs don't make sense. Just as CW replaced spark, computerized communication techniques will replace CW.

By now your getting the feeling that I hate CW. Not at all. I've pounded the brass with the best of them. It's just that I, like most true radio amateurs, look forward to new challenges. And CW, while fondly remembered, should be relegated to the dusty attic of ham-radio history.

This month, we look back at CW and reflect upon the contributions it has made to our hobby. And if any of you have anything to say about what I've written about CW, remember: I passed a 20-wpm code test. Can you say the same?

ELEMENT 1—CROSSWORD PUZZLE
(Illustration 1)

Across

1) What the "wave" in question is
6) As opposed to amateur (abbr.)
8) QRN silencer (abbr.)
9) Hams can't be this
11) FCC rule section
13) Not down
14) Telegrapher's slang for shift
16) Slash
17) 3.14
18) CW term of affection
19) CW chuckle
20) Learning code is this
22) Ham organization
24) ARRL's Stan
25) Jammer
26) Some say CW does this
29) ARRL brasspounding position (abbr.)
30) No code ops?

Down

1) Points on a key
2) Pressing a key
3) Weak signal place to noise
4) Early code mode
5) CW subband location
7) US President's initials
10) End of message (abbr.)
12) A bug is semi-________
14) Weary while sending
15) CW noises
21) Old 160 bother
23) Vibroplexes
24) Sometime key plating
25) On-air organization
27) Negative charge
28) Traffic organization (abbr.)

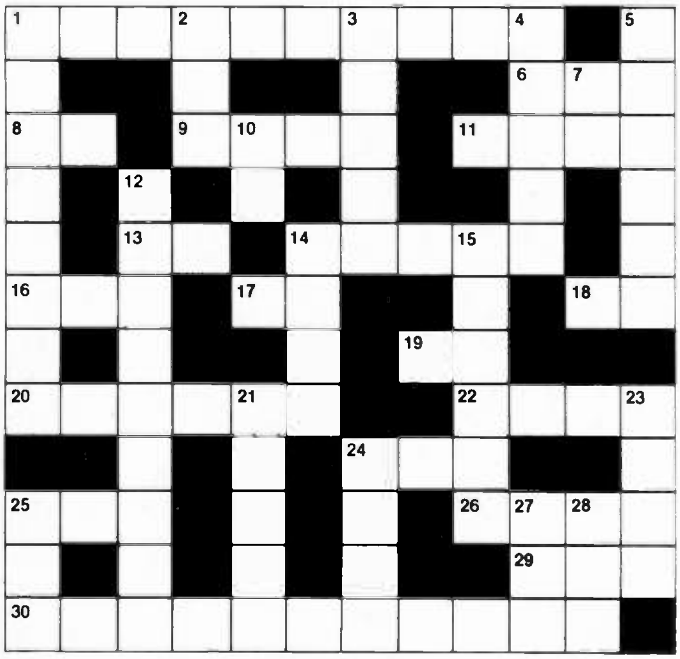


Illustration 1.

ELEMENT 2—MULTIPLE CHOICE

1) Samuel F. B. Morse, father of telegraphy, was a man of many talents. At the time he invented the telegraph, what was his profession?
   1) Professor of art at New York University
   2) Electrical engineer
   3) Lab assistant to Thomas Edison
   4) Professor of theology at Yale

2) What were the first words transmitted via code?
   1) Testing one, two, three.
   2) Hello, Watson. Can you hear me?
   3) Greetings from the President.
   4) What had God wrought!

3) The inventor of the Vibroplex semiautomatic key was:
   1) Hugo Gernsback
   2) Horace G. Martin
   3) Thomas Edison
   4) Clarence Tuska

4) What did Hiram Percy Maxim name his favorite spark transmitter?
   1) Sparky
   2) Old Betsy
   3) Little Darling
   4) The ARRL Special

5) What device was used on telegraph lines to create an audible sound at the receiving end?
   1) Heterodyne beater
   2) Sounder
   3) Beat-frequency oscillator
   4) Mechanical audio oscillator

ELEMENT 3—TRUE-FALSE

	True	False
1) C. W. McCall was the inventor of "continuous waves."	______	______
2) Samuel F. B. Morse invented the continental code.	______	______
3) The initials F. B. in Morse's name stood for "Fine Business."	______	______
4) It's legal to send continental code on US ham frequencies.	______	______
5) The FCC officially banned spark transmissions in 1954.	______	______
6) Our end of message signal—AR—is nothing but the American Morse letters FN meaning "Finish."	______	______
7) The "Glass Arm" is the top award presented by the Society of Wireless Pioneers.	______	______
8) Barry Goldwater K7UGA is the ham who introduced the League's "Tune in the World" CW practice tape.	______	______
9) The first memory keyer used six relays.	______	______
10) At one time, the Extra-class ticket required proficiency at 25 wpm.	______	______

ELEMENT 4—SCRAMBLED WORDS

GUB
CCNOTTA
YREKE
BONK
GRINSP
SIFT
IGHTEWING
YEKDROAB
KCILC
DESEP

THE ANSWERS

Element 1:
See Illustration 1A.

Element 2:
1—1 They always said that learning the code was an art.
2—4 Funny, Morse didn't include God as a co-inventor in his patent.
3—2 What! you didn't know this one?
4—2 The League still has it in its museum.
5—2 Click. Click-click. Click.

Element 3:
1—False. He wrote that crummy CB "Convoy" song.
2—False. American.
3—False. Finley Breese.
4—True. Why not? It's the one the FCC tests us on.

5—False. 1927.
6—True. You learn something new every day.
7—False. A "glass arm" is a weary arm.
8—False. Jean Shepherd K2ORS did the honors.
9—True. Developed in 1953, the "Ultimatic" used six relays. No microchips then.
10—False. It has always been pegged at 20.

Element 4:
(Reading from left to right) BUG, KNOB, KEYBOARD; CONTACT, SPRING, CLICK; KEYER, FIST, SPEED; WEIGHTING

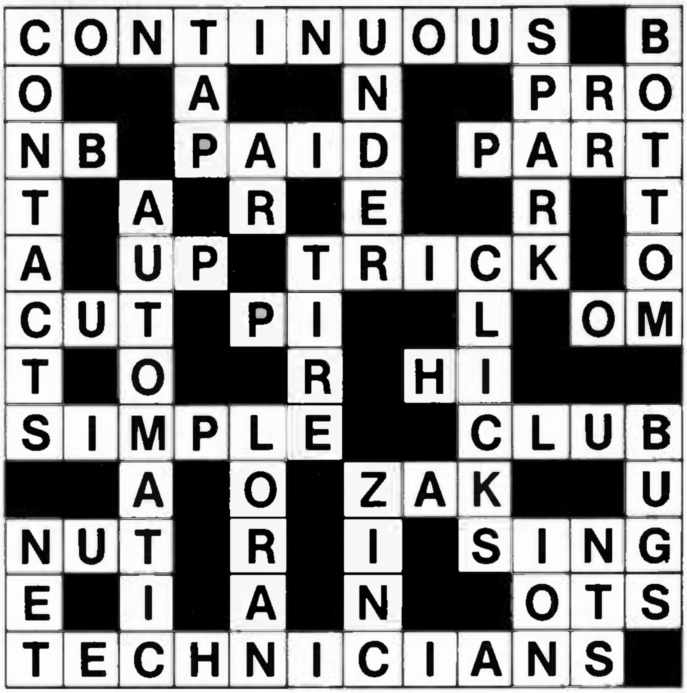


Illustration 1A.

SCORING

Element 1:
Twenty-five points for the completed puzzle, or one-half point for each question correctly answered.

Element 2:
Five points for each correct answer.

Element 3:
Two and one-half points for each correct answer.

Element 4:
Three and one-half points for each correct answer.

How well do you remember CW?

1-20 points—Not at all
21-40 points—Vaguely
41-60 points—Failed 13 wpm twice
61-80 points—CW buff
81-100 + points—A1 Op Club Member

HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time from other duties to decipher cryptic notes scrawled illegibly on dog-eared post cards and odd-sized scraps of paper. Please type or print your request (neatly!), double spaced, on an 8½" x 11" sheet of paper and use upper- and lowercase letters where appropriate. Also, please make a "1" look like a "1," not an "l," which could be an "el" or an "eye," and so on. Hard as it may be to believe, we are not familiar with every piece of equipment manufactured on Earth for the last 50 years! Thanks for your cooperation.

I need an L6 passband tuning coil (part #K42031-1) and an L1 bifilar coil (part #K42032-1). Both are for the Hallicrafters HC-10 converter. Call me collect at (907)-733-2447 or contact me at the address provided.

Jack Norris
Box 321
Talkeetna AK 99676

I am looking for a meter for a Knight-kit VTVM made by Allied Radio Corporation and a meter for a Simpson 260 VOM (20,000 Ohms-per-volt). Anyone having either of these two items, please contact me.

Guy A. Elder WB5JEV
1316 Main Street
West Point KY 40177

I need the schematic diagrams and owner's manual for the Knightkit T-150A transmitter and the R-100A receiver. I will pay all postage and copying costs.

Antonio V. Villaneuva
c/o Mrs. Erlinda V. Pastrana
7218 Belinger Court
Springfield VA 22150

I need the schematic and manual for a Knightkit color pattern generator, model KG-685. I will pay for copying and postage. Thank you.

John C. McKee
1127 Vernie
Alton IL 62002

Does anyone have a recent list or roll tube chart for the Hickok 539B tube tester? It should be no more than 2 or 3 years old if possible.

Marvin Moss W4UXJ
Box 28601
Atlanta GA 30328

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CIRCUITS

Do you have a technique, modification, or easy-to-duplicate circuit that your fellow readers might be interested in? If so, send us a concise description of it (under two pages, double-spaced) and include a clear diagram or schematic if needed.

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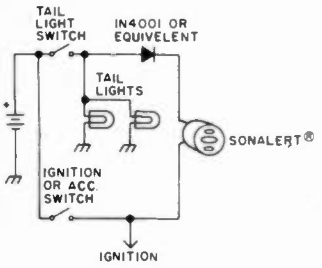
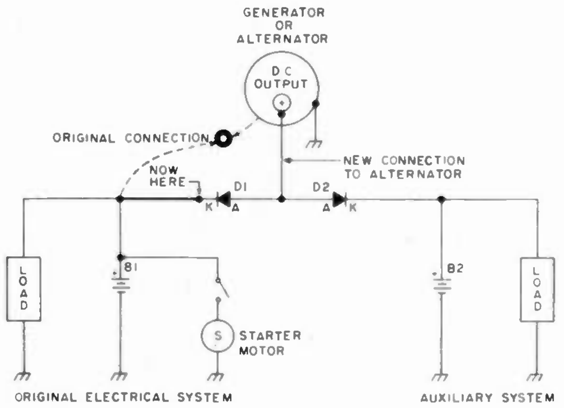
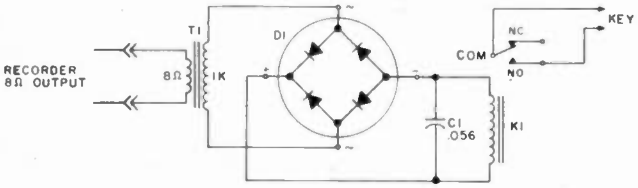


SIMPLIFIED HEADLIGHT REMINDER ALARM: The circuit uses just two components, one silicon diode and one Sonalert™ (4-28 V dc). Both of these items can be purchased surplus. The diode is a prevention device, protecting the signaling device and ensuring that the ignition switch is isolated from the circuit.—Richard S. Shepard AI5H, San Antonio TX.



DC AUXILIARY SYSTEM WITH ISOLATION: Presented here is a simple auxiliary battery system. Battery B2 is isolated from the primary battery by diode D2, and D1 is protected as well. Both diodes should be at least 40 Amperes forward current, and 50 to 100 piv. A heavy wire from the junction of the two anodes connects to the charging device terminal. Do not rewire so that D1 is between the battery and the starter motor.—A. W. Edwards K5CN, McAllen TX.



AUTOMATIC CQ CALLER: Record and send CQ or CQ DX—or any message—cheaply and easily. Begin by recording your message on a cassette tape. This recording will be used to drive the circuit. Mount the full-wave bridge astride the relay (K1). Solder the + and common leads to the coil leads. T1 is Superglued to K1. The assembly can be mounted inside a transceiver or outboard in a box. Wire the relay output to the keyjack. Install a jack to receive the audio output from the cassette. Endless-loop cassettes are available from Radio Shack. Five-minute cassettes are available from Pyramid Data Systems, 6 Terrace Ave., New Egypt NJ 08533.—Dave Nesbitt WD4AAW, Decatur GA.

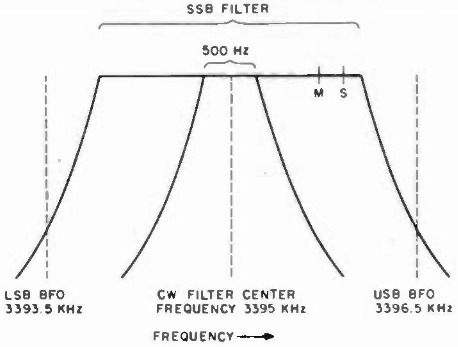


Fig. 1.

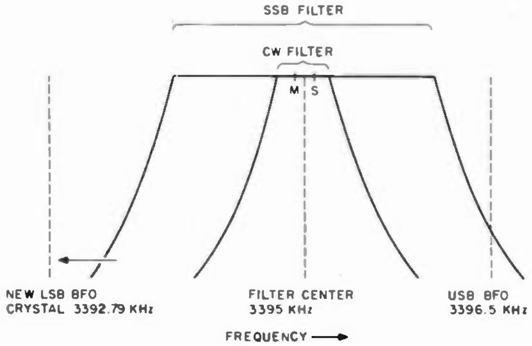


Fig. 2.

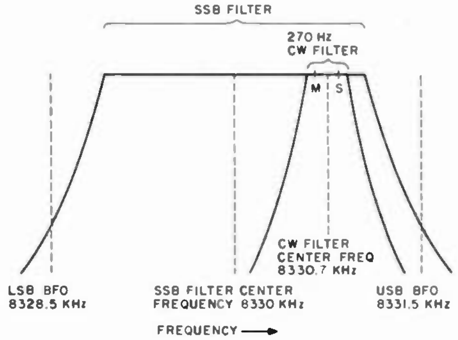
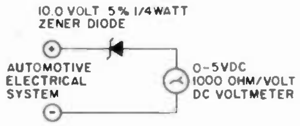


Fig. 3.

MODIFICATION TO THE KENWOOD TS-520S FOR AFSK: Fig. 1 shows the passband of the Kenwood TS-520S. By installing a crystal with a frequency of 3392790 Hz, the RTTY tones of 2125/2295 Hz will be right in the middle of the filters' respective passbands. See Fig. 2.

Fig. 3 shows the i-f filters. When installing the 270-Hz filter, follow the directions given in the manual except for the following: 1) install the filter in the SSB narrow position; and 2) jumper lead "A" to the "SSN" position and jumper lead "B" to the "SSB" position.

To set the filter, turn the switch to "CAL" and tune for a 2210-Hz tone (a scope is helpful, or else tune to a null on your RTTY tuning meter).—Richard Kulaga KA9EDX, Fond du Lac WI.



AN INEXPENSIVE EXPANDED-SCALE VOLTMETER: Use an unsealed 0-5-V-dc 1000-Ohm-per-volt meter movement. Solder a 10.0-volt, 5%, ¼-Watt zener diode to the positive meter terminal (this is located under the case). Use as short as possible a lead for good mechanical stability, observing zener polarity. Change the numbering on the meter face to 10-15 V dc. Use either a razor-pointed marking pen or dry-transfer numbers. Reassemble the meter and test it before installing it in your car. To ensure greatest accuracy, pre-check the zener and make certain that it is as close as possible to 10.0 volts.—Alan Christian WA6YOB, San Jose CA.

SOCIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received at 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices, 73 Magazine, Pine Street, Peterborough NH 03458.

DEARBORN MI
NOV 4

Encon Corporation, in cooperation with Solarex Corporation, will provide a free photovoltaic (electricity from the sun) seminar at 7:30 pm on November 4 at the Dearborn Hyatt Regency, Dearborn MI. A talk on the history, production, and applications of solar cells will inform and educate all those who attend. For reservations, contact Encon Corporation, 27584 School Craft Rd., Livonia MI 48150; (313)-261-4130.

SOUTH GREENSBURG PA
NOV 6

The Foothills Amateur Radio Club will hold its annual Swap and Shop on Saturday, November 6, 1982, at St. Bruno Church, South Greensburg PA. Tickets are $2.00 each or 3 for $5.00. There will be an indoor flea market and food. Talk-in on 146.07/.67 and .52/.52. For more details, contact Mario Carrerra W3TTN, or write FARC, PO Box 236, Greensburg PA 15601.

SELLERSVILLE PA
NOV 7

The R. F. Hill ARC will hold its 6th annual hamfest on November 7, 1982, in the Sellersville National Guard Armory, Sellersville PA. Doors will open at 7:00 am for sellers and 8:00 am for buyers. There will be refreshments and heat. Talk-in on .28/.88 and .52. For further information, contact R. F. Hill ARC, Box 29, Colmar PA 18915.

CONCORD NC
NOV 7

The Cabarrus Amateur Radio Society, Inc., will hold its annual hamfest on November 7, 1982, from 9:00 am to 5:00 pm, at the Concord Boys Club, Spring Street, Concord NC. Admission tickets are $2.50 in advance, $3.00 at the door. Flea-market tables are $4.00; table space is $2.50. There will be bingo for the ladies, speakers, and forums. Hot food, beverages, and free parking will be available. Talk-in on 146.655. For advance tickets, flea-market tables, or space, send a check to CARS, PO Box 1290, Concord NC 28025.

NORTH HAVEN CT
NOV 7

The Southcentral Connecticut Amateur Radio Association's (SCARA's) third annual electronics flea market will be held on Sunday, November 7, 1982, indoors at the North Haven Recreation Center on Linsley Street in North Haven CT. Regular admission is $1.25; children under 12 with an adult will be admitted free. Sellers' spaces are $6.00. The best spaces will be assigned first. A limited number of free tables will be provided to the first reservations received. When those tables are gone, space will be available for selling from the floor or from your own table. Food will be available. Sellers may set up at 8:00 am, and walk-ins will be admitted from 9:00 until 3:00. For reservations, send check or money order payable to "SCARA" to Ed Goldberg WA1ZZO, 433 Ellsworth Avenue, New Haven CT 06511. Include an SASE for confirmation.

BANGKOK THAILAND
NOV 12-14

The Radio Amateur Society of Thailand (RAST) will hold the 12th annual South East Asia Network Convention (SEANET 82) on Friday, Saturday, and Sunday, November 12-14, 1982, at the Imperial Hotel, Bangkok, Thailand. There will be lectures, discussions, and commercial exhibits. For more details, contact RAST Secretary, PO Box 2008, Bangkok, Thailand.

NEWMARKET ONT CANADA
NOV 13

The York Region ARC will hold its annual flea market on Saturday, November 13, 1982, from 0800 to 1400 EST, at the Newmarket Community Centre, Newmarket, Ontario. Doors will open at 0630 for exhibitors. General admission is $2.00 (children will be admitted free of charge if accompanied by an adult). Refreshments will be available. Exhibitors' tables are $2.00 each. Talk-in on 142.52 (VE3YRA) and 147.225/.825 (VE3YRC).

FORT WAYNE IN
NOV 14

The Allen County Amateur Radio Technical Society, Inc. (AC-ARTS), will hold the 10th annual Fort Wayne Hamfest on November 14, 1982, at the Allen County Memorial Coliseum, Fort Wayne IN. Admission is $2.50 in advance and $3.00 at the door; children under age 11 will be admitted free. Regular tables are $6.00 and premium tables are $20.00. The Coliseum charges a $1.00 parking fee. Doors will open to the general public at 8:00 am and for vendor setups at 5:00 am. For further ticket or table information, write Becky Skinner KA9GWE, 9720 Pinto Lane, Fort Wayne IN 46804.

BILLERICA MA
NOV 20

The Honeywell 1200 Radio Club and the Waltham Amateur Radio Association will hold their annual amateur radio and electronics auction on Saturday, November 20, 1982, at the Honeywell Plant, 300 Concord Road, Billerica MA (exit 27 off route 3). Doors will open at 10:00 am and admission and parking are free. There will be a snack bar and a bargain parts store. Talk-in on 147.72/.12 and 146.04/.64. For more information, contact Doug Purdy N1BUB, 3 Visco Road, Burlington MA 01803.

CANTON OH
NOV 21

The Massillon Amateur Radio Club (W8NP) will present Auctionfest '82 on November 21, 1982, at the Nazir Grotto Hall, 6th and Dueber Avenue SW, Canton OH. Advance tickets are $2.50; at the door, $3.00. Doors will open at 7:00 am for setups and 8:00 am for others. The auction will start at 11:00 am. Talk-in on 146.52. For advance tickets or tables, contact Steve Nevel WD8MIJ, 1864 Massachusetts Avenue SE, Massillon OH 44646.

GREENSBORO NC
NOV 27-28

The Greensboro Amateur Radio Club will hold the second annual Greensboro Hamfest on November 27-28, 1982, at the National Guard Armory, Greensboro NC. The hours will be 9:00 am to 5:00 pm on November 27th and 9:00 am to 3:00 pm on November 28th. Pre-registration before November 12, 1982, is $3.00 and registration at the door is $4.00. There will be tables and tailgating available. Talk-in on 145.25, .19/.79, and .52. For pre-registration (please include an SASE) or more details, contact Russ Brandt KE4KL, 1301 Dayton Street, Greensboro NC 27407.

STONY BROOK LI NY
NOV 28

The Radio Central Amateur Radio Club will hold its fourth annual Ham-Central, 1982 edition, on Sunday, November 28, 1982, in the main social hall of Temple Isaiah, 1404 Stony Brook Road, Stony Brook LI NY (about 50 miles east of New York City). Doors will open at 7:30 am for sellers and dealers and at 8:30 for the general public. Admission is $2.00 and XYLs and children under 12 will be admitted free. Nine-foot tables are $5.00 each and half tables are $3.00. Features will include an updated antenna lecture by Art (W2LH) and Madeline (W2EEO) Greenberg, home-cooked hot food, and drinks. Talk-in on 144.550/145.150 (WA2UEC) and 146.52. For additional information, maps, and advance reservations, contact Scotty Policastro KA2EQW, 80 7th Street, Bohemia NY 11716, (516)-589-2557, or Bob Yarmus K2RGZ, 3 Haven Court, Lake Grove NY 11755, (516)-981-2709.

HAZEL PARK MI
DEC 5

The 17th annual Hazel Park Amateur Radio Club Swap and Shop will be held Sunday, Dec. 5, at Hazel Park High School, Hazel Park MI. Hazel Park High School is located on Hughes Street at 9½ Mile Rd., 1 mile east of I-75. Tickets are $1.50 in advance or $2.00 at the door. Tables are $1.00 per foot. Doors open at 8:00 am. Plenty of food and parking will be available. Talk-in on 146.52. For tickets, table reservations, and information, send an SASE to Hazel Park Amateur Radio Club, PO Box 368, Hazel Park MI 48030 or telephone (313)-398-3189.

✓See List of Advertisers on page 130

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

ALARA CONTEST

Starts: 0001 GMT November 13
Ends: 2359 GMT November 13

Sponsored by the Australian Ladies' Amateur Radio Association, the contest is open to all licensed operators and SWLs throughout the world. YLs work everyone, OMs work YLs only. All bands may be used, phone and CW combined. Each station may be worked twice on each band—once on phone and once on CW. All contacts must be made in accordance with operator and station license regulations. No net or list operations, no crossmode, and no repeater contacts may be claimed.

EXCHANGE:

ALARA members send RS(T), serial number starting with 001, and ALARA number and name. Others (YL nonmembers or OMs) send RS(T), serial number starting with 001, and name.

FREQUENCIES:

Phone—3570-3590, 7100-7120, 14280-14300, 14180-14200, 21350-21370, 21180-21200, 28480-28520.
CW—3525-3535, 7010-7020, 14050-14060, 21125-21135, 28100-28110.

SCORING:

On phone—10 points for ALARA club stations contacted (VK2DYL or VK3DYF), 5 points for ALARA members, 3 points for YL non-members, 1 point for OMs.
On CW—double all point values shown for phone.
For SWLs—5 points for ALARA members logged and 3 points for YL nonmembers logged.

AWARDS:

Certificates will be awarded to the top scoring ALARA member in each country and VK call area; top scoring YL nonmember, OM, and SWL on each continent; and the top scoring VK Novice.

ENTRIES:

Send a single log containing date/time in GMT, band, mode, callsign worked, report and serial number sent/received, name of operator of station worked, and points claimed. Logs must be signed and should show full name, callsign, and address of operator along with final score claimed. Logs must be legible, either typed or printed, no carbon copies please. No logs will be returned and the decision of the contest manager will be final. Logs must be received by the contest manager by Dec. 31st. Address entries to: Mrs. Margaret Loft VK3DML, 28 Lawrence St., Castlemaine, Victoria, Australia 3450.

EUROPEAN DX CONTEST—RTTY

Starts: 0000 GMT November 13
Ends: 2400 GMT November 14

Sponsored by the Deutscher Amateur Radio Club (DARC). Only 36 hours of operation out of the 48-hour period are permitted for single-operator stations. The 12 hours of nonoperation may be taken in not more than three periods at any time during the contest. Operating classes include: single operator/allband and multi-operator/single transmitter. Multi-operator/single transmitter stations are only allowed to change band one time within a 15-minute period, except for making a new multiplier. Use all amateur bands from 3.5 through 28 MHz. A contest QSO can be established between all continents and also one's own continent. However, QSOs as well as QTC traffic with one's own country are *not allowed!* Each station can be worked only once per band.

EXCHANGE:

Exchange the usual six-digit number consisting of RST and progressive QSO number starting with 001.

SCORING:

Each QSO counts 1 point. Each QTC (given or received) counts 1 point. Multipliers will be counted according to the European and ARRL countries list. The multiplier on 3.5 MHz may be multiplied by 4, on 7 MHz by 3, and on 14 through 28 MHz by 2. However, contacts within the same continent only count as a multiplier of one per band (including 80 and 40 meters). The final score is the total QSO points plus QTC points multipled by the sum total multipliers.

QTC TRAFFIC:

Additional point credit can be realized by making use of the QTC traffic feature. A QTC is a report of a confirmed QSO that has taken place earlier in the contest and later sent back to another station—the general idea being that after a number of stations have been worked, a list of these stations can be reported back during a QSO with another station. An additional 1 point credit can be claimed for each station reported.

A QTC contains the time, call, and QSO number of the station being reported, i.e., 1300/DA1AA/134. This means that at 1300 GMT you worked DA1AA and received number 134. A QSO can be reported only once and not back to the originating station. A maximum of 10 QTCs to a station is permitted. You may work the same station several times to complete this quota but only the original contact has QSO point value. Keep a uniform list of QTCs sent. QTC 3/7 indicates that this is the 3rd series of QTCs sent and that 7 QSOs are reported.

AWARDS:

Certificates to the highest scorer in each classification in each country, reasonable score provided. Continental leaders will be honored with plaques. Certificates will also be given stations with at least half the score of the continental leader or with at least 250,000 points. The minimum requirements for a certificate or a trophy are 100 QSOs or 10,000 points.

ENTRIES:

Violation of the rules, unsportsmanlike conduct, or taking credit for excessive duplicate contacts will be deemed sufficient cause for disqualification. The decisions of the contest committee are final. It is suggested to use the log sheets of the DARC or equivalent. Send a large SASE to get the wanted number of logs and summary sheets (40 QSOs or QTCs per sheet). SWLs apply the rules accordingly. Entries should be sent no later than December 15th to: DARC DX Awards, PO Box 1328, D-895 Kaufbeuren, West Germany.

EUROPEAN COUNTRY LIST:

C31, CT1, CT2, DL, DM, EA, EA6, EI, F, FC, G, GC Guer, GC Jer, GD, GI, GM, GM Shetland, GW, HA, HB9, HB0, HV, I, IS, IT, JW Bear, JW, JX, LA, LX, LZ, M1, OE, OH, OH0, OJ0, OK, ON, OY, OZ, PA, SM, S, SV, SV Crete, SV Rhodes, SV Athos, TA1, UA1346, UA2, UB5, UC2, UN1, UO5, UP2, UQ2, UR2, UA Franz Josef Land, YO, YU, ZA, AB2, 3A, 4U1, 9H1.

DELAWARE QSO PARTY

Starts: 1700 GMT November 13
Ends: 2300 GMT November 14

Sponsored by the Delaware ARC. Stations may be worked once per band and mode for QSO and multiplier credits.

EXCHANGE:

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

FREQUENCIES:

CW—1805, 3560, 7060, 14060, 21060, 28160.
SSB—1815, 3975, 7275, 14325, 21425, 28650.
Novice—3710, 7120, 21120, 28120.

SCORING:

Delaware stations score 1 point per QSO. Multiply total by the number of ARRL sections and DX countries worked.

Others score 5 points per Delaware station worked. Multiply total by the number of Delaware counties worked on each band and each mode (maximum of 36 multipliers possible). The three Delaware counties are: Kent, New Castle, and Sussex.

ENTRIES & AWARDS:

Appropriate awards will be given to the top scorers. In addition, a certificate to all stations working all three Delaware counties. If you work all three counties and want the WDEL Award, send two 20-cent stamps and an address label. Mail logs by December 17th to: Charlie Sculley AE3H, 103 E. Van Buren Avenue, New Castle DE 19720. Send an SASE for a copy of the results.

SANDUSKY RADIO EXPERIMENTAL LEAGUE QSO PARTY

Starts: 1800 GMT November 13
Ends: 1800 GMT November 14

The 50th Anniversary of the Sandusky (Ohio) Radio Experimental League, Inc., will be observed and celebrated with a QSO party while members of the club operate on five amateur bands using the club call, W8LBZ. Frequencies will be: 28150 and 7125 for Novices; 3740, 7040, 14040, 21040, and 28040 on CW; 3910, 7265, 14280, 21360, and 28600 on phone. All frequencies plus/minus 10 kHz.

YELLOW THUNDER SMOKE SIGNALS

NEWSLETTER CONTEST WINNER

This month's winner is *Smoke Signals*, published by the Yellow Thunder Amateur Radio Club of Baraboo WI. The layout is superb and the articles are written in a humorous, low-key style. The newsletter is full of excellent news items from around the nation and overseas, making it appear more like a nationally-based newsletter. Also, a schedule of all the traffic nets in Wisconsin is included. The paper is full of interesting items, such as fox-hunt rules and updates on the members' activities. The editor, Jim Romelfanger K9ZZ, has done an outstanding job.

To enter your club's newsletter in our contest, send a copy to: Editorial Offices, *73 Magazine*, Peterborough NH 03458.

CALENDAR

Nov 6-7	ARRL Sweepstakes—CW
Nov 13	Australian Ladies' ARA Contest
Nov 13-14	European DX Contest—RTTY
Nov 13-14	W8LBZ QSO Party
Nov 13-15	North Carolina QSO Party
Nov 13-15	CQ-WE Contest
Nov 20-21	ARRL Sweepstakes—Phone
Nov 20-21	Trinidad and Tobago QSO Party
Dec 4-5	ARRL 160-Meter Contest
Dec 11-12	ARRL 10-Meter Contest
Dec 19	CARF Canada Contest
Jan 8	*73 Magazine* 40-Meter Worldwide SSB Championship
Jan 9	*73 Magazine* 80-Meter Worldwide SSB Championship
Jan 15-16	*73 Magazine* 160-Meter Worldwide SSB Championship
Jan 15-16	Hunting Lions in the Air Contest

All amateurs worldwide are invited to participate. A special QSL card/certificate will be sent to all who send their QSL card to the QSL Manager, W8LBZ, 2909 West Perkins Avenue, Sandusky OH 44870.

CQ-WE CONTEST

Starts: 1400 GMT November 13
Ends: 0500 GMT November 15

Sponsored by the Bell System Amateur Radio Fraternity, the contest is open to present and retired employees of Bell, Western Electric, AT&T, and subsidiaries of AT&T. Contact local interworks coordinator for logs and complete rules, or write Steve Wheatley WN8GUE, Bell Laboratories, 2525 Shadeland Avenue, PO Box 1008, Indianapolis IN 46206. Telephone: (317)-352-2442 at work or (317)-545-4029 at home.

NORTH CAROLINA QSO PARTY

1700 GMT November 13 to 0200 GMT November 14
1200 GMT November 14 to 0100 GMT November 15

This year's party is sponsored again by the Alamance ARC (K4EG). The same station can be worked on each band. Cross-band and repeater contacts are not permitted.

EXCHANGE:

RS(T) and NC county or ARRL section.

FREQUENCIES:

SSB—3980, 7280, 14280, 21380, 28580.
CW—60 kHz up from lower band edge.
Novice/Tech—20 kHz up from lower band edge.

SCORING:

NC stations count one point per QSO and multiply total by sum of ARRL sections.

Others count 2 points per NC contact and multiply total by number of NC counties worked (100 max.). Add a bonus of 25 points for working the club station, K4EG.

AWARDS:

The top scorer in and out of state will receive the 1983 *Callbook* of his/her choice. Certificates to top scorers in each ARRL section.

ENTRIES:

Send logs and summary sheets showing essential details to: F. R. Ashley WB4M, 2731 Blanche Dr., Burlington NC 27215. Include large SASE for results. Mailing deadline is December 13th.

TRINIDAD AND TOBAGO QSO PARTY

Starts: 0000 GMT November 20
Ends: 2359 GMT November 21

The 9Y4 QSO party has been organized by the Trinidad and Tobago Amateur Radio Society, Inc., to commemorate 20 years of Independence, 5 years as a republic, and 50 years of amateur radio. Use all bands from 10 through 160 meters on SSB, CW, or via satellites.

EXCHANGE:

The usual 5- and 6-figure serial number signal report plus a progressive 3-digit number starting with 001.

AWARDS:

A certificate will be awarded to any station working 5 or more 9Y4 or 9Y5O stations.

ENTRIES:

Logs must show date/time in GMT, station worked, and number sent/received. It is requested that a remittance of $2.00 or IRC equivalent be included with your log if you are eligible for an award. Entries must be postmarked no later than December 21st and addressed to: TTARS, PO Box 1167, Port of Spain, Trinidad, WI.

RESULTS

1982 SPRING BARTG RTTY CONTEST RESULTS

Single-Operator Section

No.	Callsign	Points	Total QSOs
1.	W3EKT	668196	373
2.	EA8RU	518560	343
3.	W3FV	504648	276
4.	G3HJC	462870	221
5.	I2OLW	462384	336
6.	I1TXD	430560	272
7.	SM6ASD	405958	261
8.	W4CQI	400044	242
9.	I2WEG	384948	252
10.	WB3CCZ	376516	218

Multi-Operator Section

No.	Callsign	Points	Total QSOs
1.	G3ZRS	513540	270
2.	LZ1KDP	505310	321
3.	OH2AA	431600	314
4.	G3UUP	299936	216
5.	I4JXE	282906	193

Shortwave Listener Section

No.	Name/Call	Points	QSOs
1.	OK-1-12880 (Czech SWL)	282534	187
2.	Y2-10521/0 (DM SWL)	130052	98
3.	Y2-6346/K (DM SWL)	95256	76
4.	NL4483 (PAO/SWL)	91276	121
5.	J. Matthews (USA)	63680	60

LETTERS

FEEDBACK

I know you like feedback, so here comes a long-postponed letter.

I still believe your magazine is the best all-around ham publication, but the cost is starting to concern me. You needn't defend it again. I'm fully aware that costs are continually rising. However, the saddle-staple binding of the July, 1982, edition definitely upset me. Is there an article shortage? Or are costs that high?

Speaking of articles, I had a few good ideas for short articles, but I fooled around and someone beat me to the punch—three times. Keep encouraging us to write. Even short articles are always interesting and often useful.

I particularly enjoy those about ham radio history and electronic history in general. I really loved that series your dad wrote a few years ago. Is it available in book form? By the way, how is the old gentleman?

In defense of your feelings about the code test, the July issue proves you have nothing against CW. I found the articles presented a fresh approach to some old gadgets, my favorite part of ham radio.

Incidentally, I preferred the table of contents cover when looking up old articles but I have enjoyed most of the photo covers also. My favorite was probably the chess board made up of vacuum tubes back around 1967. I once suggested a cover picture of sculpture made from the junk box. You did that a few years ago, too. I'm now working on a chess game from solid-state devices.

Another positive comment. No other magazine I have ever seen prints such an excellent mix of letters—pro and con—no matter what the subject.

Finally, I was very excited about the Braille DX Service ("Letters," July) but no address was given. I would like to pass this info to some sight-impaired friends. Could you please publish it?

Tom Grabowski K3SPY
Baltimore MD

Thanks, Tom. I don't think I get to a hamfest at which someone doesn't push me to get the Ancient Aviator articles by my father into book form. Our book division is working on this, although I'd like to get Dad to write more about some of the dirty work which went on during the time he was starting the first transatlantic airline. He's doing well at 86, spending half of his time in northern New Hampshire and half in New York. He really should write more. The saddle stitching is a little less expensive than the perfect-binding style, but the main reason for changing was our re-emphasis on construction articles. The saddle-stitched magazine lies flat on the workbench for reading or building, while the perfect bound style flops itself shut all the time. I've been pushing the fun of building gadgets for over 30 years now and I don't intend to stop. CW? The only thing I have against it is its being mandatory. I am convinced that if we made it a matter of ham pride, we would have more CW than ever. Many hams are obstinate people like me . . . as long as I am forced to do something they can go to hell. Call it Yankee perverseness, if you like.

The address you're looking for is BDXS, 8347 W. 6th Ave., Lakewood CO 80215; (303)-233-4335.—Wayne.

INNER PROCESSES

It is enjoyable to read such a practical and informative article as "Electric Health via Negative Ions" by Michael Windolph (July, '82). I especially liked the sensible statement, "Know what you are doing and be careful!"

I wanted to bring up a side point that might be of interest to your readers. To a large extent, we have become so accustomed to harmful environments that we have lost touch with our original, instinctive intelligence. It can be regained by patient, hard, and dedicated work, but it does take time.

To fully regain our instinctive intelligence to know when something is wrong, we must not only adjust our physical environment but also place our inner life in order. I find best-selling author Vernon Howard's books very helpful in this respect. Mr. Howard tells us that we have played a wrong note for so long that we have forgotten what the right note should sound like.

Using negative ions to enrich our air is 100% practical. To combine such simple and helpful projects on the practical level with intense observation of our inner processes would lead to better understanding of both worlds.

Keep up the good work. I look forward to every issue.

Tommy Russell
Boulder City NV

GEARVAKf

I can't tell you what a pleasant surprise and thrill it was to read that *The GEARVAKf Bulletin* had been selected Newsletter of the Month for August. It's gratifying to know that our "peculiar brand of madness" is appreciated by you folks out there in the real world of amateur radio publishing.

The *Bulletin*, of course, is a labor of love (we sure as hell don't make any money at it). It had its beginnings back in the distant past when my co-conspirators and I decided that too many hams, ham organizations, and ham publications tended to take themselves much too seriously. We started to poke fun at them—and ourselves—through the *Bulletin*.

We recognize that there is a serious side to amateur radio, but *The GEARVAKf*

Bulletin gives people a chance to take a "time out." With limited funds and distribution, we'll continue our periodic wackiness as long as possible. Your recognition has given us a chance to increase our readership some, and perhaps momentarily lighten the lives of our brother and sister hams. It helps us, too. Editing the paper is real therapy!

Anyway, on behalf of Dr. Felix R. Onehundredton, Dr. Elwood P. Lishnus, Dr. Avruell U. Harnishe, Ti-Grace Gaboon, Lelah Lilah Lowlou, and the rest of the GEARVAKf ruling mob, thanks from the bottoms of our warped little hearts.

Joe Ventolo, Jr. K8DMZ
Editor
The GEARVAKf Bulletin
Enon OH

SACRIFICES

Re Mr. Richardson's letter in the August *73* about rude tendencies in ham equipment salespeople:

I was formerly employed with one of the largest ham equipment dealers in the US, and I'd have to say that what he says is true to a certain extent. But give the guy behind the counter a break—there are a few legitimate reasons.

First, the salesguy is making a big sacrifice for the sake of his job; he has probably given up being an active ham. You can't talk, think, and eat ham radio all day and go on the air after work! No way. You get burned out sooner or later. Secondly, it was my experience that the amount of immature, rude nerds is disproportionately high in the ranks of hams as compared to the general population. Woe to the salesman who sold a guy an HT that breaks after a week!

I've had a guy threaten to kill me for refusing to return his money on a defective transceiver! If you take a radio in for service many times, you'll get incessant calls about its status until it's fixed, as if it'll get fixed faster while the serviceman is busy on the phone. So many hams go *berserk* when they don't have their daily radio fix, you wouldn't believe it!

You see guys come in, clamp a pair of headphones on and space out for hours listening to the Yamaguchi on display—without spending a dime. How many businesses would put up with that? If you politely tell them to leave, they get mad as heck. Hey, what can you otherwise do?

Finally, I ended up getting pretty darned disgusted with the technical ignorance of many hams of late. We had to wire dozens of mike plugs, even for Extra-class hams. As a salesman, you were expected to constantly give advice on how to hang antennas, read an swr bridge, or zero-beat a CW signal. That's fine to a certain extent, but so many wouldn't take the time to pick up an antenna manual to find out, even to maybe learn something. Why? If you are so damn lazy you memorized the Bash books to get your license, you're not about to read the ARRL antenna book to learn how to cut a dipole (which you should have known how to do in the first place). No, keep taking the easy way out and ask the radio shop guy.

So, after all this and more, a sincere guy or a beginning ham might come into a radio shop and just might get a little shortshrifted. Sorry, guys.

Name and address submitted

P.S. Please withhold my name from print. I might decide to go back into the ham business after all. (Where's my valium?)

By golly, you're not trying to tell us that you think that knowing the code isn't all that's needed? All these nerds who have been driving you crazy have passed the code test, so what are you beefing about? They may have an Extra-class license and be able to copy code at twenty per, but they can't wire a mike plug, eh? Well, that's what most hams want us to have, my friend, so stop beefing. Until I see some Bash books in shreds at ham stores I will continue to believe that most hams don't want anyone to know any theory . . . or how to build even the simplest of stuff . . . or to know one end of an antenna from the other. Your customer stories are the same as I'm hearing from all of the ham dealers. I've been pushing for a change from depending on the damned code to a real technical test, not a Bashed one. . . . with no noticeable success.—Wayne.

KEEP THE CODE

In response to your comments about having a no-code license, I was under the impression that amateur radio was developed "to provide a voluntary, non-commercial service that provides for emergency communications, the advancement of the state of radio art, and a trained pool of operators, technicians, and electronics experts (97.1.)"

Well, it seems to me that if we are to follow this rule we should go out of our way as licensed hams to help people become trained operators of CW. As you well know, CW can be heard when voice communications cannot be understood. Because of this, CW can be utilized much more efficiently during emergency situations.

I teach at the Virginia School for the Deaf and Blind in Staunton, Virginia. Two 14-year-old girls, both visually impaired, passed both parts of the Novice requirements this year and received their call letters (KB4AHA and KB4AGZ). For those who feel that the CW portion of the Novice exam is *too* hard, especially those who claim to be skilled enough to pass the technical portion of the Extra-class exam, I would like to have them talk to these two girls and the other 400-plus-thousand licensed hams across the United States.

In closing, if the no-code license is approved, the only people who will benefit are the 2-meter-rig manufacturers and those who don't really care enough about ham radio to take the time to learn one of the most important and useful aspects of amateur radio . . . CW.

William F. Bowman KA4UFI
Staunton VA

Well, Bill, what you say was true thirty years ago . . . maybe even twenty years ago. But you're so out of date with current technology that I don't know where to start. Apparently you are unaware of RTTY, which has been around for well over 30 years on the ham bands. You seem not to know about recent developments such as integrated circuits, digital electronics, and so on. Yes, in the days of spark, everything you've written was true. Alas, we still have a surprising number of hams who are living isolated in the old spark days.—Wayne.

PRICED OUT

These days, most countries, particularly Canada, have serious money problems, but even in our poor economic condition we haven't been reduced to the point where we have an official ½-cent coin.

I know the true value of our penny may not even be worth half of its face value, but it seemed very funny to me to see on the cover of your August, 1982, issue #263 that the price of the magazine was printed as $2.49½.

Either the proofreader missed it, or you have decided to print an error deliberately to see how many people really read it "from cover to cover."

R. Ian McAuley VE3MYO
Alexandria, Ontario

We have an opening for a new proofreader . . . any takers?—Wayne.

LAID OUT

Your new cover layout for the August issue of *73 Magazine* is great. Plus, I was glad to see that the articles were more in line with the *73* of a couple years ago. I was beginning to have my doubts about *73*, as the articles seemed to be getting away from ham radio somewhat. Having been a subscriber to *73* in excess of ten years, I hope the August issue is an indication of better ham radio articles to come.

Now, if you could just come out with a blockbuster RTTY issue like you did a couple of years back!

Vince Staffo WB2FYZ
Ilion NY

The September issue was packed with RTTY goodies, and let me make it perfectly clear (to coin a phrase) that I think that the future of hamming is tied in with digital communications . . . and that's RTTY. I want to publish articles on higher and higher-speed digital communications, on error-correcting code systems, on automatic relaying, and so on. If enough of us chip in (pun), perhaps we can set up some international relay system which will be of immense value in emergencies. We might even think about an organization which could be called the International Radio Relay League! The mind boggles. Anyway, glad you enjoyed the issue, and yes, we'll be having a lot more interesting construction projects.—Wayne.

NO THANKS

Just a short note to state that I have, over a period of 4 or 5 or 6 months, helped upwards of 50 hams and others through your "Ham Help" column (particularly on older receivers, transmitters, etc.).

Sad to say, only about 8 have even bothered to reply and thank me, or at least tell me to "get lost."

Kind of makes you wonder.

Roy H. Wilkinson
Bloomington MN

P.S. I have a much better "batting average" with the readers of Popular Electronics' "Operation Assist" column. Also, I miss your "want ads" column!

Roy, the place for your ham ads is in a ham ad paper, not a magazine. It takes about three months to print a ham ad in a magazine and by that time the stuff is usually sold. The ham ad papers get the ads out there in a couple weeks and do a nice job of it. I really hate to take bread out of the mouth of small entrepreneurs by competing with them in 73, so I urge all readers to use the specialty publications and keep them healthy. I wish that QST would do that, too. You'll note that we don't try to compete with CQ magazine and their specialized coverage of contests. Sure, there are only a couple thousand hams who are seriously interested in contests, but those who are should read and support the publication dedicated to them . . . which is CQ. I don't know what to say about the ungrateful cretins who get help and then say nothing.—Wayne.

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
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One of the questions raised a few months back regarding the design of a radioteletype receive program was how to make such a receiver immune to garbage or noisy signals. This month I'll take a look at one technique which can be used to overcome such a problem: multiple sampling.

Recall that each data pulse in a 60-wpm Murray character, of which there are five, lasts for 21 ms. Mechanical teleprinters do not use the entire pulse, but rather a small sample of it. Where this sample window is positioned depends upon the adjustment of the range selector. That is, only a small slice of each data pulse is read in order to determine whether that pulse is a mark or a space. Fig. 1 shows how this window overlaps the longer data pulse. Since mechanical printers time the "intra-pulse" interval from the position of the window on the data pulse, advancing the window toward the beginning of the pulse will enable the next pulse to be read that much sooner and can allow speeds slightly greater than 60 wpm to be read. It is by using this technique that so-called "66-speed" machines can be copied on an otherwise unmodified Model 15.

In an analogous fashion, simple RTTY receive programs such as those described here in the past sample each data pulse only once and use that information to reconstruct the Murray character. With the routines presented a few years ago, for example, a momentary sample from the middle of each pulse was obtained. A delay of 20 ms between samples kept the windows positioned near the middle of each data pulse.

The difficulty with such a scheme is that noise or fading can distort individual pulses within a character, thus changing the interpretation. A simple solution is to look at each pulse not just once, but several times, and base the decision of what to call that pulse on the sum of those samplings. Regular samples can be taken at, say, two-ms intervals to produce a time scheme such as shown in Fig. 2.

Having sampled each pulse many times and presuming we have stored that infor-

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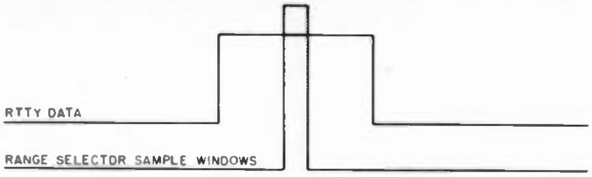

Fig. 1. The sample window.

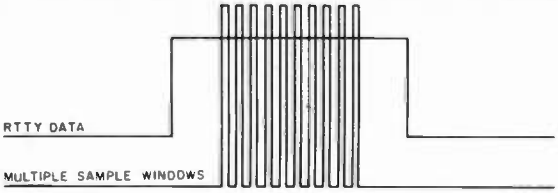

Fig. 2. Computer's multiple samples.

mation in some usable format, we must now decide what to do with that knowledge. Unless the circuit being monitored is an absolutely clear channel, it is doubtful that all ten (in this example) samples will be identical. In the case of pure noise, one might expect an average of half mark and half space, so a threshold would seem appropriate to adjudicate when to call a given pulse "mark," when "space," and when to throw it out. For want of a better suggestion, let's settle on seven or more samples one way or the other to label a state. Reading less than seven pulses of either mark or space will render the individual bit trash.

So you have a trash pulse, now what? It would seem that there are at least two ways to deal with that. Either you arbitrarily assign it as a mark or space and take your chances with the character, or you decide the entire character is lost and just loop out the time. The latter appeals to me the most; after all—garbage is garbage, no? In order to implement that, all you would need to do is keep track of how many bits you have read and delay whatever is left to get to the next stop bit.

I don't know how confusing that all is when you read it; it was not all that clear in the writing. I think that Fig. 3, a flowchart of what I am talking about, will help clear things up, though. The character reception routine is entered with a bit counter set at five, the number of pulses in a Murray character. After detection of a start pulse, additional counters for mark and space are set up and cleared. A loop is entered to sample each pulse ten times and register the state of the pulse sampled in the appropriate counter. After ten samples have been taken, the counters are examined to determine the probable identity of the pulse and record that in the correct position. Assuming all has gone well thus far, the sampling process is repeated for each of the five data bits, and the Murray character transmitted is recovered.

However, what if a bit is in error? What I have directed here is to trash the entire character. We do that by branching to a routine which waits out the remaining bits' time and then exits with a null for the received character. One presumes that the translation scheme used will ignore such a character.

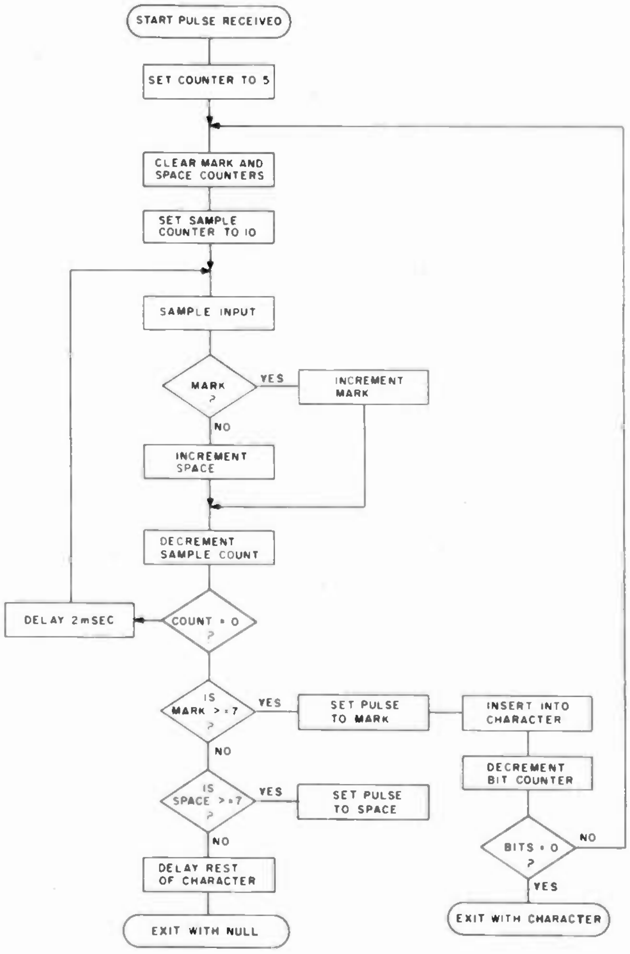

Fig. 3. Multiple sample flowchart.

This type of scheme is useful for eliminating erroneous characters where the error is generated between transmission and reception. For those errors generated on the operator side of the keyboard, you are on your own!

Turning to the mailbag, I have a note here from Leo F. McAuliffe, Jr., of Ashland, Massachusetts, who is a shortwave listener interested in copying RTTY. Leo is looking for a device which will display received RTTY on a TV screen, without having to invest a lot of money. Well, Leo, as you may have appreciated in the pages of ads here in *73*, there is not a lot on the market to do what you ask. Those units that are commercially available cost several hundreds of dollars, which you indicate is out of your range. I might suggest two possible alternatives. One would be to scout the hamfests in your area for an older, used, video RTTY unit, such as an old Microlog receiver. These were made some years back and should be turning up for reasonable prices on the flea-market circuit. Another idea is to put together a small unit yourself, using a dedicated computer, costing under $100, and an ASCII video display. Such displays may be old terminals or receive display boards, none of which should cost too much. For some time and elbow grease, you may be quite happy with what you will come up with. If there is sufficient interest, I would be willing to work out the design of such a unit. Let me know with, as they used to say on the tube, your cards and letters.

Among the new arrivals here at WA3AJR is another computer, an Atari 400. I bought it for the kids, but you know who is at the keyboard more and more. I am impressed by the programmability of this unit and hope that we will be able to use it on ham radio. I will keep my eyes open for applications, and I hope you do, too. I look forward to sharing with you whatever we all can discover in future columns.

Next month, some more investigations into the design of the ideal RTTY terminal program, as well as a look at what some of you are saying. Winter is a great time to work in the shack, even though these new transistorized/ICized rigs don't put out the heat of a pair of 807s. Let's see what kind of things we can do in next month's RTTY Loop.

DX

Chod Harris VP2ML
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Santa Rosa CA 95402

THE TOP TEN

What are the Top Ten? No, not the best selling rock-and-roll records, but the most sought-after countries in the DX world. Every year *The DX Bulletin* surveys the top DXers in this country and other countries to determine which countries are most needed. *The DX Bulletin* concentrates on those DXers with more than 250 countries worked and is the most prestigious of all the bulletins. Its Top 73 list is the most complete and well-respected of any such list in the world. Some amateur radio manufacturers determine who will receive DXpedition rigs on the basis of this survey. *The DX Bulletin* recently granted permission for this column to reproduce the 1982 list of the most needed countries. Here is the list, with comments on future amateur radio activity. (For further information on *The DX Bulletin*, write 306 Vernon Avenue, Vernon, Connecticut 06066.)

1. *China BY.* China tops everyone's most wanted list, with almost no legal amateur radio since the early 1950s. But that is changing (see this column, July). More BY stations are coming on the air, and BY will move down the most wanted list in future years. Not rapidly, but it will slowly move down until everyone has worked BY.

2. *VK/Heard.* This tiny rock near Antarctica will host one or two major DXpeditions in 1983. Watch Heard drop completely off the most wanted list next year.

3. *VU/Laccadives.* The only island worth landing on in this archipelago is the base of considerable pirate activity. No, not radio pirates, but real life pirates who don't leave live victims. No one in his right mind goes anywhere near the Laccadives.

4. *Albania ZA.* It's the political climate that keeps amateur radio out of Albania. As one of the poorest of the Eastern European countries and one close to the Soviets, Albania has taken a dim view of ham radio for years. There are signs of a softening of this attitude, however, and rumors continue to fly of a DXpedition to Albania any day now. Don't hold your breath, but don't hesitate to work any ZA you might hear.

5. *Cambodia XU.* Political turmoil and civil war preclude ham radio from Cambodia. Official permission is unlikely in the near future; we'll just have to wait until things calm down.

6. *South Yemen 7O.* A similar case to Albania. South Yemen is in the Soviet camp, and they don't endorse amateur radio.

7. *Bouvet 3Y.* Another tiny island near Antarctica. Bouvet sees occasional tourist and scientific traffic. Permission from Norway can be obtained, and Bouvet might well be a target of a DXpedition soon, but probably not this winter.

8. *Andamans VU.* At least one amateur is listed as having a license for the Andamans, but activity has been non-existent. The Indian rules prevent outside amateurs from getting licenses, and the locals don't seem to show enough interest in activating one of the rarest of all DXCC countries.

9. *Burma XZ.* The official Burmese government says "No" to any amateur radio, and the ARRL refuses to accept the operations from the "rebel" north half of the

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A gaggle of FO8s. Did you work 3 FO8 stations on two different bands during their Tiurai celebration July 14-22? If so, you qualify for a special award, but you must request the award before the end of the year. 15 active FO8s made more than 5000 QSOs during the celebration. (FO8GM photo courtesy of WB6GFJ.)

country. This political mess shows no signs of being straightened out in the foreseeable future.

10. *San Felix CE0X*. Getting a license is trivial (I have one), but getting onto the island is impossible. The entire island is a military base (like Aves in the Caribbean) and "gringoes" are not welcome. Even the Chileans have been unable to convince the military higher-ups that they mean no harm in their planned DXpedition. A recent "operation" from San Felix turned into a fiasco when the Chileans claimed the operator was nowhere near the island at the time. This could break at any time, but I rate it doubtful.

The main difference in this list from a similar one twenty years ago is in the reasons for lack of activity from a country. Twenty years ago the reasons were physical inaccessibility and lack of transportation and accommodations in the country. It's hard to mount a DXpedition when you have to pack your gear, generators, and fuel in on camels. The transportation picture has changed for the better, and no spot on this earth is out of reach of a determined amateur.

But the political realities have changed for the worse. Certain cheats and frauds in the last 20 years and increasing sensitivity to feelings in developing countries have led to a more formal approach to the documentation needed for a DXpedition to "count" for DXCC. The conservative attitude of the ARRL DXCC staff means an amateur cannot simply operate from a country; he must be welcomed by that country and operate with their full cooperation. This is simply impossible in many countries. Many emerging countries are reluctant to put *anything* down in writing, although they are eager to give verbal permission to operate.

Another reason for the reluctance of countries to permit even visiting amateurs to operate is the fear of spying, internal revolt, or outside takeover, all of which require radio communications. Unsophisticated customs officials cannot differentiate between spy gear and a TS-830. (On second thought, are there any real differences?) So it is simpler always to say "No" than to see if it is possible to say "Yes." We probably won't see this attitude change quickly. Only patient demonstrations and years of support, documentation, and assistance will win jittery governments over to the value of amateur radio, as we see happening in China.

What does this mean for the DXer? If you want to get on the Honor Roll (having worked almost all the DXCC countries), you must have patience. It may be many years before we see significant radio operations from many of the Top Ten.

If you do hear one of these highly desired countries on the air and are fortunate enough to work it, the battle is only half over. Now you have to get a QSL card to prove you worked him.

QSLS AND QSLING

There is more to DXing than working the DX station; getting the confirmation of the contact can be every bit as challenging as breaking through the pileup. But a few hints and suggestions can substantially improve your QSL percentage and get some of those coveted pasteboards "on the wall."

In this first part of this series on QSLing we will consider the card itself: the selection, design, and printing of your own QSL card. In future columns we will advise how to fill out the card, how to get the card to the appropriate place, and QSL bureaus.

Your Personal QSL Card

There are no rules requiring that acknowledgement of a DX contact must be in the form of a postcard-sized paper. QSL means acknowledgement of a contact, not a special card. But *everyone* who seeks those acknowledgements uses the universally accepted QSL card. In more than 100,000 requests for my QSLs, I have *never* received a request without such a card. Only a tiny handful have been other than postcard-sized. So while there are no formal requirements for the dimensions of the QSL, I recommend sticking to the standard format.

Choosing Your Card

Given the transient nature of most DX QSOs, the DX station has little opportunity to get to know you. If the QSLing is handled by a QSL manager, the person filling out your return card will know even less about you. So your QSL card reflects your personality and amateur radio interests even more than your DX contact.

When the time comes to choose your QSL card, you first have to decide on a custom card or an off-the-shelf commercial card. There are dozens of commercial QSL card printers. Most offer a set of samples and designs for a nominal fee. Once upon a time the QSL printers would obtain the FCC list of new licensees and send you a set of samples and order forms before you even received your license! You were so pleased to learn your callsign that you immediately ordered 1000 of their fanciest cards. 950 of these are probably still gathering dust in your basement.

The advantages of commercial QSL printers are many. They produce a good looking card at relatively small expense. The card is easily recognizable as a QSL and it is printed on stock heavy enough to go through the mail as a postcard. Prices range upward from a few cents a card. You can select from a bewildering variety of cards, including multi-colored cards, two-sided cards, and more. Ordering your commercial QSLs is trivial: You pick your design, fill in the blanks on the form, and send in your money. You will get your cards back in a few weeks—longer if you use one of the smaller printers.

But for DXing, standard QSL designs have one major disadvantage: They are all the same. No, not identical, but an active DX station who receives thousands of QSLs each year will have seen dozens or hundreds of similar cards. Your card will be one of the pack; it won't stand out. Some hams try to make their cards stand out by using bright orange QSLs that glow in the dark. I still see spots before my eyes from opening an envelope with one of these Day-Glo orange QSLs. But I have received bunches of these, too. Certain QSL designs are so popular that I have received hundreds of cards identical except for the callsign. Needless to say, I am not intrigued to receive yet another one of the same design.

This doesn't mean that standard design QSLs end up in the circular file. It just means that they get answered just like any other QSL, no faster or slower. The call and the individual operator will not be remembered any length of time.

The cards (and operators) who do stick in the mind after the QSL is answered are those personal cards, cards which say something about the ham and his station.

If you do decide on a commercially-produced, standard QSL card, there are a few things to keep in mind when making your selection. First, avoid commercially-produced two-sided cards. These are the cards with the personal information on one side (callsign, name, and address) and a standard QSL form on the reverse. Why avoid these? The DX station must first find your QSO in his log. This means comparing the time of the QSO on the back of the card and the callsign on the front with his pages and pages of log. Sometimes the card must be flipped several times before the QSO is located in the log. Then, in order to fill out the return card, the DX operator must first record the QSO information and then turn the card over to get the callsign. Big deal, you say. How difficult is it to turn the card over? Flipping one or two or ten or a hundred cards is no big deal. But when you deal with thousands and thousands of cards, the QSLer soon learns to dread the sight of another two-sided card.

Two-sided cards also lead to possible errors on your return QSL. In the process of flipping the card, the DX station might forget the call, or transpose two letters, etc. The result might be a QSL card which will be rejected by the DXCC checkers.

This does not mean that all two-sided QSL cards are useless for DX purposes. There is nothing wrong with a card which has the call and name on one side and the QSO information on the reverse, *as long as the callsign also appears on the reverse*. Then the DX station (or QSL manager) doesn't have to flip the card; the callsign is right there on the reverse with the QSO information. But few commercially-available two-sided cards offer this option. It requires custom printing of *both* sides of the card, greatly increasing the costs, and eliminating many of the economies of scale of QSL printing. So if you intend to do a lot of DXing, stick with single-sided QSL cards.

Another thing to check when you purchase commercial cards is the glossy finish. Many of these very handsome and attractive finishes will not absorb ink from felt tip pens. The ink puddles up and smudges off. Hard pencils may make a very light trace on some coated cards. Test your sample cards with your usual writing utensil. Does the pen make a clear, clean impression which doesn't smear? Not all shiny cards have this problem; you have to check the sample.

Another possible problem with commercial QSLs is the use of strange typefaces. Some amateurs choose an exotic typeface for their callsign and address, one that is different, on the hope that it will make their standard card more distinctive. Don't! These weird typefaces are often difficult to read. Typefaces that look like script or brush strokes are especially difficult to read. What difference does it make, you ask? If your callsign is difficult to read, the DX station might get it wrong. Then he might not find it in the log, or he might fill out your QSL to someone else's call! For the same reason avoid those ubiquitous silver-on-black QSLs. They are very difficult to read!

Custom QSLs

I personally prefer custom-designed QSLs, both to send and to receive. I feel the QSL card is an extension of your amateur radio personality, and it should say something about you and your amateur career. Custom-designed QSLs need not be elaborate or expensive, and the initial effort quickly pays off in improved returns.

What should go onto your personal QSL? Make sure you have the basic information: your callsign, name, and address including county. You will also need blanks for the QSO information. If you work one mode or band predominantly, you might want to customize the QSO information. For example, a 20-meter enthusiast might have "Freq. 14 ______ MHz." Be sure to say that this card is a confirmation of the QSO described; many commercial cards omit this vital line.

I have used both the box format and a sentence format for the QSO information, and I definitely recommend the former. The sentence format (i.e., "This confirms our 2X______ QSO on ______ on ______ MHz at ______ UTC, with your signals ______ RST.") is cumbersome and very prone to error. The box format is clean and easy to fill in and read. Amateurs seem to be able to make the simplest task complicated and so produce a bewildering number of combinations of these QSO information boxes. For consistency and to assist the person filling out the return card, I suggest the following format: Callsign, Date, UTC, MHz (not band), 2X(mode), RST. If you are designing your own card from scratch, be sure to leave enough space in each of the boxes for the required information. In other words, the boxes for the callsign and date should be substantially larger than those for the other information. Better yet, take a blank QSL with well-designed boxes and steal the format.

Another important item to include on your custom QSL is a request for the DX station's card. You would be amazed at the number of QSLs I have received without such a request. Since I receive and

✓See List of Advertisers on page 130

send thousands of cards each year, I do not answer cards that don't have a specific request for my card; I assume the card is an answer to a card I sent. By the way, avoid those cute QSLs with the QSO information hidden on a drawing of a rig, etc. Anything that makes the QSO information hard to find or decipher will slow up your return card.

So much for the nuts and bolts of QSL card design. What about the overall look? What personal information will customize your QSL? A photograph of yourself at your operating position with QSLs and awards in the background says more about you than any amount of text. A good photograph shows your equipment, station layout, your most prized awards, and (very important) adds a face to your call. My favorite QSLs to receive are definitely photographic QSLs, because they say so much about the operator without listing hundreds of awards no one has ever heard of.

The major drawback to a photographic QSL is the considerable initial expense. But if you can find a friend who will take a good black-and-white photograph, you can save a good part of the cost. There is usually at least one good photographer in every radio club.

What about listing your equipment and antennas on the QSL? Every time I have done this, I have changed the gear as soon as the cards come back from the printer. If you trade your equipment regularly and try new antennas every season, you should leave the listing of gear off the card. If you are satisfied with your Collins gear and Big Bertha, by all means list the equipment; the DX station is always interested in knowing what produced that strong signal.

Once your card is designed, there remains the choice of how to print it. Some of the QSL printers will produce a custom card from your sketch, but expect to pay for their services. I prefer the quick-print approach, as I usually print many thousands of cards at a time, and the quick-print shops will produce a card for less than a penny apiece. I provide camera-ready copy and the printer prints four cards on each sheet of paper and cuts them into QSL-sized cards. (Postal Service requirements insist on a certain minimum size for postcards; check this before you have the cards trimmed. Also make sure your card will fit into a standard small envelope without folding.)

Whatever format or type of QSL card you select, you still have to fill it out properly, get it to the correct individual, and get his card back. We'll discuss these other steps on QSLing in future months.

AWARDS

GLADESPEDITION

The Fort Myers Amateur Radio Club will be conducting a "Gladespedition" to Glades County, Florida. Operations will begin on November 13, 1982. W4LX will be operating in the General bands, both CW and SSB. Some Novice contacts will also be made. If you need Glades County, be sure to look for them. QSL to: David Fox KA8CXQ, PO Box 051131, Tice FL 33905. SASE please.

45th PARALLEL

The Tri-County Wireless group will mini-DX from Gaylord, Michigan, on the 45th parallel (halfway between the equator and the north pole) from 1400Z November 13 through 0600 November 14. Phone only at 3.925, 7.250, 14.300, 21.375, and 28.550. Certificate for QSL and SASE to N8COY.

ABC-TV

The ABC-TV Washington Engineering Group, celebrating the first year of operation from the network's new Washington news bureau, will be on the air Saturday, November 13, from 1400Z to 2200Z, on SSB frequencies (plus or minus 5 kHz): 7.245 and 14.285 and on CW for Novice and Technician contacts on 7.125 (listening at 45 minutes past each hour). KB7ZZ/3 will also be on 145.190 FM (W3DOS/R) throughout the operation period. Special events QSLs via business-size SASE to: Steve Malis KA4ORL, 2520 Heathcliff Lane, Reston VA 20091.

JERSEY DEVIL STATION

The West Jersey Radio Amateurs (WJRA) will mount a second operation from the South Jersey Pine Barrens, the haunt of the feared Jersey Devil. Beginning and ending at midnight, the courageous WJRA group will attempt again this year to operate the entire 24 hours of Halloween, October 31st. A unique, handsome certificate engraved with a countenance of the Jersey Devil will be sent to all stations worked who send an SASE to WJRA, PO Box 62, Burlington NJ 08016. Frequencies to be used are 15 kHz from the bottom of each General phone band, 80 through 2 meters, and 146.55 FM. Novice operation will also be 15 kHz up.

The Jersey Devil was born in 1735, a 13th child, in the Pine Barrens of Burlington County at a place called Leeds Point. Not long after its birth, on a foggy and dreary night so usual in the Pine Barrens, the child assumed a serpent-like body, cloven hoofs, the head of a horse, wings of a bat, and the forked tail of a dragon. With loud raucous cries, it flew up the chimney and into the heart of the Pinelands. Appearances and sightings occur even today. On Halloween, the WJRA will maintain a radio vigil, trying once again to capture a glimpse of the Devil. Will they see him? Give them a call—W2JUG—and get a first-hand report.

73 MAGAZINE AWARDS PROGRAM

WORK THE WORLD

97 WD6DFN	126 WB7UCU
98 KN4F	127 KA3FUU
99 WA2WRD	128 WD4JEQ
100 N8BDI	129 W7GLU
101 WB9NOV	130 VK2PY
102 KA3DBN	131 VK3DXY
103 K9GHP	132 KB2WH
104 WØYBV	133 I1WXY
105 KA7GIN	134 K3WUR
106 W8HTM	135 KA1RC
107 N6ATS	136 PY2CAR
108 KC5TK	137 I1EEW
109 K3STM	138 KØLST
110 9G1RT	139 HI3LRB
111 WA2LYF	140 ZL1SZ
112 ZS6ABA	141 ZS6XS
113 VK2HD	142 ZS6XK
114 VE3LVN	143 PY2FK
115 VE1ACK	144 JF1CPH
116 PY2BTR	145 W1SIX
117 VE3JPJ	146 PAØTP
118 HC2RG	147 JJ1KTI
119 WA9IVU	148 W3BHM
120 VK2NHV	149 JA5MG
121 KH6KU	150 JF1SEK
122 N5CSW	151 KAØMMD
123 WN5MBS	152 8P6OV
124 AK1H	153 KC8AU
125 VK3BMA	

NORTH AMERICAN AWARD

213 N5CSW	230 VE7DRI
214 KH6KU	231 I1EEW
215 K9RNR	232 W3BHM
216 VE1YX	233 PY2CAR
217 WN5MBS	234 KA2IAL
218 VK3BMA	235 KA1RC
219 WB7UCU	236 KAØMMD
220 4Z4VG	237 WD5IBM
221 PY1BVY	238 WB2VTD
222 OE1-111080	239 N4CXK
223 W7GLU	240 N7CZH
224 I1WXY	241 N5AUB
225 VK3DXY	242 KA2JJK
226 4W-16260	243 HI3AMF
227 VK2PY	244 PY2FK
228 OE2ABM	245 K2YOF
229 KØLST	246 PY2RHL
247 K9LJP	258 JF1CPH
248 HI3LRB	259 JJ1KTI
249 W9CC	260 VE6CNV
250 ZL1SZ	261 I5HOR
251 KA9CEJ	262 PY2RAN
252 ZS6XS	263 KA5FLE
253 ZS6XK	264 PY1DWM
254 PAØTP	265 JF1SEK
255 PAØIEM	266 JA5MG
256 W9CC	267 KC8AU
257 PY1EWN	268 N6GBM

SOUTH AMERICAN AWARD

186 N5CSW	211 PY2FK
187 KH6KU	212 K9LJP
188 K9RNR	213 HI3LRB
189 WN5MBS	214 WDØAQC
190 DA1AS	215 ZL1SZ
191 VK3BMA	216 KA9CEJ
192 WB7UCU	217 ZS6XS
193 4Z4VG	218 ZS6XK
194 PY1BVY	221 W9CC
195 WA9AHZ	222 KAØMMD
196 W7GLU	223 JF1CPH
197 W8UMP	224 W1SIX
198 VK2PY	225 PY2IEM
199 VK3DXY	226 PAØTP
200 I1WXY	227 JJ1KTI
201 N5AUB	228 ZL2LQ
202 N7CZH	229 KA2JJK
203 N4CXK	230 8P6OV
204 AI1Y	231 JF1SEK
205 KA1RC	232 JA5MG
206 PY2CAR	233 KC8AU
207 W3BHM	234 N5ACU
208 I1EEW	235 VE6CNV
209 KØLST	236 N6GBM
210 HI3AMF	

ASIAN AWARD

142 N5CSW	163 PY2FK
143 KH6KU	164 N4AKO
144 W7GLU	165 HI3LRB
145 WD4JEQ	166 ZL1SZ
146 WB7UCU	167 ZS6XS
147 VK3BMA	168 ZS6XK
148 DA1AS	169 PAØTP
149 AK1H	170 JF1CPH
150 W1SIX	171 JR7ICN
151 WN5MBS	172 PY2IEM
152 I1WXY	173 JJ1KTI
153 KB2WH	174 JA5PWW
154 8P6OV	175 OZ5EDR
155 VK3DXY	176 W3BHM
156 HZ-16260	177 JH3OHO
157 4W-16260	178 HI3AMF
158 VK2PY	179 JA3UCO
159 PY2CAR	180 KAØMMD
160 KA1RC	181 JF1SEK
161 I1EEW	182 JA5MG
162 KØLST	183 KC8AU

AFRICAN AWARD

160 N5CSW	168 W7GLU
161 KH6KU	169 JA5PWW
162 K9RNR	170 VK2PY
163 WN5MBS	171 HZ-16260
164 DA1AS	172 4W-16260
165 VK3MBA	173 VK3DXY
166 WB7UCU	174 I1WXY
167 4Z4VG	175 KØLST
176 I1EEW	192 WA1UDH
177 W3BHM	193 KA2JJK
178 AL7O	194 JR3LVI
179 PY2CAR	195 JF1CPH
180 PY1DWM	196 KAØMMD
181 N4CXK	197 PAØTP
182 TU2HJ	198 JJ1KTI
183 KA1RC	199 PY1BVY
184 JH7OFH	200 HI3AMF
185 PY2FK	201 PY2RAN
186 HI3LRB	202 JH3OHO
187 ZL1SZ	203 JF1SEK
188 W8UMP	204 JA5MG
189 ZS6XS	205 KC8AU
190 ZS6XK	206 N5AUB
191 PY2IEM	207 4X4OQ

EUROPEAN AWARD

251 WD8MAI	282 N7CZH
252 W7GLU	283 N5AUB
253 OE3SWL-DWZ	284 TU2HJ
254 OE1-111080	285 HI3AMF
255 DF5VO	286 PY2FK
256 WB7UCU	287 KA5BQM
257 VK3BMA	288 K2YOF
258 WN5BMS	289 JA9AXS/1
259 VE1YX	290 PY2SZK
260 K9RNR	291 K9LJP
261 KH6KU	292 HI3LRB
262 N5CSW	293 WDØAQC
263 KH6F	294 ZS1SZ
264 I1WXY	295 ZL2LQ
265 VK3DXY	296 KA9CEJ
266 KA7CPZ	297 ZS6XS
267 HZ-16260	298 ZS6XK
268 4W-16260	299 PAØTP
269 VK2PY	300 PY2IEM
270 OE2ABM	301 WA2FYW
271 KØLST	302 JR7ICN
272 VE7DRI (14 MHz)	303 JF1CPH
	304 WP4ATF
273 VE7DRI (21 MHz)	305 JJ1KTI
	306 VE6CNV
274 I1EEW	307 JA5PWW
275 W3BHM	308 JH3OHO
276 PY2CAR	309 JY9CW
277 KA2IAL	310 JF1SEK
278 KA1RC	311 JA5MG
279 KAØMMD	312 N6GBM
280 WB2VTD	313 KC8AU
281 N4CXK	

OCEANIA AWARD

145 N5CSW	163 PY2CAR
146 KH6KU	164 I1EEW
147 WN5MBS	165 KØLST
148 JA9AXS/1	166 JG1QLT
149 VK3MBA	167 PY2FK
150 WB7UCU	168 OZ-DR-1239
151 KA3FUU	169 N4AKO
152 W7GLU	170 HI3LRB
153 K3WUR	171 ZL1SZ
154 VK2PY	172 ZS6XS
155 VK3DXY	173 ZS6XK
156 KB2WH	174 JF1CPH
157 I1WXY	175 JR3LVI
158 N7CZH	176 JR7ICN
159 N4CXK	177 PAØTP
160 W1SIX	178 JA5PWW
161 K3WUR	179 JJ1KTI
162 KA1RC	180 W3BHM

See List of Advertisers on page 130

OCEANIA (Cont.)

181 VE6CNV
182 JH3OHO
183 JA3UCO
184 KAØMMD
185 JF1SEK
186 JA5MG
187 KC8AU
188 N5AUB
189 N6GBM

73 DX COUNTRY CLUB AWARD (SSB)

75 WD6DFN
76 8P6OV
77 KN4F (1979)
78 KN4F (1980)
79 WA9IVU
80 W7HAZ
81 K9IML
82 AG7P
83 KA1UA
84 N6ATS
85 KE7C
86 KA3FUU
87 VK2HD (1979)
88 VK2HD (1980)
89 VK2HD (1981)
90 9G1RT
91 SV1GJ
92 WA8KMK
93 VK2NHV
94 CT2CQ
95 HC2RG
96 NR4S
97 VK3BMA
98 WD4JEQ
99 KC4YY
100 N5CSW
101 4W-16260
102 VK2PY
103 N2CFN
104 W1SIX
105 N4CXK
106 ZS6XS
107 VE3JPJ
108 I2ODZ
109 I5HOR
110 KA1RR
111 WB3HTK
112 KI2G
113 DEØDXM (1979)
114 DEØDXM (1980)
115 DEØDXM (1981)
116 KA6D
117 DJ9ZB

73 DX COUNTRY CLUB (CW) AWARD

13 YE1ACK
14 KC3W
15 KØLST
16 OE2ABM
17 K6FO
18 4X4FU
19 PY2FK
20 PY2BTR
21 DF5UT

73 DX COUNTRY CLUB (MIXED) AWARD

22 WB5LBR
23 WD6EEQ
24 NL7J
25 KAØMMD

DX CAPITALS OF THE WORLD AWARD

18 N6ATS
19 VK2HD
20 ZS6ABA
21 SV1GJ
22 VE1ACK
23 4Z4VG
24 VK2PY
25 WB3BVL
26 WB2TOJ
27 PY2FK
28 VE6CNV

10-METER DX DECADE AWARD

1 WB4WRE/M
2 AC3Q
3 W5TJQ
4 WDØAVG
5 DA2AL
6 WB4TZA
7 WD5JRG
8 WA4ZLZ
9 WB8LSV
10 WB9WFZ
11 W8AKS/6
12 KA3FUU

SPECIALTY COMMUNICATIONS AWARD CLASS A: WORKED ALL STATES

1 WA6VGS
2 KE7C

SPECIALTY COMMUNICATIONS AWARD CLASS A-1: DX COUNTRIES

9 K3WUR (RTTY)
10 WB2VTD (RTTY)
11 PY3CJS (RTTY)
12 KE7C (RTTY)
13 AL7O (RTTY)
14 PY1EWN (RTTY)
15 OE1PBA (RTTY)
16 N5CSW (RTTY)
17 HB9MQM (OSCAR 7/8)
18 OE4HQ (RTTY)
19 VE2OO (RTTY)
20 VE2OO (OSCAR 7/8)
21 ON4CM (RTTY)

Q-5 AWARD OF EXCELLENCE

61 N7CPE
62 N8BDI
63 KA7EII
64 W8UPD
65 KA2IDJ
66 WB9KUV
67 KA5KKZ
68 KA9ENM
69 PY2UGS
70 KA3FUR
71 KA6JQB
72 KA7CPZ

73 KA1DJB
74 KA3GSN
75 WB9HPR
76 W4PCK
77 KA4LSJ (28 MHz)
78 KA4LSJ (21 MHz)
79 KA3FUU
80 N1BDB
81 KP4FCK
82 KA2MIM
83 W1DWA
84 KA2JMJ
85 KA7JNP
86 WA2AKX
87 KP4ERH
88 KA8CUS
89 KA4VNS
90 N8CJF
91 WDØEPV
92 KB8WJ
93 KAØJTT
94 KA5KOS
95 VK2VVA
96 KA4WBR
97 KA8MVV
98 KA1HJK
99 KA9JJK
100 KA2IAL
101 WL7AHD
102 PY2SZK
103 KAØMMD
104 KA1HFN
105 KA9CEG
106 KA9CEJ
107 KA9LYH
108 N8CYS
109 WB9UIA
110 NS4J
111 VE6CNV
112 KA2LHO

CENTURY CITIES AWARD

23 KC9CA
24 N8CJF
25 KE7C
26 AKØG
27 WB7VBQ
28 KA8MVV
29 KA3FUU
30 OE8MOK
31 8P6OV
32 KAØMMD
33 WA6NIE
34 VE3JPJ
35 KA9BJX
36 KA1HJK
37 NP4DZ
38 VE6CNV

DISTRICT ENDURANCE AWARD

8 XE1TIS (49 min.)
9 KØWNY (52 min.)
10 KE7C (14 min.)
11 KA3FUU (50 min.)
12 SV1GJ (42 min.)
13 OK2QX (56 min.)
14 KAØMMD (39 min.)

WORKED ALL USA AWARD (80 METERS)

7 WAØRVK
8 N4QH
9 W4PCK
10 WB2ZEL

WORKED ALL USA AWARD (40 METERS)

4 WDØBOS
5 N5AHZ
6 N4QH
7 KA1DNB

WORKED ALL USA AWARD (20 METERS)

11 KA9JOL
12 KE7C
13 KC4YY
14 WAØCEL
15 KA4OOU
16 KA9LYH

WORKED ALL USA AWARD (15 METERS)

5 KA4IFF
6 WB9UKS
7 N4QH
8 WB7VQB

WORKED ALL USA AWARD (10 METERS)

5 VK7NBT
6 VE1BWP
7 N4QH
8 N5CSW

WORKED ALL USA AWARD (6 METERS)

8 N5DDB
9 N9CEX
10 K4GOK
11 W4CKD

WORKED ALL USA AWARD (MIXED BAND)

54 N7CPE
55 KA3GSN
56 KA3FUU
57 KA4VNS
58 AG7P
59 N8CJF
60 KA5EEZ
61 KA7JNP
62 WA9IVU
63 8P6OV
64 KA7CPZ
65 AKØG
66 VE3JPJ
67 HC2RG
68 KAØJTT
69 KA2MIM
70 KA8MVV
71 N3CHN
72 N3AKQ
73 KA1HJK
74 KAØMMD
75 WB9UIA (1980)
76 WB9UIA (1981)
77 WB9UIA (1982)
78 VE6CNV

SATELLITES

Net Name	Day	Time	Freq. (MHz)
East Coast	Wed	2100 Eastern	3.850
Mid-America	Wed	2100 Central	3.850
West Coast	Wed	2000 Pacific	3.850
New York City	Wed	2200 Eastern	144.400
Goddard Center	Wed	2100 Eastern	146.835
Los Angeles	Wed	2000 Pacific	145.805
UK	Sun	1000 UTC	3.780
International	Sun	1800 UTC	21.280
International	Sun	1900 UTC	14.282
European	Sat	1000 UTC	14.280
Espanol	Sun	1900 UTC	14.180
Asia/Pacific	Sun	1100 UTC	14.305
South Pacific	Sat	2200 UTC	28.878
South Africa	Sun	0900 UTC	14.280
SEASAT	Sun	1300 UTC	7.280
Australian	Sun	1000 UTC	3.680
New Zealand	Wed	0800 UTC	3.850

Table 1. AMSAT nets provide up-to-the-minute news about amateur satellite developments.

AMSAT NETS

Keeping up with the latest developments in the amateur space program is as easy as tuning your ham rig to one of the AMSAT nets. During these sessions, you'll hear information ranging from the latest Phase III news to tips on when and where to work the rare satellite DX. Technical discussions abound, and you can usually pick up the latest tracking data. Table 1 is a list of these informative gatherings.

PHASE IIIB PROGRESS

Summer was a time of further testing and refinement for the Phase IIIB satellite, now tentatively scheduled for January, 1983,

Amateur Satellite Reference Orbits

Date	OSCAR 8 UTC	OSCAR 8 EQX	RS-5 UTC	RS-5 EQX	RS-6 UTC	RS-6 EQX	RS-7 UTC	RS-7 EQX	RS-8 UTC	RS-8 EQX	Date
Nov 1	0013	79	0008	296	0157	326	0101	311	0133	317	1
2	0017	80	0002	296	0141	324	0051	310	0131	318	2
3	0022	81	0157	326	0126	322	0042	309	0128	319	3
4	0026	82	0151	327	0110	319	0032	308	0125	320	4
5	0030	84	0146	327	0055	317	0022	307	0122	320	5
6	0035	85	0141	327	0040	315	0013	306	0119	321	6
7	0039	86	0135	327	0024	312	0003	305	0116	322	7
8	0043	87	0130	327	0009	310	0153	334	0114	323	8
9	0048	88	0125	327	0152	337	0143	333	0111	324	9
10	0052	89	0119	328	0137	335	0133	332	0108	324	10
11	0057	91	0114	328	0121	333	0124	332	0105	325	11
12	0101	92	0109	328	0106	330	0114	331	0102	326	12
13	0105	93	0103	328	0050	328	0104	330	0059	327	13
14	0110	94	0058	328	0035	326	0055	329	0057	328	14
15	0114	95	0053	329	0020	323	0045	328	0054	329	15
16	0119	96	0047	329	0004	321	0035	327	0051	329	16
17	0123	98	0042	329	0148	349	0026	326	0048	330	17
18	0127	99	0037	329	0132	346	0016	325	0045	331	18
19	0132	100	0031	329	0117	344	0006	324	0043	332	19
20	0136	101	0026	329	0101	342	0156	354	0040	333	20
21	0141	102	0020	330	0046	339	0146	353	0037	333	21
22	0002	78	0015	330	0031	337	0137	352	0034	334	22
23	0006	79	0010	330	0015	335	0127	351	0031	335	23
24	0011	80	0004	330	0000	332	0117	350	0028	336	24
25	0015	81	0159	0	0143	360	0108	349	0026	337	25
26	0019	82	0153	1	0128	357	0058	348	0023	338	26
27	0024	83	0148	1	0112	355	0048	347	0020	338	27
28	0028	84	0143	1	0057	353	0039	346	0017	339	28
29	0033	86	0137	1	0041	350	0029	346	0014	340	29
30	0037	87	0132	1	0026	348	0020	345	0011	341	30
Dec 1	0041	88	0127	2	0011	346	0010	344	0009	342	1
2	0046	89	0121	2	0154	13	0000	343	0006	342	2
3	0050	90	0116	2	0139	11	0150	12	0003	343	3
4	0055	91	0111	2	0123	9	0140	11	0000	344	4
5	0059	93	0105	2	0108	6	0130	10	0157	15	5
6	0103	94	0100	2	0052	4	0121	9	0154	16	6
7	0108	95	0055	3	0037	2	0111	8	0151	17	7
8	0112	96	0049	3	0022	359	0102	7	0149	17	8
9	0117	97	0044	3	0006	357	0052	7	0146	18	9
10	0121	98	0038	3	0149	24	0042	6	0143	19	10
11	0125	100	0033	3	0134	22	0033	5	0140	20	11
12	0130	101	0028	4	0119	20	0023	4	0137	21	12
13	0134	102	0022	4	0103	17	0013	3	0134	21	13
14	0139	103	0017	4	0048	15	0004	2	0132	22	14
15	0000	78	0012	4	0032	13	0153	31	0129	23	15

launch. According to the *AMSAT Satellite Report*, malfunctions which occurred in both communications transponders during a midsummer thermal/vacuum test were quickly corrected by the AMSAT DL crew in Germany.

If all goes as planned, Phase IIIB will fly aboard the seventh launch (L7) of the European Space Agency (ESA) Ariane missile. The January launch date depends to a large extent on the successful launches of L5 and L6. The former was scheduled for early September and the latter for late November.

ESA's Ariane is now a head-on competitor with the Space Shuttle as a commercial satellite launcher. By means of low prices, advertisements in satellite industry magazines, and other marketing tools, ESA has built a backlog of more than 20 spacecraft awaiting a boost into orbit.

FLEXI-BILITY

AEA once again breaks new ground in the code communications field with the new model MBA-RC reader/-code converter. The MBA-RC decodes Morse, Baudot or ASCII signals off the air and displays them on a large 32 character alphanumeric vacuum fluorscent display. In addition, it will output Morse code for keying your transmitter. It will also generate RTTY (Baudot or ASCII AFSK two tone output. (170 or 850 Hz shifts.) Any of the acceptable input codes can be converted to any of the specified output codes (any speed to any speed). If you have any of the common Baudot RTTY terminals as an example, you can now send and receive Morse and ASCII with your keyboard and printer. You can even generate ASCII or BAUDOT RTTY using your Morse hand key or memory keyer.

Get the details. Write for our free product catalogue or better yet, see your favorite dealer.

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Telex: 152571 AEA INTL

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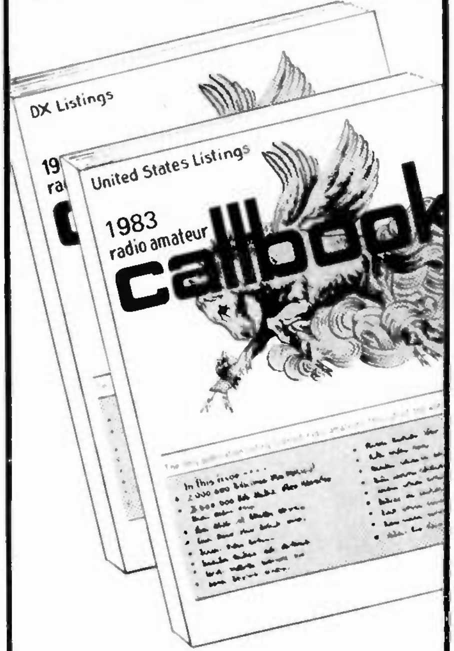
✓2

1983 CALLBOOKS



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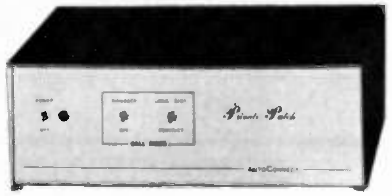

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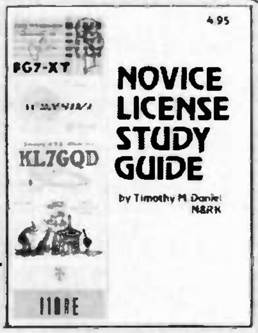

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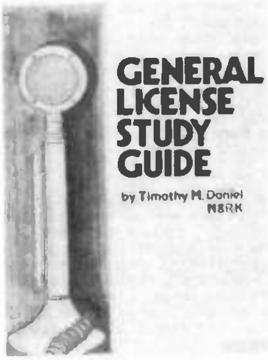

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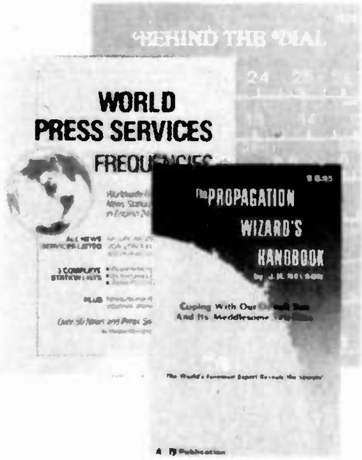

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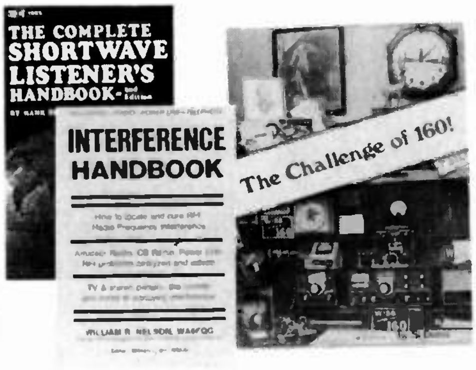

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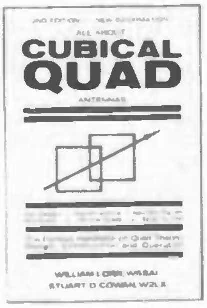

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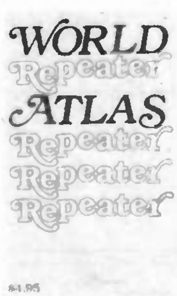

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BK7370	WEATHER SATELLITE HANDBOOK	$ 2.50
BK1202	WORLD PRESS SERVICE FREQUENCIES	$ 5.95
BK1184	WORLD RADIO TV HANDBOOK	$16.50
BK7315	WORLD REPEATER ATLAS	$ 4.95

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The above models complete with high-quality drilled PC boards, all electronic components, etc., with 15-page manual.

Note: Any of the above, factory wired, $50 additional

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HAL 567-12: single line in, 12 lines out, complete with 2-sided plated-through G-10 board and all components. Uses seven 567's and three 7402's **$39.95**

HAL 567-16: single line in, 16 lines out, complete with 2-sided plated-through G-10 board and all components; includes 22-pin edge connector. Uses eight 567's and four 7402's. (See construction article in April 1981 Radio & Electronics for complete writeup.) **$69.95**

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HAL ECD-12: 3 x 4 twelve-character encoder utilizing the ICM 7206 Intersil chip. Kit comes complete with both LED and audio-coupled outputs (speaker included). With aluminum anodized case **$29.95**

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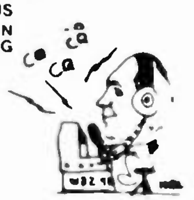

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NEW PRODUCTS

GaAsFET VHF/UHF AMPLIFIERS

Lunar has announced a line of narrowband tuned receiving preamplifiers for the VHF and UHF communities. Typical specifications exceed those of previously-available receiving preamplifiers by up to ten times in performance. Exhibiting very high gain at VHF (typically 22–24 dB), moderate gain at UHF (typ. 16 dB), and a very low noise figure (typ. 0.3–0.4 dB on VHF and 0.5–0.6 dB on UHF land-mobile frequencies), these units are also well-suited to high-rf environments, exhibiting 1-dB compression power levels of + 10 dBm or more.

The good gain, coupled with the very low noise figure, effectively reduces a typical repeater receiver sensitivity to that of ambient limitations. 6–10-dB improvements in receiver performance have been consistently reported by users in a typical repeater installation between the duplexer and receiver input.

Units are built to the customer's specified frequency, but do exhibit a typical bandwidth of 5% CF with little degradation in performance. Dc input is well-filtered and regulated, which allows accepting any dc voltage between 12 and 28 V (drain approx. 35 mA). VHF connector options include BNC, SMA, N in and out; UHF connector options are SMA, N in and out, with SMA in BNC out the standard option. SMA to RG-58 connectors are included as options for UHF units. Frequencies are available from as low as 15 MHz to as high as the 800-MHz land-mobile bands.

For further information, contact *Lunar Electronics, 2775 Kurtz Street, Suite 11, San Diego CA 92110.* Reader Service number 484.

NEW FROM W-S ENGINEERING

W-S Engineering, manufacturers of the Porta-Peater, have announced the introduction of new related products that will be of interest to both Porta-Peater owners and other amateurs alike.

In addition to the Porta-Peater M-100, which will interface with any two transceivers or receiver and transmitter pairs to create a full-function repeater, W-S Engineering now offers its new Porta-Link PL-250 and MB-1 Multi-Board building block.

The Porta-Link PL-250 is a single-board simplex link and portable repeater that may be interfaced with two transceivers, or two receiver-transmitter pairs, to form a complete repeater system for applications that do not require a CW-ID system. Owners of the Porta-Peater can add the Porta-Link board and have a complete duplex link, remote base, and dual repeater. The PL-250 has on-board controls for timeout duration, hang time, audio balance, local mike gain, and local speaker amplifier gain. Connections to the PL-250 are done via a 22-pin, 0.156-inch edge connector.

The MB-1 Multi-Board building block is a "universal" circuit that can provide up to *ten* different functions. Configured by the user, the MB-1 can be a variable audio-frequency signal generator, variable radio-frequency signal generator, audible CMOS logic probe, LED output logic probe, repeater beeper, gated monostable, gated astable, pulse stretcher, adjustable timer, individual positive and negative edge triggers, and more.

The MB-1 is completely self-contained and operates on any dc voltage between 5 and 15 volts. Output level, pulse length, and frequency are fully adjustable with on-board controls. The MB-1 comes complete with an assembly and applications manual, and all parts, sockets, PC board, and accessories are furnished.

For further information about these products, contact *W-S Engineering, PO Box 58, Pine Hill NJ 08021.* Reader Service number 481.

YAESU FT-102

Yaesu Electronics Corporation has announced the availability of its new FT-102 line of HF equipment.

The FT-102 transceiver utilizes an all-new transmitter section featuring three 6146B final tubes for extremely low distortion. In addition to VOX and an rf clipping-type speech processor, the FT-102 transmit audio may be adjusted for optimum response to the operator's voice.

The FT-102 receiver uses husky JFET components in the front end for wide dynamic range. A number of filter options are available, with wide/narrow filter selection independent of the mode switch. Audio peak filtering for CW, audio shaping for all modes, and an i-f notch filter provide outstanding intelligence recovery. The noise blanker is highly effective against the "woodpecker" and pulse noises.

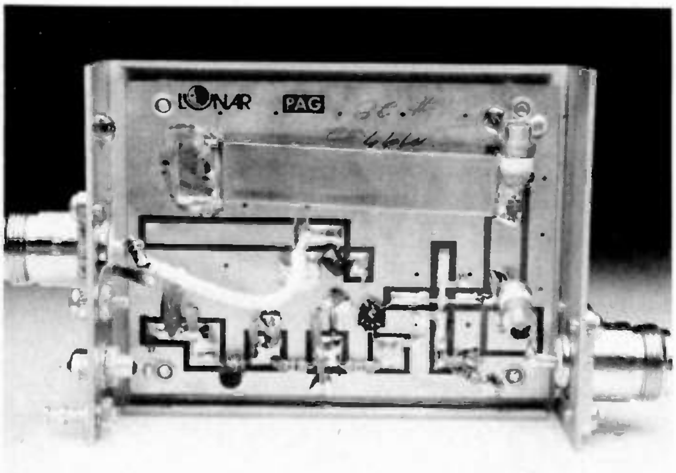
Equipped for SSB and CW operation, the FT-102 option list includes an AM/FM module for activating those modes. Other accessories for the FT-102 are the FV-102DM synthesized vfo, the SP-102 speaker with audio filter, the SP-102P speaker/patch, and the FC-102 1.2-kW antenna tuner with optional remote antenna selector.

For further information, contact *Yaesu Electronics Corp., PO Box 49, Paramount CA 90723.* Reader Service number 476.

DENTRON'S NEW 5-BAND TRANSCEIVER

DenTron Radio Company has begun production on a new 200-Watt, CW, SSB solid-state transceiver named the Horizon One, which covers 80-15 meters and any 500-kHz segment of 10 meters. Its sensitivity is .35 uV for 10-dB signal-to-noise ratio, with selectivity of 2.4 kHz at 6-dB points and G-60-dB factor of 1.7:1. Performing with the latest MOSFET and ballasted emitter semiconductors, the Horizon One also has a pinpoint digital frequency readout using LSI technology.

Input power is 200 W PEP with an output of 100 W PEP nominal and 80 W PEP on 10 meters. Power requirements are 12.6–14.5 V dc regulated at 2.0 Amps maximum and 12.6–14.0 V dc regulated or unregulated at 18 Amps peak. The Horizon One has a built-in VOX, noise blanker, and hand mike as standard



Lunar's GaAsFET VHF/UHF amplifier.

Yaesu's FT-102.

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For $69.95 you get the most efficient, dependable, fully guaranteed 35W 2 meter amp kit for your handy talkie money can buy.
Now you can save your batteries by operating your H.T. on low power and still get out like a mobile rig. The model 335A produces 35 watts out with an input of 3 watts, and 15 watts out with only 1 watt in. Compatible with IC-2AT, TR-2400, Yaesu, Wilson & Tempo! Other 2 meter models are available with outputs of 25W and 75W, in addition to a 100W amplifier kit for 430MHZ.

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MODEL	BAND
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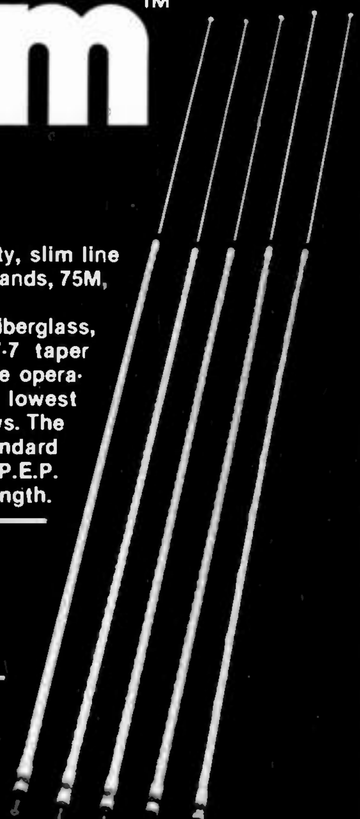
PHF40	40 Meters
PHF20	20 Meters
PHF15	15 Meters
PHF10	10 Meters



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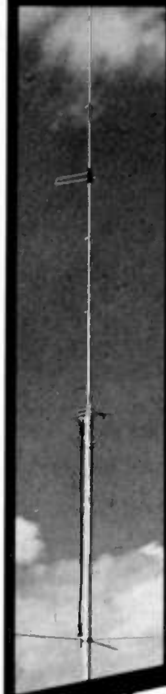

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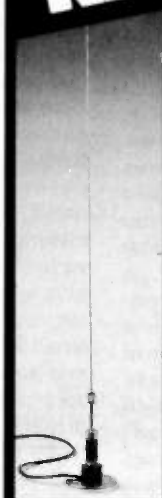

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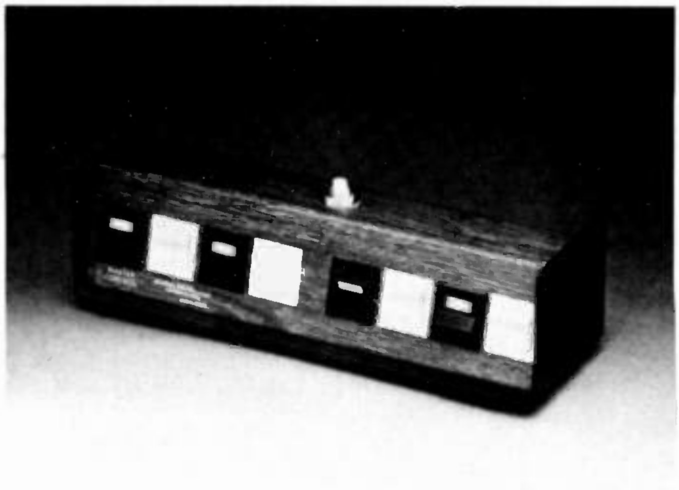
DenTron's Horizon One.



Alpha Delta's Master Control Console.

equipment. Optional accessories include an ac power supply, matching antenna tuner, linear amplifier, and mobile mount.

For further information, contact Tim Neill, Technical Sales Representative, *DenTron Radio Company, Inc., 1605 Commerce Drive, Stow OH 44224; (216)-688-4973*. Reader Service number 485.

DIVERSITY RECEPTION FOR REPEATERS

Pegasus Electronics has announced a new diversity receiving system for repeaters. Now you can turn any repeater into a "super repeater" by adding a VS-2 voting system and an rf link. The VS-2 compares the audio quality of any 2 receivers (they need not be matched) and connects the one that hears you best to the repeater for retransmission. Since the VS-2 is always listening to both receivers, it can continuously update as you go from a peak on one to a null on the other. The result: You have a repeater which sounds like it has no "dead" spots and your users are always readable as long as they are solid into any *one* of your receivers.

The VS-2 was designed to work with anything. It has all its own level controls and ensures a constant output to your repeater. It was designed to be installed by anyone who knows how to read a scope. The VS-2 is supplied on a single circuit board (5⅛" × 5¼") and contains two squelch circuits (COS). It is fully compatible with 12-volt logic, 5-volt logic, and inverted logic by cutting the desired jumpers (or you can use your own logic and bypass that portion of the VS-2). The VS-2 is not a kit—it comes fully assembled and tested and is warranteed for one full year.

For further information, contact *Pegasus Electronics, Inc., 88 New Dorp Plaza, Staten Island NY 10306*. Reader Service number 488.

PHOTOVOLTAIC SYSTEMS

Encon Corporation, authorized distributors of Solarex photovoltaic products, has a publication entitled *The Complete Photovoltaic Systems Catalog* which can answer many of your questions about solar energy conversion and distribution. The catalog covers an introduction to photovoltaic systems, photovoltaic cells and panels, renewable energy batteries, charge controllers and metering devices, ac power inverters, how to select a workable system for your needs, basic 12-volt systems, large-dc/small-ac systems, components and accessories you will need, solar demonstrators, educational materials, marine and recreational panels, and much more.

If you have an interest in direct conversion of sunlight to power, you will enjoy this catalog and overview of the entire subject. A price guide as well as an applications questionnaire form are included so that you can obtain expert advice and assistance for potential applications that you may have in mind. Encon will assist you with your questions and needs in solar applications.

For further information, contact *Encon Corporation, 27584 Schoolcraft, Livonia MI 48150*. Reader Service number 479.

MASTER CONTROL CONSOLE

Alpha Delta Communications has just announced its new Master Ac Control Console which combines power-surge protection and centralized "on/off" control of several components. The MACC unit plugs into a single outlet and provides eight plug-in "U" ground outlets: one "hot" outlet for continuously-powered appliances such as a clock, for example, and seven outlets for individually-controllable components.

The front panel has rocker switches for the individually-controllable components, plus a master control "on/off" rocker which allows the entire system to be turned on or off at once. All rockers are lighted when "on."

The surge-protection feature is perhaps the most important feature of Alpha Delta's MACC unit. The delicate circuitry of modern solid-state electronic equipment is particularly vulnerable to damage from power surges and spikes which can be caused by natural or man-made sources such as lightning strikes, electric motors, transformers, wind-blown snow, clouds, fluorescent lamps, power outages, and the like. The MACC is tested to IEEE pulse standards and is rated at 15 A, 125 V ac, 60 Hz, 1875 Watts continuous-duty total for the console.

Priced at $79.95 (US), the MACC is available from Alpha Delta dealers or, for $4 more to cover postage and handling, direct from the factory. Alpha Delta will quote on overseas postage and on the "European Model" MACC-E available with VDE-approved socket for 240 V ac.

For further information, contact *Alpha Delta Communications, PO Box 571, Centerville OH 45459*. Reader Service number 486.

MORTTY SOFTWARE FOR COMMUNICATIONS

MORTTY is a general-purpose communications program adaptable to almost any set of conventions in current use. It includes ASCII and Baudot capabilities at a wide range of baud rates. There are 18 parameters for adaptation to particular conventions such as full screen, split screen, full or half duplex, and many more. There are 15 disk operations, including disk file send, receive, direct binary to hex upload, hex to binary download, automatic message capture with file sequencing, and automatic answering of messages from a disk file.

The equipment required to make use of the program is an H89 or Z89 microcomputer with 32K of memory and an H88-3 serial interface. MORTTY reprograms the serial interface for baud rate, etc., according to the communications mode selected, and does the translation between ASCII and Baudot when a Baudot mode is in use. In place of the H89 or Z89 with H88-3, you may use an H8 with H19 terminal and H8-4 serial interface with H17 disk system.

The software required is HDOS v. 2.0, which is the current Heath disk operating system. Heath claims that programs should be upward-compatible with new HDOS releases, but we cannot guarantee that this will always be true.

The price of the MORTTY pro-

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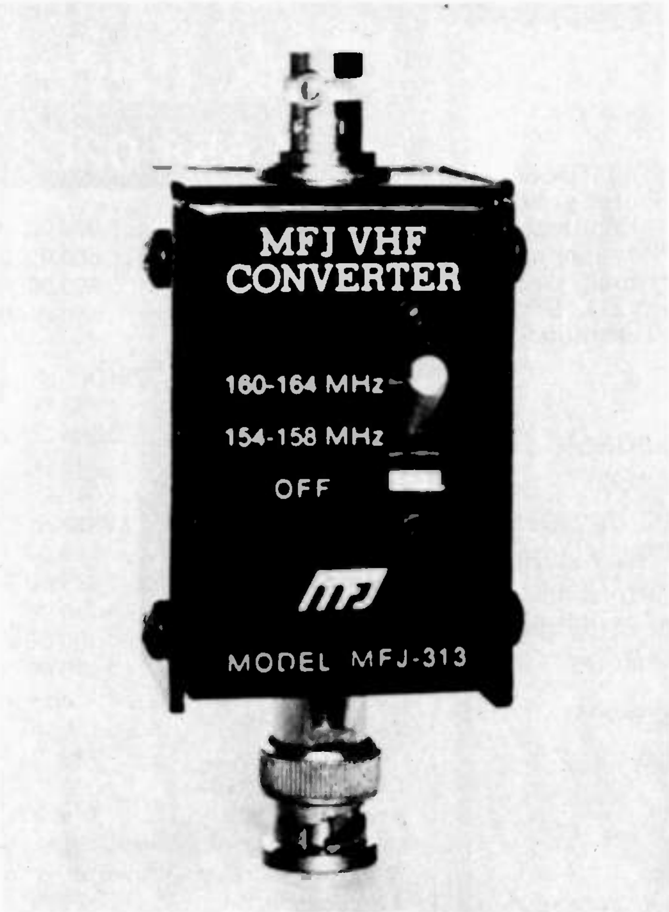


MFJ's VHF converter.

gram is $100.00 ppd in the USA. Ohio purchasers should add 6% sales tax. Foreign prices will depend on the additional expenses of mailing. This price buys a printed copy of a thorough user's guide of about 60 pages and a 5¼" hard-sector disk with the absolute binary MORTTY program.

For further information, write *"MORTTY program"* or *"Phillip L. Emerson" at 3707 Blanche, Cleveland Heights OH 44118.* Reader Service number 480.

MFJ-313 POLICE/FIRE/ WEATHER BAND CONVERTER FOR 2-METER HAND-HELDS

MFJ has introduced its new compact VHF police/fire/weather band converter for 2-meter hand-helds.

It turns your synthesized 144-148-MHz hand-held into a police/fire receiver (154-158 MHz) and gives you direct frequency readout on your hand-held. A programmable scanning hand-held becomes a sensitive programmable police/fire scanner.

You can also receive weather, maritime coastal, and more on the 160-164-MHz band. Feed-through allows simultaneous scanning of both 2 meters and the 160-164-MHz band.

A high-pass input filter and a 2.5-GHz transistor give very high uniform sensitivity over both the 154-158-MHz and 160-164-MHz bands. Each band is crystal-controlled for excellent stability.

A Bypass/Off position allows transmitting through the converter. It is protected against burnout if you transmit (up to 5 Watts) with the converter on. Short direct-signal paths give low insertion swr.

This compact converter measures only 2¼ x 1½ x 1½ inches and weighs 4 ounces. A single AAA battery (not included) gives you months of operation. The cabinet is black and is made of rugged, lightweight aluminum for years of hard use. BNC connectors mount the converter directly between your handle-talkie and antenna without cables.

For further information, contact *MFJ Enterprises, Inc., PO Box 494, Mississippi State MS 39762.* Reader Service number 483.

NEW FROM VOCOM

VoCom Products Corporation has announced two new products for the amateur 220-MHz band: a "two Watts in, twenty Watts out" power amplifier with a suggested list price of $84.95 and a "Power Pocket" for the Icom IC-3AT hand-held transceiver with a suggested list price of $229.95.

Channel Master's model 6128 satellite receiver.

With the Power Pocket, the 220-MHz operator now has the same advantage that he had on two meters: the convenience of a hand-held and the punch of a mobile rig. Styled essentially the same as the two-meter version, the 220-MHz Power Pocket offers a large speaker, an audio amplifier, an rf power amplifier, and a battery charger that meets the current requirements of the radio. For example, you can use the amplified hand-held in your car on the way to work, hold your own in any QSO, and arrive with a battery that is still charged . . . as good or better than it was when you started!

For further information, contact *VoCom Products Corporation, 65 East Palatine Road, Prospect Heights IL 60070.* Reader Service number 478.

EARTH-STATION RECEIVER

Channel Master has just introduced a new Earth-station receiver, the model 6128, offering a wide range of features and advanced electronics. The receiver is a 24-channel synthesized unit employing a single downconverter installed at the dish and a receiver unit located in the home.

For simplified tuning, the full 24-channel number format is displayed on the receiver's LED digital channel display. Channels are power-selected by Up/Down push-buttons and fine tuning is provided with the assistance of the Center/Fine Tune meter.

Two Priority Audio buttons select audio channels (6.8 and 6.2 MHz), while additional audio channels may be selected manually.

A signal-strength meter shows the relative strength of received signals. The Channel Scan button is depressed to cycle the receiver through the complete horizontal channel range in about one second, as an aid to aiming the antenna.

Automatic polarity switching allows one-button selection of any channel without additional polarity adjustments, and a built-in modulator eliminates the need for a separate modulator. The model 6128 is capable of receiving normal or inverted video signals. An optional model 6192 remote control unit offers the added convenience of remote channel selection and fine tuning.

For further information, contact *Channel Master, Division of Avnet, Inc., Ellenville NY 12428.* Reader Service number 482.

NEW TS-830, TS-930, R-820 FILTER KIT

Fox Tango Corporation has announced the availability of a special high-quality matched-filter kit designed to significantly improve the selectivity of the popular Kenwood R-820, TS-830, and new TS-930 series. These rigs all use similar dual-conversion i-f systems with 8830-kHz first and 455-kHz second intermediate frequencies. I-f bandwidth filtering at both frequencies is used to provide VBT (variable bandwidth tuning). However, in the TS-830S model, the 2.7-kHz bandwidth of both original filters (resulting in a net bandwidth of 2.4 kHz with VBT off), the combined filter shape factors (1.34 with VBT off), and a combined ultimate rejection of about 80 dB leave much to be desired.

Under the same conditions, the Fox Tango filters (both 8-pole discrete crystal units instead of the original monolithic and ceramic types) each have a bandwidth of 2.1 kHz (net bandwidth of 1.99 kHz), a combined shape factor of 1.19 (the lower, the better), and an ultimate rejection greater than 110 dB (the higher, the better). The effects are even more pronounced when VBT is used to narrow the operating i-f bandwidth to reduce QRM.

The matched-pair filter kit, complete with detailed instructions, two 2.1-kHz Fox Tango filters (guaranteed for one year), and all needed cables and parts, is being offered at an introductory price of $150 plus $3 for shipping ($5 for air).

For further information, contact *Fox Tango Corporation, PO Box 15944, W. Palm Beach FL 33406; (305)-683-9587.* Reader Service number 477.

REVIEW

COM-RAD INDUSTRIES CR1720A "MOBILE EAR" ANTENNAS

Jim Waldron of Com-Rad has been interested in space-saving antennas for a long time, and he has built and tested dozens of them with the idea that a better antenna can be built and is much needed. Jim's idea of a "better" antenna is one that is small, compared with a full-size antenna for the band selected; one that is rugged and has a low profile; one that is easy to tune; and one that is duck soup for mobile operation, yet may be used in portable or fixed operation as well.

At first glance, the Mobile Ears look something like a cross between a giant coil and a short dipole, and that is almost exactly what they are. The large-diameter helix is resonated to frequency by the capacitance-to-ground of the adjustable "resonator"—a capacity hat which is basically two telescoping whip antennas mounted above the coil and parallel with the roof of the automobile. The helix radiates vertically-polarized rf energy in the radial, rather than axial, mode... similar to that from a conventional vertical antenna.

The CR1720A comes from the factory with a large magnetic mount that will defy almost any attempt to remove it accidentally from the roof of your car once it has been placed in position. The shunt feed has been factory-preset to provide the proper 50-Ohm feedpoint impedance, and a UHF chassis-type rf connector (SO-238) is located on the center support pillar just above the mounting base. Although it is normally used with the magnetic mount supplied by Com-Rad, the Mobile Ear can be used with any mount that is connected directly to ground, such as groundplane radials or the like. The reason for this is that the coaxial cable is connected to the antenna rather than to the mounting base; for proper operation, the base of the antenna should be grounded. For example, you might wish to replace the magmount with a permanent base for the home station, and this can be done by using the 3/8-24 bolt at the bottom of the antenna—the one that the magmount screws into.

The CR1720A comes completely assembled, except for attachment of the telescoping whips to the top of the support pillar. This is easily and quickly done by sliding the setscrew ends of each whip over the 5/16-inch stubs at the top of the support pillar and tightening the setscrews.

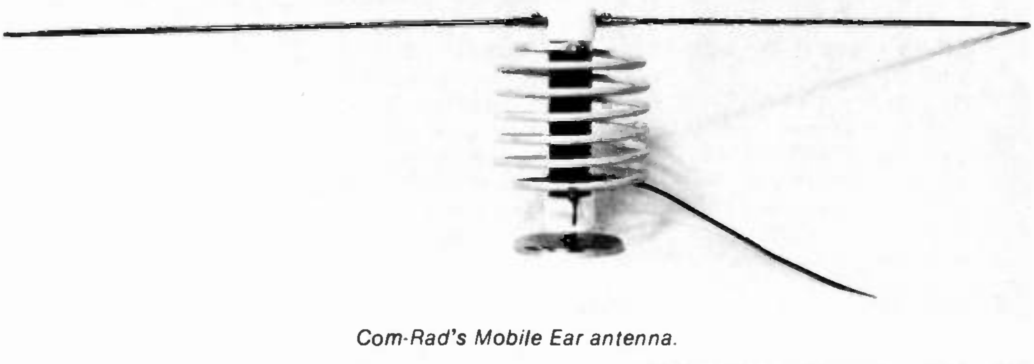
After you have mounted the antenna in the desired location on your car roof, connect an swr bridge in the line between the antenna and your transceiver or transmitter by means of a short length of coaxial cable, placing it as close as practical to the antenna itself (within two or three feet). Set the telescoping whips to approximately 50 inches each, and set your transmitter to the desired operating frequency. Apply a small amount of power and look at the swr. Small incremental adjustments of whip length by sliding the ends in or out (*out*—or longer—to lower the frequency and *in*—or shorter—to raise the frequency) will quickly provide a 1:1 vswr. Observe the lowest possible swr that you can get with your particular vehicle. If it isn't less than about 1.5:1, you can move the clamp ring of the shunt feed in tiny increments to achieve a perfect match. In the case of the test antenna, this wasn't necessary, as a perfect 1:1 match was obtained immediately.

I checked the bandwidth after achieving a perfect match and found that the frequency could be moved 65 kHz in either direction from the resonant frequency without exceeding 2:1 vswr. This means that with most rigs you can operate over your favorite phone or CW segment of the 20-meter band without any retuning at all. Of course, if you are a perfectionist, you can achieve exact matching at any frequency within the band... no sweat.

In the case of the test antenna, the inner sections of the whips were fully extended and the outer sections only partly extended. This gives the largest possible diameter at all times. I resonated the antenna at 14.025 MHz and found each whip length to be exactly 53¼ inches, measured from the surface of the support pillar. On the phone portion of twenty meters, I found that 14.3 MHz required a whip length of only 48½ inches. This is likely to vary slightly from car to car because of the different sizes of roof area, etc. A station wagon, for example, will have more groundplane area than a tiny subcompact, but both will work!

No doubt you are anxious to hear about results, and I won't disappoint you. The twenty-meter Mobile Ear really works. After tuning the antenna to resonance and firing up the *73* FT-707 transceiver (with my 1980 Olds Omega parked in my driveway), I found myself in the middle of the WAE contest on Sunday afternoon, August 15th. I answered many calls and received replies from each one. All were 599. Now, I'll admit that this is often the case in a contest, to make things easier for the report giver, but I got an answer to the first call every time! Not only that, but when I called CQ I got answers, too. In the space of only a few minutes I had worked UT5, UQ2, DL7, OZ1, OH5, UK5, G4, N9, KØ, and W4 lands! (Naturally, the US stations don't count, but I wanted to try the antenna.) To date, I've not done much with phone, as I am predominantly a CW operator. However, a few contacts up around 14.300 have been made with good results—G3, for example... and others.

I noticed that the noise pickup of the antenna is surprisingly low compared with other verticals I've tried. One possible explanation could be that the com-



Com-Rad's Mobile Ear antenna.

ponents are horizontally-configured and thus less subject to man-made or natural QRN.

I should mention that the CR1720A is beautifully made—the helix is heavy-duty aluminum tubing and the whips are stainless steel. The supporting pillar appears to be heavy-wall PVC and the magmount is chrome-plated steel. Everything considered, the CR1720A is a very fine portable/mobile/fixed antenna, one that the *73* staff really liked. You ought to know that the antenna doesn't need to be removed to put my car in the garage, so yours shouldn't need to be removed either, unless you want to. In public parking facilities, just slide in the whips, remove the coax, take the Mobile Ear off the roof and stow it in the trunk. It takes about 20 seconds . . . and, best of all, it can be remounted and ready to go in about the same time. In my case, I ran the whips fore and aft parallel to the car's centerline so that they wouldn't be sticking out into the side. If you live in an apartment or condo where outside antennas are forbidden, you might find one of the Mobile Ears to your liking.

By the way, the "17" part of 1720 means that this antenna will also work on the 18-MHz (17-meter) band whenever that becomes available to amateurs in the United States. The CR1720A is one of three Mobile Ears which cover 12/15 meters, 17/20 meters, and 30/40 meters: versatile, indeed. The CR1720A lists for $55 plus $4 shipping, direct from the manufacturer.

For further information, contact *Com-Rad Industries, 1635 West River Parkway, Grand Island NY 14072*. Reader Service number 487.

Jim Gray W1XU
***73 Magazine* Staff**

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 8

a lot, I suspect. It read: C/Q/THE/FASTEIET/GROWING/AMATEUR/RADIO/MAGAZINE/ That's operculiform sending . . . and does not surprise us.

BUNCH GETS BASHED!

The recent Bash debacle in Baltimore should put an end to the fantasy that Bash is doing anyone any good except Bash. I also hope it will shut up a lot of the hams who are moaning about the code and ignoring the fact that Bash has totally done away with any need for technical competence . . . or at least had until the Baltimore epic.

As usual, Bash collected his most generous fees and set about helping a large group of hopefuls to memorize the answers to the FCC exams. He drilled them thoroughly, as always. But this time the FCC had made some very minor changes in the wording of the exam, with the result that 89% of his group flunked. The word is that the changes were small, such as in some of the values in the math problems.

One of the new questions for the General class had to do with the yagi antenna, asking which way it radiated energy. Only *one* of the Bash trainees got this one right! We're dealing with massive ignorance of amateur radio theory, not superficial ignorance, with these memorization sessions and the Bash books.

You know, I've been writing about this problem for quite a long time now and I've had almost zero response from readers. I have yet to hear of one single case where an amateur or a club has protested to a ham dealer carrying the Bash books. Not one case of an irate ham tearing up the books. No protests to *CQ* for carrying the ads for these pernicious books. No, it is obvious that no one really gives a damn whether a newcomer to amateur radio has even the slightest technical knowledge or even the ability to pass a fair test. So why all the fuss about Morse code? Am I talking to a bunch of hypocrites?

The Bash books and the Bash high-priced blitz weekend course are designed for one thing: to help people cheat at the FCC exams and bypass the entry requirements. As long as you don't care if people cheat to get a ham ticket, why should you care whether they are sold by Sears along with a two-meter HT? I don't see any difference, do you? If you really, sincerely, believe that people who cheat to get their ham licenses are suddenly going to be wonderful and productive hams once they get the magic paper from the FCC, then you also believe in the tooth fairy and that Congress will balance the budget. In other words, you're crazy.

Frankly, I'd rather see Sears making all that money instead of Bash; at least we would have more than a tiny dribble of new hams. Bash, despite his heroic efforts, has only been able to bring in a few thousand new hams for us. True, he's probably responsible for much of the few we've had. But if we are going to go along with the Bash system, which you have wholeheartedly accepted, let's go all the way and get some mass merchandisers into the act.

You've seen this thing happening and you haven't done a damned thing about it. Why should I have any respect for you? The hypocrisy over the code just makes this all the more irrational. And don't try to tell me that this is all news to you. Baloney.

NO SECOND LANGUAGES

There has been a liberally-fueled effort to cope with the inrush of Hispanics by allowing them to continue to use Spanish in school rather than force them to learn English. Fortunately, there is now a gathering movement against this policy. We showed that the "melting pot" system worked in America and then we tried to ignore it.

The more we keep newcomers to the United States able to make do without learning English, the more we are taking away from them the benefits which they presumably came here for. I'd like to see our schools teaching foreign languages, but not catering to students who do not have a solid use of English. I'd like to see the publication of foreign-language newspapers and foreign-language radio and television programs discouraged.

The lesson in Canada of how different languages split a country should be heeded. When a group in a country holds on tight to its language and culture, it is a disruptive force. Americans living in other countries tend to stick together and avoid learning the language as much as possible. This hurts both them and the country in which they are living.

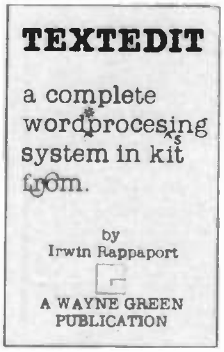
The Indians (Asian) have long had a problem with this. In every country where there are a significant number of Indians, they are clannish and generate resentment with the other people. We don't have many Indians in the US, so we are not aware of them, but we do see the Chinese, who have the same problem. For many years we sort of accepted that the Chinese for some reason don't know English and run either laundries or restaurants.

Both the Indians and the Chinese are very hard-working people and, I suspect, if either group had made an effort to integrate into their new countries, they would have virtually taken over. Of course, Americans used to be hard-working people . . . and a few still are . . . but for the most part I see few remnants of this heritage. Perhaps we are most fortunate that the Chinese in America are so clannish and thus are kept from enjoying and benefitting from our educational opportunities.

We still live in a world where hard work pays off. This is one of the reasons we have so few wealthy people. Given equal opportunity, I suspect that the US would be as proportionately populated with wealthy Chinese as it is wealthy Jews. In Taiwan, Hong Kong, and Singapore, we see how well the Chinese can do when they are not held down by Communism. Perhaps we are fortunate, in a way, that the political systems in China have been so destructive. I'm sure that the Chinese could, if working in a free country, run circles around us.

Wayne Green Books

NEW ARRIVALS



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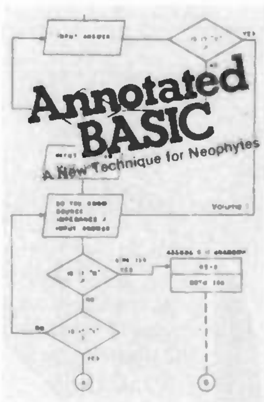

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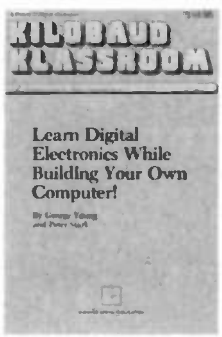

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The Facit 4555 alphanumerical serial printer is complete. Equipped with RS232C Interface, printing mechanism, control electronics, drive electronics, power supply and character generator. The adaptation electronics can be modified in four versions:Bit-parallel data transfer, CCITT (EIA, RS232C) for bit-serial data transfer and the current loop (TTY) interface also for bit serial data transfer. The Facit 4555 prints on ordinary paper and is adjustable for different paper widths and formats, 9.5" paper width with 66 lines per page or DIN A4 with 70 lines per page.

SPECIFICATIONS

Print speed	up to 60ch.s.	Char. spacing	2.54mm/1/10" 80ch/line 1.55mm/0.06" 132ch/line
Printing mode	Incremental.		
Max. # of ch/line	80 alt. 132.	Char. Code	ECMA-6 7-bit coded char. set
Matrix	7 X 5 dot matrix.	Char. Set	63 Char. various national versions.
Char. Size Height	2.7mm/1/8"		
Char. Size Width	1.3mm/0.05" 132ch/line 2.1mm/0.083" 80ch/line	Feed mechanism	Sprocket feed.

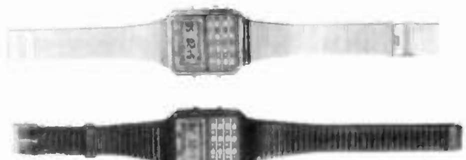
THESE UNITS WERE PULLED OUT OF SERVICE IN GOOD WORKING CONDITION. WE CHECK EACH UNIT ON A RADIO SHACK TRS-80 COLOR COMPUTER.

PRINTER ONLY $129.99

Printer with linecord, box of paper, inter-connect cable for TRS-80 COLOR COMPUTER.
$149.99

GENEVA CALCULATOR WATCH

This attractive watch has the following modes:
Normal Time Setting,
Calendar Setting,
Daily Alarm Time Setting,
Weekly Alarm Time Setting,
Chronograph,
Calculator.



Featured in Black Plastic $24.99 or Featured in Stainless Steel $29.99

SILICON DIODES

MR751	100vdc	6Amps	10/$5.00	100/$38.00
MR510	1000vdc	3Amps	10/$3.75	100/$24.00
HEP170	1000vdc	2Amps	20/$2.00	100/$15.00
1N3209	100vdc	15Amps	$2.00	10/ $15.00
BYX21/200	200vdc	25Amps	$2.00	10/ $15.00
1N2138A	600vdc	60Amps	$5.00	10/ $40.00
DS85-04C	400vdc	80Amps	$10.00	10/ $80.00
1N3269	600vdc	160Amps	$15.00	10/$120.00
275Z41	300vdc	250Amps	$20.00	10/$175.00
7-5754	300vdc	400Amps	$30.00	10/$250.00
RCD-15	15KVDC	20ma.	$3.00	10/ $20.00
SMFR20K	20KVDC	20ma.	$4.00	10/ $30.00
1N4148	signal		30/$1.00	100/ $3.00

FEED THRU SOLDER RF CAPACTORS

470pf +-20%

5/$1.00 or 100/$15.00 or 1000/$100.00

1000pf/.001uf +-10%

4/$1.00 or 100/$20.00 or 1000/$150.00

E PROMS

2708 1024x1	$2.00 each
2716 2048x8	$4.00 each
27L32/25L32	$10.00 each

FAIRCHILD 4116 16K DYNAMIC RAMS 200ns. Part # 16K75

25 For $25.00 or 100 For $90.00 or 1000 For $750.00

HEWLETT PACKARD MICROWAVE DIODES

1N5711	(5082-2800)	Schottky Barrier Diodes	$1.00 or 10 for $ 8.50
1N5712	(5082-2810)	" " "	$1.50 or 10 for $10.00
1N6263	(HSCH-1001)	" " "	$ .75 or 10 for $ 5.00
5082-2835		" " "	$1.50 or 10 for $10.00
5082-2805	Quad Matched	" " " per set	$5.00 or 10 for $40.00

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RECALL PHONE MEMORY TELEPHONE WITH 24 NUMBER AUTO DIALER

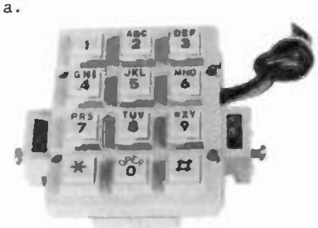
The Recall Phone Telephone employs the latest state of art communications technology.It is a combination telephone and automatic dialer that uses premium-quality,solis-state circuity to assure high-reliability performance in personal or business applications. $49.99

ARON ALPHA RAPID BONDING GLUE

Super Glue #CE-486 high strength rapid bonding adhesive.Alpha Cyanoacrylate.Set-Time 20 to 40 sec.,0.7fl.oz.(20gm.)
$2.00

THOUCH TONE PAD

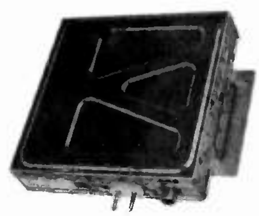
This pad contains all the electronics to produce standard touch-tone tones. New with data.



$9.99 or 10/$89.99

MITSUMI UHF/VHF VARACTOR TUNER MODEL UVE1A

Perfect for those unscrambler projects. New with data.



$19.99 or 10/$149.99

INTEGRATED CIRCUITS

		1 to 10	11up
MC1372P	Color TV Video Modulator Circuit.	$ 4.42	$2.95
MC1358P	IF Amp.,Limiter,FM Detector,Audio Driver,Electronic Attenuator.	5.00	4.00
MC1350P	IF Amplifier	1.50	1.25
MC1330A1P	Low Level Video Detector	1.50	1.15
MC1310P	FM Stereo Demodulator	4.29	3.30
MC1496P	Balanced Modulator/Demodulator	1.50	1.25
LM565N	Phase Locked Loop	2.50	2.00
LM380N14	2Watt Audio Power Amplifier	1.56	1.25
LM1889N	TV Video Modulator	5.00	4.00
NE564N	Phase Locked Loop	10.00	8.00
NE561N	Phase Locked Loop	10.00	8.00

FERRANTI ELECTRONICS AM RADIO RECEIVER MODEL ZN414 INTERGRATED CIRCUIT.

Features:

1.2 to 1.6 volt operating range.,Less than 0.5ma current consumption. 150KHz to 3MHz Frequency range.,Easy to assemble,no alignment necessary. Effective and variable AGC action., Will drive an earphone direct. Excellent audio quality.,Typical power gain of 72dB.,TO-18 package. With data. $2.99 or 10 For $24.99

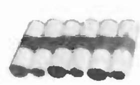
NI CAD RECHARGEABLE BATTERIES

AA Battery Pack of 6 These are Factory New. $5.00

SUB C Pack of 10 2.5Amp/Hr. $10.00

Gates Rechargeable Battery Packs

12vdc at 2.5Amp/Hr. $11.99
12vdc at 5Amp/Hr. $15.99



VHF DUPLEXERS

This duplexer was made for RF Harris Mobile Phones. These duplexers can be used in any mobile phone system,along with having the capabilities to be modified for UHF use. Dimensions are 3 3/5"Lx 4 2/5" Wx 1 1/10"D. App. weight is 18oz./1lb.2oz.

PRICE $74.99

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RF TRANSISTORS, MICROWAVE DIODES

PART	PRICE	PART	PRICE	PART	PRICE
1S2199	$ 7.50	2N6083	$ 13.25	CA2612 (TRW)	$ 25.00
1S2200	7.50	2N6084	15.00	CA2674 (TRW)	25.00
2N1561	25.00	2N6094 /M9622	11.00	CA2881-1(TRW)	25.00
2N1562	25.00	2N6095 /M9623	12.00	CA4101 (TRW)	25.00
2N2857	1.55	2N6096 /M9624	15.50	CA4201 (TRW)	25.00
2N2857JAN	2.55	2N6097	17.25	CA4600 (TRW)	25.00
2N2876	11.00	2N6136	21.85	CD1889	20.00
2N2947	18.35	2N6166	40.25	CD2545	20.00
2N2948	15.50	2N6201	50.00	CMD514AB	20.00
2N2949	3.90	2N6459	18.00	D4959	10.00
2N2950	4.60	2N6603	12.00	D4987M	20.00
2N3375	8.00	2N6680	80.00	D5147D	10.00
2N3553	1.57	2SC756A	7.50	D5506	10.00
2N3632	13.80	2SC781	2.80	D5827AM	20.00
2N3818	5.00	2SC1018	1.00	DMD6022	30.00
2N3866	1.30	2SC1042	12.00	DMS-2A-250	40.00
2N3924	3.35	2SC1070	2.50	HEP76	4.95
2N3927	17.75	2SC1239	2.50	HEPS3002	11.30
2N3950	25.00	2SC1251	12.00	HEPS3003	30.00
2N4072	1.80	2SC1306	2.90	HEPS3005	10.00
2N4127	21.00	2SC1307	5.50	HEPS3006	19.90
2N4427	1.30	2SC1760	1.50	HEPS3007	25.00
2N4428	1.85	2SC1970	2.50	HEPS3010	11.34
2N4957	3.45	2SC2166	5.50	HTEF2204 H.P.	112.00
2N4958	2.90	8B1087 (M.A.)	25.00	5082-0112 H.P.	14.20
2N4959	2.30	A50-12	20.00	5082-0253 H.P.	105.00
2N5090	13.90	A283B	5.00	5082-0320 H.P.	58.00
2N5108	4.00	ALD4200N (AVANTEK)	395.00	5082-0386 H.P.	POR
2N5109	1.70	AM123	97.35	5082-0401 H.P.	POR
2N5160	3.45	AM688	100.00	5082-0438 H.P.	POR
2N5177	21.62	BB105B	.52	5082-1028 H.P.	POR
2N5179	1.00	BD4/4JFBD4 (G.E.)	10.00	5082-2711 H.P.	23.15
2N5583	4.00	BFQ85	1.50	5082-3080 H.P.	2.00
2N5589	8.65	BFR90	1.30	5082-3188 H.P.	1.00
2N5590	10.35	BFR91	1.65	5082-6459 H.P.	POR
2N5591	13.80	BFW92	1.50	5082-8323 H.P.	POR
2N5635	10.95	BFX89	1.00	35826E H.P.	POR
2N5637	15.50	BFY90	1.00	35831E H.P.	29.99
2N5641	9.20	BGY54	25.00	35853E H.P.	71.50
2N5642	10.95	BGY55	25.00	35854E H.P.	75.00
2N5643	15.50	BGY74	25.00	HPA0241 H.P.	75.60
2N5645	13.80	BGY75	25.00	HXTR3101 H.P.	7.00
2N5646	20.70	BL161	10.00	HXTR3102 H.P.	8.75
2N5691	18.00	BLX67	11.00	HXTR6101/2N6617 H.P.	55.00
2N5764	27.00	BLY568CF	25.00	HXTR6104 H.P.	68.00
2N5836	5.45	BLY87	13.00	HXTR6105 H.P.	31.00
2N5842	8.00	BLY88	14.00	HXTR6106 H.P.	33.00
2N5849	20.00	BLY89	15.00	QSCH1995 H.P.	POR
2N5913	3.25	BLY90	20.00	J02000 TRW	10.00
2N5922	10.00	BLY351	10.00	J02001 TRW	25.00
2N5923	25.00	C4005	20.00	J04045 TRW	25.00
2N5941	23.00	CA402 (TRW)	25.00	K3A	10.00
2N5942	40.00	CA405 (TRW)	25.00	MA450A	10.00
2N5944	9.20	CA612B (TRW)	25.00	MA41487	POR
2N5945	11.50	CA2100 (TRW)	25.00	MA41765	POR
2N5946	19.00	CA2113 (TRW)	25.00	MA43589	POR
2N6080	9.20	CA2200 (TRW)	25.00	MA43636	POR
2N6081	10.35	CA2213 (TRW)	25.00	MA47044	POR
2N6082	11.50	CA2418 (TRW)	25.00	MA47651	25.50

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GaAs, TUNNEL DIODES, ETC.

PART	PRICE	PART	PRICE	PART	PRICE
MA47100	$ 3.05	MRF503	$ 6.00	PT4186B	$ POR
MA47202	30.80	MRF504	7.00	PT4209	POR
MA47771	POR	MRF509	5.00	PT4209C	POR
MA47852	POR	MRF511	8.65	PT4566	POR
MA49558	POR	MRF605	20.00	PT4570	POR
MB4021	POR	MRF629	3.47	PT4571	POR
MBD101	1.00	MRF644	23.00	PT4571A	POR
MD0513	POR	MRF816	15.00	PT4577	POR
MHW1171	42.50	MRF823	20.00	PT4590	POR
MHW1182	48.60	MRF901	3.00	PT4612	POR
MHW4171	49.35	MRF8004	2.10	PT4628	POR
MHW4172	51.90	MS261F	POR	PT4640	POR
MHW4342	68.75	MT4150 Fair.	POR	PT4642	POR
MLP102	25.00	MT5126 Fair.	POR	PT5632	POR
MM1500	32.32	MT5481 Fair.	POR	PT5749	POR
MM1550	POR	MT5482 Fair.	POR	PT6612	POR
MM1552	50.00	MT5483 Fair.	POR	PT6626	POR
MM1553	50.00	MT5596 Fair.	POR	PT6709	POR
MM1614	10.00	MT5764 Fair.	POR	PT6720	POR
MM2608	5.00	MT8762 Fair.	POR	PT8510	POR
MM3375A	11.50	MV109	.77	PT8524	POR
MM4429	10.00	MV1401	8.75	PT8609	POR
MM8000	1.15	MV1624	1.42	PT8633	POR
MM8006	2.30	MV1805	15.00	PT8639	POR
MO277L	POR	MV1808	10.00	PT8659	POR
MO283L	POR	MV1817B	10.00	PT8679	POR
MO3757	POR	MV1863B	10.00	PT8708	POR
MP102	POR	MV1864A	10.00	PT8709	POR
MPN3202	10.00	MV1864B	10.00	PT8727	POR
MPN3401	.52	MV1864D	10.00	PT8731	POR
MPN3412	1.00	MV1868D	10.00	PT8742	POR
MPSU31	1.01	MV2101	.90	PT8787	POR
MRA2023-1.5 TRW	42.50	MV2111	.90	PT9790	41.70
MRF212/208	16.10	MV2115	1.55	PT31962	POR
MRF223	13.25	MV2201	.53	PT31963	POR
MRF224	15.50	MV2203	.53	PT31983	POR
MRF237	3.15	MV2209	2.00	PTX6680	POR
MRF238	12.65	MV2215	2.00	RAY-3	24.99
MRF243	25.00	MWA110	7.45	40081	POR
MRF245	34.50	MWA120	7.80	40281	POR
MRF247	34.50	MWA130	8.25	40282	POR
MRF304	43.45	MWA210	7.80	40290	POR
MRF315	23.00	MWA220	8.25	RF110	25.00
MRF420	20.00	MWA230	8.65	SCA3522	POR
MRF421	36.80	MWA310	8.25	SCA3523	POR
MRF422	41.40	MWA320	8.65	SD1065	POR
MRF427	16.10	MWA330	9.50	SS43	POR
MRF428	46.00	NEC57835	5.30	TP1014	POR
MRF450/A	13.80	ON382	5.00	TP1028	POR
MRF453/A	17.25	PPT515-20-3	POR	TRW-3	POR
MRF454/A	19.90	PRT8637	POR	UT0504 Avantek	70.00
MRF455/A	16.00	PSCQ2-160	POR	UT0511 Avantek	75.00
MRF458	19.90	PT3190	POR	V15	4.00
MRF463	25.00	PT3194	POR	V33B	4.00
MRF472	1.00	PT3195	POR	V100B	4.00
MRF475	2.90	PT3537	POR	VAB801EC	25.00
MRF477	11.50	PT4166E	POR	VAB804EC	25.00
MRF502	1.04	PT4176D	POR	VAS21AN20	25.00

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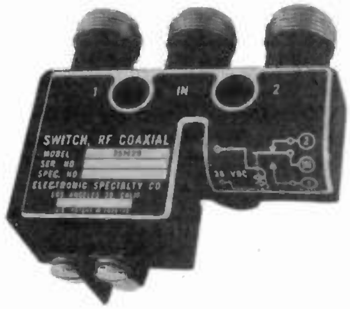
COAXIAL RELAY SWITCHES SPDT

Electronic Specialty Co./Raven Electronics FSN 5985-556-9683 $49.00
Part # 25N28 Part # SU-01
26Vdc Type N Connector, DC to 1 GHz.



Amphenol
Part # 316-10102-8
115Vac Type BNC DC to 3 GHz.

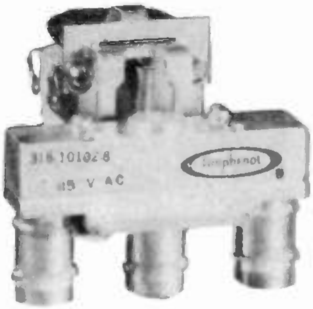
$29.99

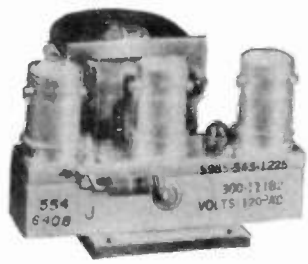
FXR
Part # 300-11182
120Vac Type BNC DC to 4 GHz.
FSN 5985-543-1225

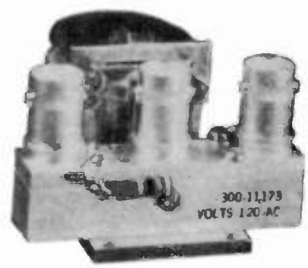
$39.99

FXR
Part # 300-11173
120Vac Type BNC Same
FSN 5985-543-1850

$39.99







BNC To Banana Plug Coax Cable RG-58 36 inch or BNC to N Coax Cable RG-58 36 inch.

$7.99 or 2 For $13.99 or 10 For $50.00

$8.99 or 2 For $15.99 or 10 For $60.00

SOLID STATE RELAYS

P&B Model ECT1DB72 PRICE EACH $5.00	5vdc turn on	120vac contact at 7amps or 20amps on a 10"x 10"x .124 aluminum. Heatsink with silicon grease.
Digisig, Inc. Model ECS-215 PRICE EACH $7.50	5vdc turn on	240vac contact 14amps or 40amps on a 10"x 10"x .124 aluminum. Heatsink with silicon grease.
Grigsby/Barton Model GB7400 PRICE EACH $7.50	5vdc turn on	240vac contact at 15amps or 40amps on a 10"x 10"x .124 aluminum. Heatsink with silicon grease.

NOTE: *** Items may be substituted with other brands or equivalent model numbers. ***

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"SOCKETS AND CHIMNEYS"

EIMAC TUBE SOCKETS AND CHIMNEYS

SK110	Socket	$POR
SK300A	Socket For 4CX5000A,R,J, 4CX10,000D, 4CX15,000A,J	$520.00
SK400	Socket For 4-125A,250A,400A,400C,4PR125A,400A,4-500A,5-500A	260.00
SK406	Chimney For 4-250A,400A,400C,4PR400A	74.00
SK416	Chimney For 3-400Z	36.00
SK500	Socket For 4-1000A/4PR1000A/B	390.00
SK600	Socket For 4CX250B,BC,FG,R,4CX350A,F,FJ	51.00
SK602	Socket For 4CX250B,BC,FG,R,4CX350A,F,FJ	73.00
SK606	Chimney For 4CX250B,BC,FG,R,4CX350A,F,FJ	11.00
SK607	Socket For 4CX600J,JA	60.00
SK610	Socket For 4CX600J,JA	60.00
SK620	Socket For 4CX600J,JA	66.00
SK626	Chimney For 4CX600J,JA	10.00
SK630	Socket For 4CX600J,JA	66.00
SK636B	Chimney For 4CX600J,JA	34.00
SK640	Socket For 4CX600J,JA	36.00
SK646	Chimney For 4CX600J,JA	71.00
SK700	Socket For 4CX300A,Y,4CX125C,F	225.00
SK711A	Socket For 4CX300A,Y,4CX125C,F	225.00
SK740	Socket For 4CX300A,Y,4CX125C,F	86.00
SK770	Socket For 4CX300A,Y,4CX125C,F	86.00
SK800A	Socket For 4CX1000A,4CX1500B	225.00
SK806	Chimney For 4CX1000A,4CX1500B	40.00
SK810	Socket For 4CX1000A,4CX1500B	225.00
SK900	Socket For 4X500A	300.00
SK906	Chimney For 4X500A	57.00
SK1420	Socket For 5CX3000A	650.00
SK1490	Socket For 4CV8000A	585.00

JOHNSON TUBE SOCKETS AND CHIMNEYS

124-111/SK606	Chimney For 4CX250B,BC,FG,R, 4CX350A,F,FJ	$ 10.00
122-0275-001	Socket For 3-500Z, 4-125A, 250A, 400A, 4-500A, 5-500A	(pair)15.00
124-0113-00	Capacitor Ring	15.00
124-116/SK630A	Socket For 4CX250B,BC,FG,R, /4CX350A,F,FJ	55.00
124-115-2/SK620A	Socket For 4CX250B,BC,FG,R, /4CX350A,F,FJ	55.00
	813 Tube Socket	20.00

TUBE CAPS (Plate)

HR1, 4	$11.00
HR2,3, 6 & 7	13.00
HR5, 8	14.00
HR9	17.00
HR10	20.00

CHIP CAPACITORS

.8pf	10pf	100pf*	430pf
1pf	12pf	110pf	470pf
1.1pf	15pf	120pf	510pf
1.4pf	18pf	130pf	560pf
1.5pf	20pf	150pf	620pf
1.8pf	22pf	160pf	680pf
2.2pf	24pf	180pf	820pf
2.7pf	27pf	200pf	1000pf/.001uf*
3.3pf	33pf	220pf*	1800pf/.0018uf
3.6pf	39pf	240pf	2700pf/.0027uf
3.9pf	47pf	270pf	10,000pf/.01uf
4.7pf	51pf	300pf	12,000pf/.012uf
5.6pf	56pf	330pf	15,000pf/.015uf
6.8pf	68pf	360pf	18,000pf/.018uf
8.2pf	82pf	390pf	

PRICES: 1 to 10 - .99¢ 101 to 1000 .60¢ * IS A SPECIAL PRICE: 10 for $7.50
11 to 50 - .90¢ 1001 & UP .35¢ 100 for $65.00
51 to 100 - .80¢ 1000 for $350.00

WATKINS JOHNSON WJ-V907: Voltage Controlled Microwave Oscillator $110.00

Frequency range 3.6 to 4.2GHz, Power ouput, Min. 10dBm typical, 8dBm Guaranteed. Spurious output suppression Harmonic (nf_0), min. 20dB typical, In-Band Non-Harmonic, min. 60dB typical, Residual FM, pk to pk, Max. 5KHz, pushing factor, Max. 8KHz/V, Pulling figure (1.5:1 VSWR), Max. 60MHz, Tuning voltage range +1 to +15volts, Tuning current, Max. -0.1mA, modulation sensitivity range, Max. 120 to 30MHz/V, Input capacitance, Max. 100pf, Oscillator Bias +15 +-0.05 volts @ 55mA, Max.

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TUBES

TYPE	PRICE	TYPE	PRICE	TYPE	PRICE
2E26	$ 5.69	KT88	$ 20.00	6562/6974A	$ 50.00
2K28	100.00	DX362	50.00	6832	22.00
2X1000A	300.00	DX415	50.00	6883/8032A/8552	7.00
3B22	19.75	572B/T160L	49.00	6897	110.00
3B28/866A	7.50	592/3-200A3	144.00	6907A	75.00
3-500Z	102.00	807	7.50	6939	15.00
3-1000Z	400.00	811	10.00	7094	125.00
3CX1000A/8283	428.00	811A	15.00	7117	17.00
3CX1500A7/887	533.00	812A	35.00	7211	60.00
3X2500A3	200.00	813	50.00	7289/3CX100A5	34.00
3CX3000A7	490.00	829B	38.00	7360	11.00
4-65A/8165	45.00	832A	28.00	7377	67.00
4-125A/4D21	58.00	4624	310.00	7408	4.00
4-250A/5D22	75.00	4662	80.00	7650	250.00
4-400A/8432	90.00	4665	585.00	7695	8.00
4-400C/6775	95.00	5675/A	25.00	7843	58.00
4-1000A/8166	300.00	5721	200.00	7854	83.00
4B32	22.00	5768	85.00	7868	5.00
4E27A/5-125B	155.00	5836	100.00	7894	12.00
4CS250R	146.00	5837	100.00	8072	65.00
4X150A/7034	30.00	5861/EC55	110.00	8117A	130.00
4X150D/7035	40.00	5876A	25.00	8121	60.00
4X150G/8172	100.00	5881/6L6W	6.00	8122	100.00
4X250B	30.00	5893	45.00	8236	30.00
4CX250B/7203	45.00	5894/A	50.00	8295/PL172	506.00
4CX250F/G/8621	55.00	5894/B	60.00	8462	100.00
4CX250K/8245	100.00	5946	258.00	8505A	73.50
4CX250R/7580W	69.00	6080	10.00	8533W	92.00
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4CX350A/8321	83.00	6098/6AK6	14.00	8560AS	90.00
4CX350F/J/8904	95.00	6115/A	110.00	8608	34.00
4X500A	282.00	6146	7.00	8637	38.00
4CX600J/8809	607.00	6146A	7.50	8643	100.00
4CW800F	625.00	6146B/8298A	8.50	8647	123.00
4CX1000A/8168	340.00	6146W	14.00	8737/5894B	60.00
4CX1500B/8660	397.00	6156	66.00	8873	260.00
4CX5000A/8170	932.00	6159	15.00	8874	260.00
4CX10000D/8171	990.00	6161	233.00	8875	260.00
4CX15000A/8281	1260.00	6291	125.00	8877	533.00
4PR60A	100.00	6293	12.00	8908	12.00
4PR60B/8252	175.00	6360	5.00	8930/651Z	71.00
4PR400A/8188	192.00	6524	53.00	8950	12.00
5CX1500A	569.00	6550	10.00		
6BK4C	6.00	6JM6	6.00	6LQ6 (Sylvania)	7.50
6DQ5	5.00	6JN6	6.00	6LU8	6.00
6FW5	6.00	6JS6B	6.00	6LX6	6.00
6GE5	6.00	6KG6/EL505	6.00	6ME6	6.00
6GJ5	6.00	6KM6	6.00	12BY7A	4.00
6HS5	6.00	6KN6	6.00	12JB6A	6.00
6JB5/6HE5	6.00	6LF6	6.00	6KD6	6.00
6JB6A	6.00	6LQ6 (GE)	6.00	6JT6A	6.00
				6KD6	6.00

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"TVRO BOARD LIST"

70 MHZ IF BOARD: This circuit provides about 43dB gain with 50 ohm input and output impedance. It is designed to drive the Demodulator. The on-board bypass filter can be tuned to bandwidths between 20 and 35 MHz with a passband ripple of less than ½ dB. Hybrid IC's are used for the gain stages.

SINGLE AUDIO BOARD: This circuit recovers the audio signals from the 6.8 MHz frequency. The Miller 9051 coils are tuned to pass the 6.8MHz subcarrier and the 9052 coil tunes for recovery of the audio.

DUAL AUDIO BOARD: Duplicate of the single audio but also covers the 6.2 range.

DC CONTROL BOARD: No description.

DUAL AUDIO BOARD		PRICE EACH
Printed Circuit Board		$ 25.00
2	3pf sm	1.00
2	12pf sm	1.00
2	50pf sm	1.00
2	68pf sm	1.00
4	91pf sm	1.00
5	.001mfd	.35
6	.01mfd	.35
2	.047mfd	.35
1	.47mfd 25vdc	.35
2	1mfd 10vdc	.59
4	4.7mfd 35vdc	.59
1	470mfd 25vdc	1.29
2	220K 1/4w	.15
2	150K 1/4w	.15
2	6.8K 1/4w	.15
2	3.3K 1/4w	.15
2	2.2K 1/4w	.15
4	1K 1/4w	.15
2	10 ohm 1/4w	.15
2	50K pots	1.00
1	5K pot	1.00
2	CA3065	2.16
1	LM380	1.56
1	7812 Voltage Reg.	1.17
5	2N2222	.50
4	Miller 9051	5.99
2	Miller 9052	5.99
TOTAL KIT PRICE		97.62

DC CONTROL BOARD		
Printed Circuit Board		15.00
2	470mfd 25vdc	1.29
2	4.7mfd 25vdc	.59
1	1meg 1/4w	.15
3	10K 1/4w	.15
1	3.3K 1/4w	.15
3	2.2K 1/4w	.15
1	1K 1/4w	.15
2	5K 10 turn trimpot	1.00
4	10K 10 turn trimpot	1.00
1	10K 10 turn with dial	10.00
1	7815 Voltage Reg.	1.17
1	LM324	2.50
1	5 pole rotary switch	2.50
1	SPDT switch	1.00
1	DPDT swich	1.00
1	0-1ma meter	5.00
1	18 to 24vdc at 1 amp power supply	24.99
TOTAL KIT PRICE		74.27

DEMODULATOR BOARD		PRICE EACH
Printed Circuit Board		$ 40.00
1	1mfd 35vdc	.59
13	.01mfd 50vdc disc	.35
1	470mfd 25vdc	1.29
2	100mfd 16vdc	.69
2	22mfd 35vdc	.59
3	4.7mfd 35vdc	.59
1	4300pf sm	2.00
1	330pf sm	1.00
1	100pf sm	1.00
1	91pf sm	1.00
2	3pf sm	1.00
1	2 to 8pf ceramic trimmer	1.00
1	100uh choke	1.50
1	4.7uh choke	1.50
1	2.7uh choke	1.50
4	100K 1/4w	.15
1	51 ohm 1/4w	.15
1	27K 1/4w	.15
5	10K 1/4w	.15
1	8.2K 1/4w	.15
2	4.7K 1/4w	.15
1	2.2K 1/4w	.15
1	1.2K 1/4w	.15
3	1K 1/4w	.15
3	560 ohm 1/4w	.15
1	470 ohm 1/4w	.15
1	390 ohm 1/4w	.15
1	300 ohm 1/4w	.15
1	270 ohm 1/4w	.15
1	150 ohm 1/4w	.15
1	41 ohm 1/4w	.15
1	10K pot	1.00
1	NE592/LM733N	2.50
1	NE564	5.00
1	MWA120 (Motorola)	7.80
1	7812 Voltage Reg.	1.17
1	7815 Voltage Reg.	1.17
3	2N2222	.50
2	1N34/38	.50
1	HP5082-2800	2.20
1	5 to 7 volt Zenner	1.00
TOTAL KIT PRICE		92.25

COMPLETE KIT WITH DUAL AUDIO $923.23
COMPLETE KIT WITH SINGLE AUDIO 880.77

LESS 10% ON ALL COMPLETE KIT ORDERS

BOARDS AND PARTS MAY BE PURCHASED SEPERATELY AT THE PRICES LISTED ABOVE.

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TVRO BOARD DESCRIPTION AND PARTS LIST

DUAL CONVERSION BOARD: This board provides conversion from the 3.7-4.2 band first to 900 MHz where gain and bandpass filtering are provided and, second, to 70 MHz. The board contains both local oscillators, one fixed and the other variable, and the second mixer. Construction is greatly simplified by the use of Hybrid IC amplifiers for the gain stages.

DEMODULATOR BOARD: This circuit takes the 70 MHz center frequency satellite TV signal in the 10 to 200 millivolt range, detects them using a phase lock loop, de-emphasizes and filters the result to produce standard NTSC video. Other outputs include the audio subcarrier, a DC voltage proportional to the strength of the 70 MHz signal, and AFC voltage centered at about 2 volts DC.

DUAL CONVERSION BOARD		PRICE EACH
Printed Circuit Board		$ 25.00
6	47pf chip caps	1.00
2	4.7mfd 35vdc	.59
2	.01mfd 50vdc disc cap	.35
4	1.5 to 8pf piston trimmer cap	5.99
2	470 ohm 1/4w	.15
2	MWA320 (Motorola)	8.65
1	7815 Voltage Reg.	1.17
1	VT08090	150.00
1	VT08240	156.25
2	1N4005	.39
1	DBM500/1100 (Varil)	125.00
1	MLP102 (Engleman)	25.00
8	SMA Male Connector	5.00
TOTAL KIT PRICE		572.64

70 MHZ IF BOARD		
Printed Circuit Board		25.00
3	MWA120	7.80
7	.01mfd 50vdc	.35
2	4.7mfd 35vdc	.59
1	10pf sm	1.00
5	22pf sm	1.00
1	18pf sm	1.00
1	33pf sm	1.00
2	330 ohm 1/4w	.15
5	J.W. Miller 4500-4	4.99
1	7815 Voltage Reg.	1.17
TOTAL KIT PRICE		86.45

SINGLE AUDIO BOARD		PRICE EACH
Printed Circuit Board		$ 15.00
1	3pf sm	1.00
1	12pf sm	1.00
1	50pf sm	1.00
1	68pf sm	1.00
2	91pf sm	1.00
3	.001mfd	.35
3	.01mfd	.35
1	.047mfd	.35
1	.47mfd	.35
1	1mfd 10vdc	.59
3	4.7mfd 35vdc	.59
1	470mfd 25vdc	1.29
1	220K 1/4w	.15
1	150K 1/4w	.15
1	6.8K 1/4w	.15
1	3.3K 1/4w	.15
1	2.2K 1/4w	.15
3	1K 1/4w	.15
1	10 ohm 1/4w	.15
1	50K pot	1.00
1	5K pot	1.00
1	CA3065/MC1358P	2.16
1	LM380	1.56
1	7812 Voltage Reg.	1.17
3	2N2222	.50
2	Miller 9051	5.99
1	Miller 9052	5.99
TOTAL KIT PRICE		55.16

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"CHIPS"

FAIRCHILD VHF AND UHF PRESCALER CHIPS		PRICE
95H90DC	350MC Prescaler divide by 10/11	$ 8.50
95H91DC	350MC Prescaler divide by 5/6	8.50
11C90DC	650MC Prescaler divide by 10/11	15.50
11C91DC	650MC Prescaler divide by 5/6	15.50
11C06DC	UHF Prescaler 750MC D Type Flip Flop	12.30
11C05DC	1GHz Counter Divide by 4 (Regular price $75.00)	50.00
11C01FC	High Speed Dual 5/4 Input NO/NOR Gate	15.40
82S90	Presettable High Speed Decade/Binary Counter used with the 11C90/91 or the 95H90/91 Prescaler can divide by 100. (Signetics)	5.00
11C24DC	This chip is the same as a Motorola MC4024/4324 Dual TTL Voltage Control Multivibrator.	3.37
11C44DC	This chip is the same as a Motorola MC4044/4344 Phase Frequency Detector.	3.37

GENERAL ELECTRIC CO. GUNN DIODE MODEL Y-2167
Freq. Gap (GHZ) 12 to 18, Output (Min.) 100mW, Duty (%) CW, Typ. Bias (Vdc) 8.0, Type. Oper. (MAdc) 550, Max. Thres. (mAdc) 1000, Max. Bias (Vdc) 10.0. **$39.99**

VARIAN GALLIUM ARSENIDE GUNN DIODES MODEL VSX-9201S5
Freq. Coverage 8 to 12.4GHz, Output (Min.) 100mW, Bias Voltage (Max.) 14vdc, Bias current (mAdc) Operating 550 Typ. 750 Max., Threshold 850 Tup. 1000 Max. **$39.99**

VARI-L Co. Inc. MODEL SS-43 AM MODULATOR
Freq. Range 60 10 150MC, Insertion Loss 13dB Nominal, Signal Port Imp. 50ohms Nominal, Signal Port RF Power +10dBm Max., Modulation Port BW DC to 1KHZ, Modulation Port Bias 1ma. Nominal. **$24.99**

AVANTEK CASCADABLE MODULAR AMPLIFIERS	Model UTO-504	UTO-511
Frequency Range	5 to 500 MHz	5 to 500 MHz
Gain	6dB	15dB
Noise Figure	11dB	2.3dB to 3dB
Power Output	+17dB	−2dB to −3dB
Gain Flatness	1dB	1dB
Input Power Vdc	+24	+15
mA	100	10
PRICE	$70.00	$75.00

HEWLETT PACKARD MIXERS MODELS	10514A	10514B
Frequency Range	2MHz to 500MC	2MHz to 500MC
Input/Output Frequency L & R	200KHz to 500MC	200KHz to 500MC
X	DC to 500MC	DC to 500MC
Mixer Conversion Loss (A)	7dB	7dB
(B)	9dB	9dB
Noise Performance (SSB) (A)	7dB	7dB
(B)	9dB	9dB
PRICE	$49.99	$39.99

FREQUENCY SOURCES, INC MODEL MS-74X MICROWAVE SIGNAL SOURCE
MS-74X: Mechanically Tunable Frequency Range (MHz) 10630 to 11230 (10.63 to 11.23GHz) Minimum Output Power (mW) 10, Overall Multiplier Ratio 108, Internal Crystal Oscillator Frequency Range (MHz) 98.4 to 104.0, Maximum Input Current (mA) 400.

The signal source are designed for applications where high stability and low noise are of prime concern. these sources utilize fundamental transistor oscillators with high Q coaxial cavities, followed by broadband stable step recovery diode multipliers. This design allows single screw mechanical adjustment of frequency over standard communications bands. Broadband sampling circuits are used to phase lock the oscillator to a high stability reference which may be either an internal self-contained crystal oscillator, external primary standard or VHF synthesizer. This unique technique allows for optimization of both FM noise and long term stability. List Price is $1158.00 (THESE ARE NEW) **Our Price—$289.**

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C.O.D.: Acceptable by telephone or mail. Payment from customer will be by cash, money order or cashier's check. We are sorry but we cannot accept personal checks for C.O.D.'s.

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ENGLAND	7	7	7	3A	7	7	14	21A	21A	14	14	7
HAWAII	21	14	7B	7	7	7	7	7B	14	21A	21A	21A
INDIA	7B	7B	7B	7B	7B	7B	14	21	14	7B	7B	7B
JAPAN	14	7B	7B	7B	7B	7	3A	14B	14B	14	14	21
MEXICO	21	14	7	7	7	7	7A	21	21A	21A	21	21
PHILIPPINES	14	14	7B	7B	7B	7B	3A	14B	14	14	14	14A
PUERTO RICO	14	7	7	7	7	7	14	21	21A	21A	21	14A
SOUTH AFRICA	14	7	7	7B	7B	14	21A	21A	21A	21A	21A	14A
U.S.S.R.	7	7	7	7	7	7B	14	21A	21	7B	7B	7
WEST COAST	21A	14	7	7	7	7	7	14	21A	21A	21A	21A

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	7	7	7	3A	7	7A	14A	21A	21
ARGENTINA	14	14	7	7	7	7	14	21A	21A	21A	21A	21
AUSTRALIA	21A	14	7B	7B	7B	7B	7B	7B	14	14	21A	21A
CANAL ZONE	21	14	7	7	7	7	14	21A	21A	21A	21A	21A
ENGLAND	7	7	7	3A	7	7	7A	21	21A	14	14	7
HAWAII	21A	14A	14B	7	7	7	7	7	14	21A	21A	21A
INDIA	7B	14B	7B	7B	7B	7B	7B	14	14	7B	7B	7B
JAPAN	21	14	7B	7B	7B	7	3A	3A	14B	14	14	21A
MEXICO	14	14	7	7	7	7	7	14	21A	21A	21	21
PHILIPPINES	21A	14	7B	7B	7B	7B	3A	7	14	14	14	21A
PUERTO RICO	14A	7	7	7	7	7	14	21	21A	21A	21A	21
SOUTH AFRICA	14	7	7	7B	7B	7B	14	21A	21A	21A	21A	14A
U.S.S.R.	7	7	7	7	7	7B	7B	21	14	7B	7B	7

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	21	14	7	7	7	7	3A	3A	7	14	21	21A
ARGENTINA	21	14	7A	7	7	7	7B	21	21A	21A	21A	21
AUSTRALIA	21A	21A	14	14B	7B	7B	7B	7B	14	14	21A	21A
CANAL ZONE	21	14	7	7	7	7	7	21	21A	21A	21A	21A
ENGLAND	7B	7	7	3A	7	7	3A	14	21	14	14	7B
HAWAII	21A	21	14	14	7	7	7	7	14	21A	21A	21A
INDIA	7B	21	14B	7B	7B	7B	7B	7B	14	7B	7B	7B
JAPAN	21A	21	14B	7B	7	7	3A	3A	14B	14	14	21A
MEXICO	21	14	7	7	7	7	7	14	21A	21A	21	21
PHILIPPINES	21A	21	14B	7B	7B	7B	7	7	14	14	14	21A
PUERTO RICO	21	7	7	7	7	7	7	14A	21A	21A	21A	21A
SOUTH AFRICA	14	7	7	7B	7B	7B	7B	14	21A	21A	21A	14A
U.S.S.R.	7B	7	7	7	7	7B	7B	14	14	7B	7B	7B
EAST COAST	21A	14	7	7	7	7	7	14	21A	21A	21A	21A

A = Next higher frequency may also be useful.
B = Difficult circuit this period.

First letter = night waves. Second = day waves.
G = Good, F = Fair, P = Poor. * = Chance of solar flares.
# = Chance of aurora.

NOTE THAT NIGHT WAVE LETTER NOW COMES FIRST.

NOVEMBER

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

New Yaesu FT-102 Series
Transceiver of Champions!

The long-awaited new generation of Yaesu HF technology has arrived! New research in improved receiver filtering and spectral purity is brought to bear in the competition-bred FT-102, the HF transceiver designed for active Amateurs on today's intensely active bands!

Unique Cascaded Filter System
The FT-102 utilizes an advanced 8.2 MHz and 455 kHz IF system, capable of accepting as many as three filters in cascade. Optional filters of 2.9 kHz, 1.8 kHz, 600 Hz, and 300 Hz may be combined with the two stock 2.9 kHz filters for operating flexibility you've never seen in an HF transceiver before now!

All New Receiver Front End
Utilizing husky junction field-effect transistors in a 24 volt, high-current design, the FT-102 front end features a low-distortion RF preamplifier that may be by-passed via a front panel switch when not needed.

IF Notch and Audio Peak Filter
A highly effective 455 kHz IF Notch Filter provides superb rejection of heterodynes, carriers, and other annoying interference appearing within the IF pass-band. On CW, the Audio Peak Filter may be switched in during extremely tight pile-up conditions for post-detection signal enhancement.

Variable IF Bandwidth with IF Shift
The FT-102's double conversion receiver features Yaesu's time-proven Variable Bandwidth System, which utilizes the cascaded IF filters to provide intermediate bandwidths such as 2.1 kHz, 1.5 kHz, or 800 Hz simply by twisting a dial. The Variable Bandwidth System is used in conjunction with the IF Shift control, which allows the operator to center the IF passband frequency response without varying the incoming signal pitch.

Wide/Narrow Filter Selection
Depending on the exact combination of optional filters you choose, a variety of wide/narrow operating modes may be selected. For example, you may set up 2.9 kHz in SSB/WIDE, 1.8 kHz in SSB/NARROW, then select 1.8 kHz for CW/WIDE, and 600 Hz or 300 Hz for CW/NARROW. Or use the Variable Bandwidth to set your SSB bandwidth, and use 600 Hz for CW/WIDE and 300 Hz for CW/NARROW! No other manufacturer gives you so much flexibility in selecting filter responses!

Variable Pulse Width Noise Blanker
Ignition noise, the "Woodpecker," and power line noise are modern-day enemies of effective Amateur operation. The FT-102 Noise Blanker offers improved blanking action on today's man-made noise sources (though no blanker can eliminate all forms of band noise) for more solid copy under adverse conditions.

Low Distortion Audio/IF Stage Design
Now that dynamic range, stability, and AGC problems have been largely eliminated thanks to improved technology, Yaesu's engineers have put particular attention on maximizing intelligence recovery in the receiver. While elementary filter cascading schemes often degrade performance, the FT-102's unique blend of crystal and ceramic IF filters plus audio tone control provides very low phase delay, reduced passband ripple, and hence increased recovery of information.

Heavy Duty Three-Tube Final Amplifier
The FT-102 final amplifier uses three 6146B tubes for more consistent power output and improved reliability. Using up to 10 dB of RF negative feedback, the FT-102 transmitter third-order distortion products are typically 40 dB down, giving you a studio quality output signal.

Dual Metering System
Adopted from the new FT-ONE transceiver, the Dual Metering System provides simultaneous display of ALC voltage on one meter along with metering of plate voltage, cathode current, relative power output, or clipping level on the other. This system greatly simplifies proper adjustment of the transmitter.

Microphone Amplifier Tone Control
Recognizing the differences in voice characteristics of Amateur operators, Yaesu's engineers have incorporated an ingenious microphone amplifier tone control circuit, which allows you to tailor the treble and bass response of the FT-102 transmitter for best fidelity on *your* speech pattern.

RF Speech Processor
The built-in RF Speech Processor uses true RF clipping, for improved talk power under difficult conditions. The clipping type speech processor provides cleaner, more effective "punch" for your signal than simpler circuits used in other transmitters.

VOX with Front Panel Controls
The FT-102 standard package includes VOX for hands-free operation. Both the VOX Gain and VOX Delay controls are located on the front panel, for maximum operator convenience.

IF Monitor Circuit
For easy adjustment of the RF Speech Processor or for recording both sides of a conversation, an IF monitor circuit is provided in the transmiter section. When the optional AM/FM unit is installed, the IF monitor may be used for proper setting of the FM deviation and AM mic gain.

WARC Bands Factory Installed
The FT-102 is factory equipped for operation on all present and proposed Amateur bands, so you won't have to worry about retrofitting capability on your transceiver. An extra AUX band position is available on the bandswitch for special applications.

Full Line Of Accessories
For maximum operating flexibility, see your Authorized Dealer for details of the complete line of FT-102 accessories. Coming soon are the FV-102DM Synthesized VFO, SP-102 Speaker/Audio Filter, a full line of optional filters and microphones, and the AM/FM Unit.

Price And Specifications Subject To Change Without Notice Or Obligation

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