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January 1997

Kenwood TS-570D HF Transceiver

SCS PTC-II Multimode Controller with PACTOR-II

Two Ultra-Accurate Clocks
(Oregon Scientific Time Machine; Arcron Zeit)

Edited by **Rick Lindquist, N1RL**• Senior Assistant Technical Editor

Kenwood TS-570D HF Transceiver

Reviewed by Larry Wolfgang, WR1B
Senior Assistant Technical Editor

Like many amateurs, I sometimes dream of having one of the latest HF transceivers sitting on my operating table…a radio that would offer features such as two VFOs, for easy split-frequency operation; a numeric keypad, for direct frequency entry; lots of memory channels; adjustable CW offset; and ease of selecting various filter bandwidths for different modes. Oh, yes, I'd like to have a built-in antenna tuner, an easy-to-read informative display with multifunction meter and a built-in RF preamplifier, as well as an RF attenuator. Of course the radio should be small enough to fit easily on my desk and not require extra bracing to hold the weight. One of those fancy digital signal processor (DSP) boxes would sure be a nice accessory.

Ah, but we just refinanced our mortgage to add onto our house and do some repair and maintenance work, so taking out a second mortgage to buy my new radio is out of the question. What's a dreamer to do?

If you think the only answer is to just keep on dreaming, then you are *mistaken*. With a list price substantially below that of the high-end radios, the Kenwood TS-570D offers all these features and more in a single box! While not a contester's dream machine, we might call this "a radio for the rest of us."

Front Panel

There are few knobs but many buttons on the TS-570D's front panel. The radio is packed with features designed to enhance your operating pleasure. In fact, the front panel doesn't begin to show all the operating controls you have at your fingertips with this radio! A menu system allows you to change 47 parameters to suit your particular preferences. And, if you would like to configure your radio for two sets of operating conditions (or you share your station with another operator), there are *two* menu memory banks.

You will find the complement of controls you would expect on any full-featured HF rig, plus some you would not expect to find. A 12-button numeric keypad allows direct frequency entry. These buttons also access alternative functions, such as selecting one of three CW keyer memories or selecting between either of the two antenna input connectors on the rear panel. (The radio remembers which band you're on when you select one of these antenna ports, so it will return to that selection the next time you switch to that band. There's no "Beverage" antenna port, however.)

You can select fast or slow AGC operation (but not turn it off) and turn the analog noise blanker on or off. The button labeled **FINE** selects 1-Hz tuning steps instead of 10-Hz steps for SSB, CW and FSK modes or 10-Hz instead of 100-Hz steps on AM and FM. The **REV** button allows you to select the opposite sideband on CW or FSK (handy if you need to reverse the mark and space tones for RTTY operation).

The **POWER**, **ATT**, **PRE-AMP**, **VOX**, **PROC**, **SEND** and **AT TUNE** buttons are self-explanatory. But what about that **PF** button in the top left corner? It is a "Programmable Function" button. You can set this button to go immediately to one of the menu selections. For example you might want to set this button to activate menu item 15, which controls the speech processor compression level, if you find yourself frequently adjusting that option. Very handy!

To the right of the keypad is a column of buttons labeled **MIC**, **PWR**, **KEY** and **DELAY**. These activate the microphone gain, transmitter power, electronic keyer speed and VOX delay controls, respectively. The **MULTI/CH** knob to the right side of the radio then adjusts the level for each control.

This **MULTI/CH** knob has more uses than Carter has little pills. It also was the focus of some frustration with the TS-570D. In VFO mode, the **MULTI/CH** knob lets you make quick frequency excursions up or down the band in 10-kHz steps. When you press the **MENU** button, the **MULTI/CH** knob selects the menu item number. When you press the **FILTER** button, the **MULTI/CH** knob adjusts the IF and DSP filter bandwidths (we installed the optional 500-Hz CW filter in our unit). In memory mode, it picks the memory channel. Because Kenwood has invested so many functions in this single control, the **MULTI/CH** knob at times proved to be absolutely maddening to our reviewers. As we said, if no other active feature requires this knob, turning it changes the main operating frequency in 10-kHz steps. We found it was too easy—say in the heat of a contest—to reach for the **MULTI/CH** knob instead of the **RIT** knob right above it. Or, you might grab the **MULTI/CH** knob to change the filter setting without first pressing the **FILTER** button. *Zap!* There goes "your" frequency just as a new multiplier is calling you.

Aside from simply paying closer attention, there's a partial remedy for this: One of the first menu items you will want to change is item 5. This turns off numerical rounding of VFO frequencies as this knob is turned. Otherwise, not only will you go skating up or down the band in rapid fashion, but the kilohertz, hundred-hertz and ten-hertz digits all go to zero. Now try getting back to your operating frequency! Also, if you use both the filter settings and the RIT a lot, simply turn on the RIT *first*, then press **FILTER**. This puts the RIT in the background. You won't have a separate RIT

BOTTOM LINE

A compact, affordable, full-featured transceiver that will find a happy home in many ham shacks. Kenwood has a winner with the TS-570D.

Table 1

Kenwood TS-570D, serial number 80600403

Manufacturer's Claimed Specifications	***Measured in the ARRL Lab***
Frequency coverage: Receive, 500 kHz–30 MHz; transmit, 1.8-2; 3.5-4; 7-7.3; 10.1-10.15; 14-14.35; 18.068-18.168; 21-21.45; 24.89-24.99; 28-29.7 MHz.	Receive, 31 kHz—30 MHz; transmit, as specified.
Modes of operation: USB, LSB, CW, AM, FM., FSK	As specified.
Power requirement: Receive, 2 A (no signal); transmit, 20.5 A, at 13.8 V.	Receive, 0.8 A (max volume, no signal); transmit, 18 A (max), tested at 13.8 V.
Size (height, width, depth): 3.8×10.6×10.6 inches; weight, ≈15 lb.	
Receiver	*Receiver Dynamic Testing*
SSB/CW/FSK sensitivity (bandwidth not specified, 10 dB [S+N]/N): 0.5-1.7 MHz, ≤4 μV (–95 dBm); 1.7-24.5 MHz, ≤0.2 μV (–121 dBm).	Minimum discernible signal (500-Hz filter): *Preamp off* / *Preamp on* 1.0 MHz: –113 dBm (0.5 μV) / –121 dBm (0.19 μV) 3.5 MHz: –132 dBm (0.06 μV) / –140dBm (0.02 μV) 14 MHz: –130 dBm (0.07 μV) / –139 dBm (0.03 μV)
AM sensitivity (bandwidth not specified, 10 dB [S+N]/N): 0.5-1.7 MHz, ≤31.6 μV; 1.7-24.5 MHz, ≤2 μV; 24.5-30 MHz, ≤ 1.3 μV.	10 dB (S+N)/N, signal 30% modulated with a 1-kHz tone, narrow filter: *Preamp off* / *Preamp on* 1.0 MHz: 8.4 μV / 3.3 μV 3.8 MHz: 1.05 μV / 0.4 μV
FM sensitivity: For 12-dB SINAD, 28-30 MHz, ≤0.25 μV	For 12-dB SINAD: 29 MHz, preamp off, 0.6 μV; preamp on, 0.15 μV.
Blocking dynamic range: Not specified.	Blocking dynamic range (500-Hz IF filter): *Preamp off* / *Preamp on* 1.0 MHz: 114 dB* / 115 dB 3.5 MHz: 114 dB* / 119 dB* 14 MHz: 115 dB* / 115 dB*
Two-tone, third-order IMD dynamic range: Not specified.	Two-tone, third-order IMD dynamic range (500-Hz IF filter:) *Preamp off* / *Preamp on* 1.0 MHz: 86 dB / 91 dB 3.5 MHz: 99 dB / 99 dB 14 MHz: 98 dB* / 97 dB*
Third-order input intercept point: Not specified.	*Preamp off* / *Preamp on* 1.0 MHz: +19.5 dBm / +19.5 dBm 3.5 MHz: +17 dBm / +9.4 dBm 14 MHz: +21.7 dBm / +9.6 dBm
Second-order intercept point: Not specified.	14 MHz, preamp off, +60 dBm; preamp on, +59 dBm.
FM adjacent channel rejection: Not specified.	29 MHz, preamp on, 68 dB; preamp off, 67 dB.
FM two-tone, third-order IMD dynamic range: Not specified	29 MHz, preamp on, 67 dB; preamp off, 66 dB.
Noise reduction: Not specified.	NR1, ≈10 dB; NR2, ≈20 dB (at default 20 ms setting).
Beat cancel attenuation: Not specified.	50 dB or greater notch.
S-meter sensitivity: Not specified.	S9 signal at 14 MHz: preamp off, 94 μV; preamp on, 25 μV.
Squelch sensitivity: SSB, CW, FSK, AM, 0.5-1.7 MHz, 20 μV or less; 1.7-30 MHz, 2 μV or less; FM, 28-30 MHz, 0.25 μV or less.	29 MHz, at threshold, FM, preamp off, 0.2 μV; preamp on, 0.04 μV. 14 MHz, at threshold, USB, preamp off, 1.7 μV; preamp on, 0.4 μV.
Receiver audio output: ≥1.5 W at 10% THD into 8Ω.	2.1 W at 3.7% THD into 8 Ω.
IF/audio response: Not specified.	Range at –6 dB points, (bandwidth): CW (500-Hz IF/600-Hz DSP): 258-769 Hz (511 Hz) CW (500-Hz IF/100-Hz DSP): 443-557 Hz (114 Hz) CW (500-Hz IF/50 Hz DSP): 470-530 Hz (60 Hz) USB wide: 286-2433 Hz (2147 Hz) USB narrow (DSP controls at 12 o'clock): 404-1633 Hz (1229 Hz) LSB wide: 287-2428 Hz (2141 Hz) LSB narrow (DSP controls at 12 o'clock): 404-1626 Hz (1222 Hz) AM wide: 115-2670 Hz (2555 Hz) AM narrow:113-1270 Hz (1157 Hz)
If rejection: 1.8-30 MHz, 70 dB or greater.	Preamp off, 115 dB; preamp on, >120 dB.
Image rejection: 1.8-30 MHz, 70 dB or greater.	Preamp off, 109 dB; preamp on, 120 dB.
Transmitter	*Transmitter Dynamic Testing*
Power output: SSB, CW, FM, FSK, 5-100 W; AM, 5-25 W.	SSB, 5-115 W; CW, 5-108 W (varies slightly from band to band); AM, 5-23 W; FM, 5-109 W.
Spurious-signal and harmonic suppression: 50 dBc or greater.	As specified. Meets FCC requirements for spectral purity.
SSB carrier suppression: 40 dB or greater.	As specified.
Undesired sideband suppression: 40 dB or greater.	As specified.
Third-order intermodulation distortion (IMD) products:	See Figure 1.
CW keyer speed range: Not specified.	Approximately 10-75 wpm.
CW keying characteristics: Not specified.	See Figure 2.
Transmit-receive turnaround time (PTT release to 50% audio output): Not specified.	S9 signal, ≈50 ms.
Receive-transmit turnaround time ("tx delay"): Not specified.	SSB, 18 ms; FM, 14 ms.
Composite transmitted noise: Not specified	See Figure 3.

NOTE: All dynamic range measurements are taken at the ARRL Lab standard spacing of 20 kHz.

*Measurement was noise-limited at the value indicated.

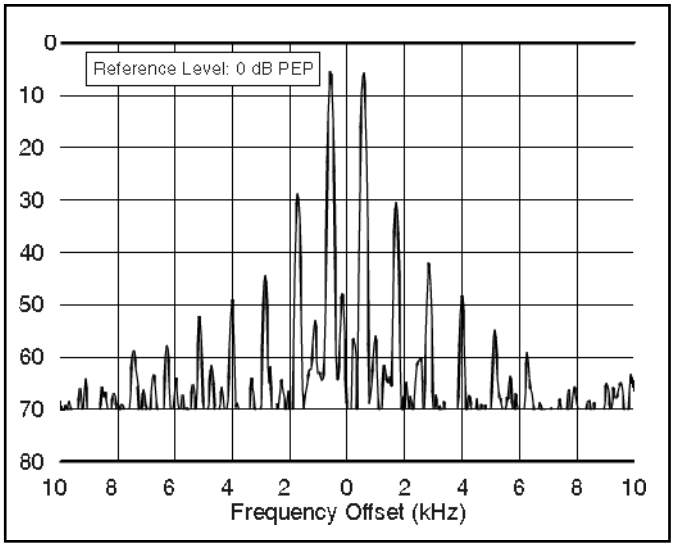


Figure 1—Worst-case spectral display of the TS-570D transmitter during two-tone intermodulation distortion (IMD) testing. The worst-case third-order product is approximately 28 dB below PEP output, and the worst-case fifth-order product is approximately 42 dB down. The transceiver was being operated at 100 W output at 18.120 MHz.

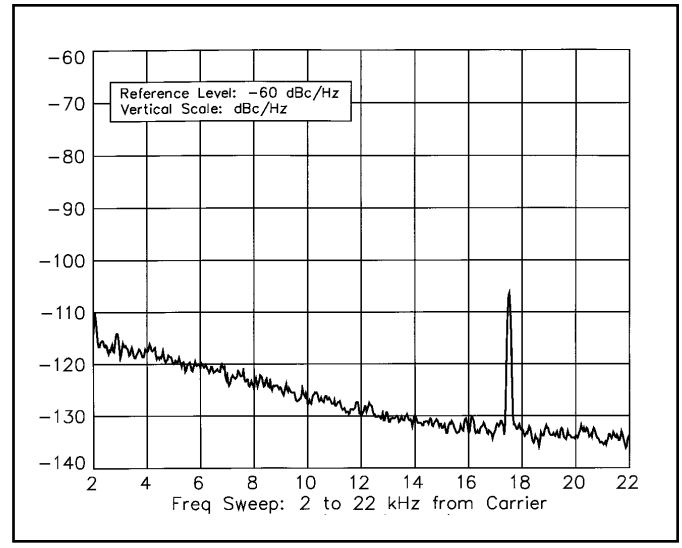


Figure 3—Worst-case tested spectral display of the TS-570D transmitter output during composite-noise testing. Power output is 100 W at 3.5 MHz. The carrier, off the left edge of the plot, is not shown. This plot shows composite transmitted noise 2 to 22 kHz from the carrier.

readout, but the main frequency displays the increment. This way, you can use the RIT, and you won't disable the **MULTI/CH** knob as a filter setter (unless you use the CW memories, which cancel the **FILTER** display, but not the **RIT** display). Unfortunately, there is no way to turn off the rapid frequency-change function. Putting that function on a button might have been a more elegant solution.

On the right-hand side of the front panel, one dual concentric control adjusts the squelch level and IF shift, a second adjusts the AF and RF gain and a third sets the high and low-frequency DSP slope. This last set of controls allows you to set the audio DSP filter characteristics on SSB and AM.

The built-in DSP circuitry provides two noise-reduction (**N.R.**) modes. NR1 is more effective for eliminating static-type noise during SSB or CW reception while NR2 is more effective during CW reception (you can set the time constant for NR2 at 7.5 or 20 ms—the default). Both do a great job, but they impart an ethereal, hollow quality to the audio. The beat cancel (**B.C.**) DSP feature proved quite effective against the ever-present broadcast heterodynes on the 40-meter phone band. Pressing this button makes a carrier simply disappear! One reviewer participated in a multistation QSO right next to a fairly strong 40-meter broadcaster. One press of the aptly named **B.C.** button made the interference go away. Since this is audio-level DSP, the carrier continued to show up on the S meter, however.

Kenwood included one very handy feature—a first for an HF transceiver—that will be especially appreciated by those who have trouble matching up signal pitches on CW. The **CW TUNE** button actually does this job for you. Just tune the radio close to the desired CW signal and press the **CW TUNE** button. Then watch as the radio promptly fine-tunes itself so that you and the other station are on the same frequency.

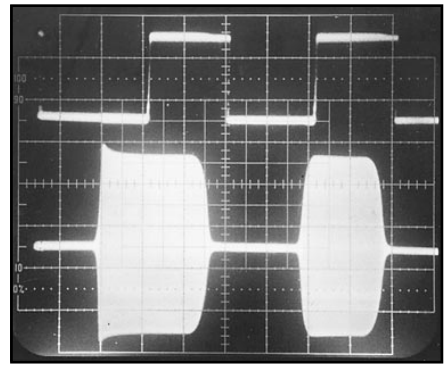


Figure 2—CW keying waveform for the TS-570D showing the first two dits in the full-break-in (QSK) mode. The equivalent keying speed is 60 wpm. The upper trace is the actual key closure; the lower trace is the RF envelope. Horizontal divisions are 10 ms. The transceiver was being operated at 100 W output at 14.2 MHz.

The main tuning knob is large, has a soft rubber grip that provides a comfortable feel, and a finger depression for quickly spinning up or down the band. You also can adjust the degree of drag. Of course there are two VFOs plus 100 memory channels. Any VFO or memory channel can be used to transmit or receive. If you select different VFOs (ie, during **SPLIT** operation) or memory data for transmit and receive, pressing and holding the **TF-SET** button lets you adjust the transmit frequency via the main tuning control.

The **QUICK MEMO** is a terrific feature! To store an operating frequency during a contest or while chasing a rare DX station, for example, just press the **M.IN** button. Later, you can press **MR** to quickly check back on that frequency. There are five quick memory channels. Press **MR,** and the **MULTI/CH** knob lets you select among them.

The menu system is easy to use and keeps guesswork to a minimum. A single **MENU** button activates the menu (but does not disable the radio), and the **MULTI/CH** knob selects the appropriate menu item. You can change any parameter by pressing the big **UP** or **DOWN** buttons to jog through the possible choices. Another press of the **MENU** button returns the display to normal operation. When the **MENU** is activated, the right half of the display tells which menu-option setting is selected. But the best part is the crawl text, which eliminates the cryptic menu-item descriptions typical of most radios. The crawl text—like the weather-warning messages TV stations sometimes broadcast along the bottom of the screen—tells you straight out what menu item you're on. You also can pick menus by number.

You select **RIT** and **XIT** using separate push buttons, and a single control knob sets the amount of incremental tuning (±9.99 kHz). A **CLEAR** push button quickly zeros the incremental tuning. When either or both of these functions is active, the right side of the display shows **RIT** or **XIT** as appropriate, along with the tuning increment (unless you have another function layered on top of it). The main frequency display also changes to show the actual receive frequency as you adjust the RIT or XIT. You can clear the RIT while transmitting.

The substantial display area conveys plenty of information about the radio's operating status. You quickly learn to

check the display for all kinds of status information. Is the AGC set to fast or slow? (A "FAST" legend appears in the display, but *no* legend appears for the slow setting.) How about the speech processor? Which antenna jack is active and is the automatic antenna tuner in line? Are either (or both) the RF preamp or RF attenuator turned on? Did I set the radio to operate split and if so, what is my transmit frequency? As noted, the same section of the display area that's used to show RIT or XIT tuning amount is also used to show DSP filter information. In addition, it can display microphone gain, transmitter power level, CW keyer speed or VOX delay, as well as the split transmit frequency. You would seldom need all this information at the same instant, so the fact that it displays one item at a time usually isn't a problem.

The left side of the display provides the various metering functions. On receive, the top of the arced LCD "meter" shows received signal strength. The same meter segments indicate transmitter power. During transmit, the lower meter section displays SWR, and ALC or speech compression. The meter can be set to hold peaks.

Reviewers found the display window easy to read. The main display numerals are about 1/2 inch high. A menu option sets display brightness. We had no problems viewing the display under a variety of lighting conditions.

Rear Panel

There is nothing particularly remarkable about the backside of the TS-570D, except perhaps its simple, uncluttered appearance. In addition to the cooling fan, there are two antenna jacks, as well as connections for a keyer paddle, a straight key or external electronic keyer, external speaker, amplifier connections, accessory connector for a multimode communications processor (MCP—sometimes called a TNC) for RTTY, packet and other digital modes, and a 9-pin RS-232 computer interface connector for direct connection to a PC. A wingnut on the grounding stud would have been more convenient.

The accessory connector for an MCP is a 13-pin DIN plug. Fortunately, Kenwood supplies one of these with the radio. Soldering the wires to this plug for connection to your MCP can be a real challenge.

Computer Control

Reviewers felt the built in RS-232 port was a definite plus. Many contesters like to use contest software like *CT*, *NA*, or *TR* to run their radios (we told *CT* it was a TS-450, and it seemed to work fine). Just connect a 9-pin modem cable and let your software do the rest! Unfortunately, the *Windows*-based Kenwood control software for the TS-570D was not available in time for this review, when the radio first appeared on the market. The program Kenwood demonstrated (see sidebar, Selling the TS-570D) had functionality similar to that now available on Kenwood's TS-870 (see "Product Review," *QST*, Feb 1996).

The Selling of the TS-570D

The TS-570D could turn out to be Kenwood's 50th anniversary present to itself. Following last year's introduction of the TS-870S, Kenwood has taken a different tack to marketing its mid-priced TS-570D, which combines traditional IF filters with audio DSP. Instead of just introducing the radio to a gathering of dealers—as it did with the TS-870S—Kenwood took the TS-570D on the road, demonstrating the new radio to groups of both dealers and prospective customers at nine locations across the US. We attended one of these dog-and-pony shows in the Hartford, Connecticut, area.

The TS-570D was produced primarily with US amateurs in mind, according to Paul Middleton, KD6NUH, Kenwood's national sales manager. Middleton told our gathering that Kenwood polled hams across the country to learn what they'd like to see in a radio before Kenwood began producing the TS-570D (which almost ended up being called the TS-460). In any case, the '570D will replace the TS-450SAT in Kenwood's transceiver lineup as part of what Middleton called "a whole new design series." (Middleton also let it be known at the October presentation that Kenwood would discontinue its very popular TS-850S "within the next nine to twelve months.")

The Kenwood presentation featured Toshio Torii, JA6QXW, the engineer from Yokohama who designed both the TS-850 and the TS-570D, as well as built the prototype for the TS-50S. During the evening, Kenwood spent a lot of time comparing the relative merits of the TS-570D to the TS-450SAT. Of course, the '570D has DSP at audio, not IF (to keep production costs down), while the TS-450SAT has no DSP. Kenwood called its implementation "near-IF DSP," whatever that means. But the presenters were very up front that the DSP implementation in the '570D is not as sophisticated as that in their higher-end TS-870S (see "Product Review," *QST*, Feb 1996). While the DSP notch filter in the TS-570D will zap a heterodyne, the S meter will continue to display the carrier that caused it.

Like its bigger sibling, the TS-570D can be controlled via a PC. The *Radio Control Program* Ver 2 (*RCP2*) software, not yet ready at the time of Kenwood's demonstration, should now be available for downloading from the Kenwood Web site, **http://www.kenwood.net/**. The radio does not need an external computer interface; it offers RS-232 on the rear apron. The TS-570D's built-in antenna tuner can be made active in the receive mode, unlike the one in the TS-450SAT. (Kenwood says this can reduce QRM from strong local BC stations when using 160 and 80 meters.) The antenna tuner also uses only relays, no motors.

It was an impressive demonstration (among other things, Mr. Torii demonstrated the DSP system and showed how you can tailor your transmitted audio), and Kenwood even stayed around after the formal remarks to take questions—and some flak—from those on hand. One op hammered Kenwood for once again failing to make provisions for a separate receive antenna (such as a Beverage). Others wondered aloud whether the lettering on the rubber buttons that populate the front-panel would hold up. A few wanted to see the insides, and Kenwood obliged. But most seemed favorably impressed by the radio and seemed to appreciate Kenwood's willingness to conduct a show-and-tell on the prospective customer's home turf—with free refreshments, no less. Kenwood hopes it will prove to be a very effective approach —*Rick Lindquist, N1RL*

Operating Impressions

Except for the previously noted difficulties with the **MULTI/CH** knob, this radio was a joy to operate. We found the controls to be intuitive and well placed, and even operators with clumsy fingers seldom had trouble finding the right button. The control knobs are far enough apart so you can easily manipulate one without constantly bumping its neighbor.

Received audio quality—even with the small upward-firing internal speaker—was excellent, as were reports of transmitted audio. On-the-air reports suggested the default processor setting (10 dB) made the audio "a little stronger," but it was neither an overly dramatic boost nor objectionable (maximum available compression is 25 dB). The speech processor operates at audio frequencies. The built-in DSP allows you to tailor the transmitted audio to suit your voice and operating conditions. This is super for contesting and DXing on SSB. On-the-air reports confirmed that it worked as intended.

On CW, the built-in memory keyer has a nice "feel," and setting the operating speed is easy. Curiously, Kenwood named the button you press to set the speed the **KEY** button. After you hit the **KEY** button, the manual says that the display shows the current speed, adjustable by turning the **MULTI/CH** knob. The displayed numbers (0 to 100) do not correspond with "real" words per minute (ie, "50" was about 35 wpm), but this arrangement made it easier than a lot of radios to set your sending speed. On-the-air keying reports were favorable, even at higher speeds using full-break-in, where some radios start to chop characters. The keyer's three memories were easy to program and play back using front-panel buttons.

The optional 500-Hz CW filter was easy to install because there is an access panel on the bottom of the cabinet. After installing

the filter, we had to "activate" it via a menu option. To engage the optional 500-Hz filter, you have to hit the **FILTER** button and turn the audio DSP bandwidth to 600 Hz or less. Setting the DSP audio filtering to a wider bandwidth takes out the filter. With the audio DSP filter, you can crank the received audio bandwidth down to 50 Hz on CW. It's not a good idea to try tuning the radio with the filter that narrow, but once you have tuned in the signal exactly (remember that **CW TUNE** feature?), you can sure eliminate a lot of interference! The DSP filtering was pleasantly non-ringy too.

One reviewer who operated the TS-570D during the Boy Scouts' Jamboree on the Air and the CQ WW SSB contest found himself frequently adjusting the concentric **DSP SLOPE** (high and low-cut controls). These can do amazing things on SSB, and even under crowded band conditions he reports often being able to reduce or eliminate interference from nearby signals. The radio also got a thorough CW workout during the ARRL November Sweepstakes. It never broke a sweat (although the somewhat noisy cooling fan came on a lot), and it performed flawlessly under often less-than-ideal, crowded band conditions. The DSP, coupled with the 500-Hz filter, was a godsend in separating stations. The CW sidetone adjusts in sync with the CW pitch, which may be changed via the menu. The **NR1** position stayed on most of the time (and helped reduce operator fatigue from the noisy low bands). The built-in tuner quickly matched the transceiver to the multiband 80-meter dipole in use at the SS location in Vermont. It even delivered full power to the feed line in some situations where the match was obviously less than optimum.

We found the default 10-Hz tuning step (ie, 10 kHz per dial rotation) too rapid for casual CW or SSB tuning. Pushing **FINE** produces a comfortable 1-kHz-per-dial-rotation rate. Unfortunately, **FINE** *also* affects the RIT/XIT, and the 1-Hz step size there (approximately 100 Hz per knob rotation) is too small to be terribly useful on SSB or CW.

The *Instruction Manual* is thorough and well-written, and keeps the newcomer in mind without being overly elementary.

Footnotes

The TS-570D has a double-conversion superheterodyne receiver, with IFs of 73.05 MHz and 8.83 MHz. On FM, the receiver adds a third conversion step, with a 455-kHz IF. All digital signal processing (DSP) functions are performed on baseband audio. You won't need an external DSP box, although the unit built into this radio doesn't provide all the adaptive modems, tracking and other features found in some of the add-on boxes. To improve IMD performance, the TS-570D includes a narrow-profile bandpass filtering system in the front end for 40 and 20 meters, similar—if not identical—to the front end in the TS-850 and TS-870S. The radio is also plenty sensitive, so you won't need to engage the preamp very often. It has separate preamps for the low and high bands.

The boards inside the compact unit are solidly mounted to a cast-aluminum frame that's part of the heat sink. The radio has a carrying handle, too—a feature often not included these days—which makes it easy to carry along on DXpeditions or Field Day excursions.

Power output is adjustable between 5 W and 100 W in 5-W increments. When using the radio with a VHF transverter, the power is limited to 5 W output, once the display is be set to directly read out the appropriate 6-meter or 2-meter frequency.

This radio may not compete feature for feature with the top-of-the-line radios (Kenwood intends it to replace the TS-450SAT), but for its price class and size, it performs quite admirably. The TS-570 does not have a built in AC power supply, so you will have to provide 13.8 V dc from a source capable of supplying 20.5 A to the rear-panel connector. If you don't already have a suitable supply, you will have to add that cost to the price of the radio. You may want to add several accessories. There's only one slot for an optional filter: You can mount either a 500-Hz or a 250-Hz IF CW filter or a 1.8-kHz SSB filter. The optional digital recording unit—or "voice keyer"—might come in handy for contest operating. A voice synthesizer unit also is available if you like (or need) your radio to speak to you about its operating conditions.

I would like to thank Mike Gruber, W1DG; Rick Lindquist, N1RL; and Chuck Hutchinson, K8CH, for their input and assistance with this review.

Manufacturer: Kenwood Communications Corp, PO Box 22745, Long Beach, CA 90801-5745, tel 310-639-5300. Manufacturer's suggested retail prices: TS-570D, $1820; MC-90 desktop microphone, $270; PS-52 heavy-duty power supply, $310; SP-23 external speaker, $90; DRU-3A digital voice recording unit, $140; SO-2 temperature-compensated crystal oscillator (TCXO), $190; VS-3 voice synthesizer unit, $40; YK-88C-1 500-Hz CW filter, $140; YK-88CN-1 270-Hz CW filter, $140; YK-88SN-1 1.8-kHz SSB filter, $140.

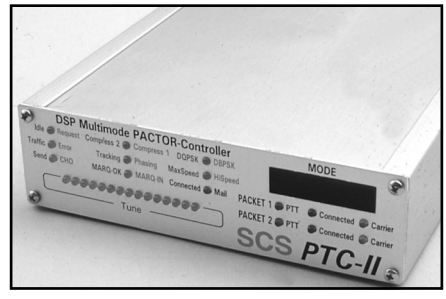
SCS PTC-II Multimode Controller with PACTOR-II

By Steve Ford, WB8IMY
Managing Editor

It's astonishing to think about how far we've come in HF digital communications in such a short time. Prior to 1982, Baudot RTTY was the norm. It was a great mode for casual conversation, but it lacked the means to detect errors. If the RTTY signal you were copying fell victim to noise, fading or interference, the result was gibberish on your screen. (Before the PC revolution, the "screen" was often teletype paper!)

AMTOR burst (pun intended) onto the scene in '82. It gave us text that was almost error-free, and filled the bands with those odd *chirp-chirp* sounds. A few years later HF packet came into its own. Although far from ideal in terms of dealing with the vagaries of HF, packet at least gave us the ability to exchange the entire ASCII character set, as well as binary files.

Special Communications Systems (SCS) created PACTOR, starting with PACTOR-I, which hit the airwaves in 1991 with sophisticated data compression and the remarkable ability to "reconstruct" corrupted data. Reaction from the ham community was swift and positive. It wasn't long before PACTOR-I became a staple in virtually all multimode controllers.



BOTTOM LINE

A top-of-the-line digital box at a top-of-the-line price. This one's for *serious* digital enthusiasts.

Just when it seemed that the HF digital waters had calmed a bit, CLOVER and G-TOR appeared. Both modes offered superior performance, but hams seemed content with PACTOR-I and were reluctant to make a change. Even so, CLOVER and G-TOR found dedicated, if somewhat limited, audiences.

As we progress toward the end of the 20th century, we have no fewer than six digital modes competing for the hearts and minds of HF-active amateurs. If you listen to the HF digital subbands for any length of time, you'll discover that while the venerable RTTY is still quite popular for digital contesting and DXing, PACTOR-I reigns as the undisputed king of the "burst modes."

In the current "Tower of Babel" digital climate, will hams accept a *seventh* mode? If they're offered an HF digital mode that promises the ultimate in performance, will they flock to it in numbers sufficient to dethrone PACTOR-I? That's what the folks at SCS—the creators of PACTOR-II—are betting on.

PACTOR-II

I once heard a ham describe PACTOR-II as being PACTOR-I on steroids. There may be some truth to this analogy! PACTOR-II retains many of the features that made PACTOR-I so popular: Support of the compete ASCII character set; memory ARQ to reduce the number of retransmissions; on-line data compression to speed transfers; automatic data-rate selection; and independence from sideband selection (it doesn't matter if you operate with your rig set to LSB or USB).

What PACTOR-II brings to the party is considerable. Using differential phase-shift keying (DPSK) and innovative convolutional coding (with a true Viterbi decoder), PACTOR-II boasts data transfer rates at least *three times* faster than PACTOR-I. Under optimum band conditions, the rate could soar to six times faster. In terms of effective data rates, that translates to about 800 bits/s. PACTOR-II has the option of using Huffman coding for data compression (the same as PACTOR-I), or Pseudo-Markov coding (PMC) for even greater performance and efficiency.

One of the most astonishing aspects of PACTOR-II is that it achieves all this wondrous performance while using only 500 Hz of spectrum (at –50 dB). You need fast hardware and digital signal processing (DSP) techniques to make all of this practical. That's why you won't find PACTOR-II included in the current crop of multimode controllers. In fact, the *only place* you'll find PACTOR-II at the moment is in the PTC-II.

The PTC-II

When I first eyeballed the front panel of the PTC-II, one image came to mind: A Christmas tree. There are no fewer than 30 LEDs populating the panel, along with a dot-matrix LED readout. They're all quite informative, telling you whether the data is flowing without errors, which compression scheme is in use, if you have messages waiting in the mailbox and so on. In practice I found that I didn't have time to focus on any one of them. Only the dot-matrix **MODE** display and the tuning indicator saw much use. The **MODE** display is handy when you're tuning around in the *listen* mode. If I came upon a PACTOR signal, the display would immediately indicate whether it was a PACTOR-I or PACTOR-II conversation.

The tuning indicator is a real gem! It is simply a row of dual-color LEDs with a **TUNE** LED in the center. As you tune across a PACTOR-II signal, for example, the LEDs on the right- and left-hand ends flash red, then green, as you "arrive" on frequency. At that point you make slight adjustments of your VFO until the **TUNE** LED is centered. With a little practice I found that I could tune in a PACTOR-II signal in a matter of a few seconds.

On the back panel are two packet radio ports. (Yes, the PTC-II supports *simultaneous* HF/VHF communication—up to *three* channels at once!) You can't operate packet with the standard PTC-II, though. If you want packet capability, you must purchase additional modules from SCS. A 300 baud modem is not yet available, but SCS offers an AFSK modem for 1200 and 2400 baud, plus an FSK modem for 4800, 9600, 19,200 and higher baud rates. The labeling of the HF ports can be a little confusing. There is a port labeled **AUDIO** and another labeled **CONTROL**. The **AUDIO** port provides the audio inputs and outputs, as well as the push-to-talk lines. **CONTROL** refers to the interface between the PTC-II and your transceiver's computer-control port, if it has one. For basic operating you need only construct a cable for the **AUDIO** port, although you can do some very clever things with the **CONROL** port, as we'll discuss later.

Communicating with your computer is as easy as running an RS-232 cable between the PTC-II and your computer's serial port. The PTC-II package includes a freeware program called *PlusTerm* on a 3.5-inch diskette. I tried to load *PlusTerm* using its installation batch file and had a devil of a time. I eventually gave up and worked around the problem.

To my dismay I discovered that *PlusTerm* is strictly a DOS program. As a guy who's been spoiled by *Windows*, I found it painful to use. The good news is that the terminal program already available in *Windows* works very well with the PTC-II. The even better news is that Wilfried Max, DL1XAM, has developed a full-featured *Windows* program specifically for the PTC-II. (You can get a demo version by sending a formatted 3.5-inch diskette with $10 *cash* (no checks) to Wilfried Max, DL1XAM, Lisbeth Bruhn Str 18, D-21035 Hamburg, Germany. For more information see the SCS site on the Web at **http://www.scs-ptc.com/software.html**.)

The only serious weak spot in the PTC-II package is the manual. The slender volume does an excellent job of explaining PACTOR-II, but gives poor coverage to other aspects of the PTC-II. For example, I didn't know that the PTC-II could send and receive CW until I discovered this feature by accident while reading through the list of commands. Some of the unit's most interesting features are described vaguely, leaving users very much on their own.

On the Air

After hearing and reading so much hype about PACTOR-II, I was dying to give it a try. My first problem was *finding* a PACTOR-II station. With the PTC-II in the *listen* mode, I scanned through the 20-meter digital subband, but all of the "burst" links were using PACTOR-I. I wasn't entirely surprised. There are only a handful of PACTOR-II stations in the US and a limited number in Europe.

After about 30 minutes of hunting I finally copied a link with the ON4OB mailbox. As I tuned in the signal, the **MODE** indicator on the PTC-II flashed **PT-2**. Bingo! When the station signed off, I sent a connect request to the mailbox. Two seconds later we were connected and the data stream was flowing nicely. The band was in poor shape, and conditions were worsening by the minute. I requested a list of his station equipment just as his signal took a deep fade. To my astonishment, the list began marching across my monitor despite the fact that I could *no longer hear his signal*!

Later the same afternoon I witnessed a dramatic demonstration of PACTOR-II's ability to withstand interference. I had connected to FG5FU and was downloading information when a RTTY station fired up right on top of us. The link seemed totally unaffected by the RTTY interference. In fact, the text continued to zip by faster than I could read!

Of course, the PTC-II features its own mailbox, with a 512-kB message capacity (expandable to 2 MB with the optional static RAM extension). It offers some versatile remote-control functions as well. The mailbox accepts connections in PACTOR-I or II, or AMTOR.

It is important to point out that PACTOR-II, as implemented in the PTC-II, is entirely "backward compatible" with PACTOR-I. That is, you can work PACTOR-I stations and they can work you. When you connect to a PACTOR-II station, the exchange begins in PACTOR-I and then automatically "upshifts" to PACTOR-II.

AMTOR conversations were even harder to find than PACTOR-II. I spent the better part of an afternoon searching for stations running AMTOR and came up empty. That evening I finally encountered a few on 80 meters. Once again the PTC-II did an outstanding job of maintaining links in the face of considerable noise and interference. After using the PTC-II on both PACTOR modes, however, AMTOR seemed almost primitive.

The PTC-II had a surprise in store on RTTY. The DSP filter performance that proved itself so well on the other modes did a *superb* job with RTTY. I encountered a number of stations using RTTY on 20 meters and enjoyed several live conversations (all of my PACTOR-II connections were with mailbox systems). The PTC-II provided wonderful copy even when signals sank into the noise. This unit might be a great contest box!

CW performance was about what you would expect. If the code was sent perfectly, the PTC-II copied perfectly. If the fist was poor, the copy was poor. The PTC-II's tuning indicator made CW reception quick and easy. You simply tune your rig until the LEDs begin "bouncing" from left to right in sync with the signal.

Fascinating Extras

The PTC-II includes a number of bells and whistles that you won't find on other controllers.

I had to chuckle when I read that the

PTC-II can function as a *DSP audio filter*. No kidding! The unit provides an audio output line (on the **CONTROL** port) that you feed to a small amplifier and speaker. (The audio from your rig is already feeding into the HF transceiver port.) At your keyboard you enter the AUDIO menu and select either an adjustable-bandwidth CW filter, a "denoiser" or a notch filter. I noticed dramatic performance with the CW filter; the skirts seemed incredibly sharp. The denoiser worked best on CW, while giving a somewhat "hollow" sound to SSB signals. The automatic seek-and-destroy notcher did a fine job of eliminating "tuner-uppers."

And what about that **CONTROL** port? If your transceiver provides computer control, you're in luck. The PTC-II can use it to do one or both of the following:

- Control the frequency of your radio from your computer keyboard, or remotely from another station.
- Set up an automatic scan on frequencies you select in advance. You can enter up to 16 frequency "channels" and command the PTC-II to scan through all of them. As it does so, it commands your radio to jump from one frequency to another. For example, you can configure the PTC-II to scan on 16 different frequencies from 80 meters through 10 meters. If your friend wants to connect to your PTC-II mailbox, he has 16 different frequencies he can try, depending on band conditions.

No special software is required for rig control. The PTC-II comes preconfigured to work with Yaesu, Kenwood, or ICOM rigs. You simply "tell" the PTC-II which brand you own.

DPSK requires exceptional frequency stability. The PTC-II includes automatic offset and drift compensation using a tracking algorithm that follows the received signal.

Although the manual only mentions it briefly, the PTC-II has the ability to vary your output power *automatically* during PACTOR-II contacts. If conditions are good, the PTC-II will reduce the audio level applied to your transceiver, thereby reducing your output. If conditions go to pot, audio levels automatically increase to push your radio up to full power. The default setting for this command is OFF, so you must switch it on yourself.

Speaking of transmit audio, some transceivers offer audio line-input ports on their rear panels (these are often labeled **AFSK**). If the PTC-II doesn't seem to provide enough audio through this port to drive your rig to full output, no problem! Just use the **PSKA** command at your keyboard to adjust the transmit audio level.

Finally, the DSP architecture of the PTC-II provides extraordinary flexibility for the future. SCS plans to offer free firmware updates that will allow the PTC-II to operate on FAX and SSTV. All you'd have to do is place the software in your computer and implement the PTC-II's **UPDATE** command.

Is PACTOR-II for You?

If you demand high-performance HF digital communication regardless of cost, PACTOR-II may be your dream come true. There is no question that PACTOR-II offers superb performance, and its implementation in the PTC-II is outstanding. Is PACTOR-II better than the other contenders for the high-performance market—CLOVER or G-TOR? PACTOR-II proponents would answer "yes," but CLOVER and G-TOR disciples would argue otherwise, depending on specific conditions. Monitor the Internet e-mail "reflectors" and you'll be treated to an ongoing battle among those who champion these modes.

In the meantime, the average ham has yet to embrace PACTOR-II, CLOVER or G-TOR in significant numbers. They seem comfortable with PACTOR-I, especially since it provides excellent performance in controllers costing less than $300. As one fellow commented on the air during one of my tests, "PACTOR-I already gives me the ability to swap text at rates faster than I can read or type. Isn't that enough?" Perhaps, but the benefits of PACTOR-II go beyond speed. The robust nature of PACTOR-II makes global communication possible for low-power stations, or stations with less-than-optimal antennas, *or both*.

Regardless of its technical merits, the fate of PACTOR-II is likely to be decided in the marketplace. If PACTOR-II is to gain wide acceptance, hams will have to be convinced that the benefits are worth the substantial investment.

Manufacturer: Special Communications Systems GmbH, Roentgenstrasse 36, D-63454 Hanau, Germany; tel 49-6181-23368; e-mail **info@scs-ptc.com**; WWW **http://www.scs-ptc.com**. Manufacturer's suggested retail price, $950; SCS RCU remote control amplifier unit, $195. (PacComm Packet Radio Systems Inc, Tampa, Florida, manufactures a nearly identical version of the PTC-II in the US, under a license from SCS, for $995. Call 800-486-7388 or e-mail **ptc@paccomm.com**.)

Two Ultra-Accurate Clocks

Every so often we discover consumer products that have applications in the ham world. When we do, we like to bring them to your attention. Let's take a look at two highly accurate clocks hams might find useful: The Time Machine by Oregon Scientific and The *Zeit* radio-controlled desktop clock by Arcron-Zeit.

Amateur Radio is among those hobbies whose adherents often need to have very accurate time—for keeping schedules, log-keeping, contesting, tracking satellite passes and setting the clock on the computer, among other things. Each of these clocks contains a VLF receiver and automatically sets itself according to time signals broadcast on 60 kHz by National Institute of Standards and Technology (NIST) radio station WWVB in Boulder, Colorado. WWVB time signals are based on NIST's cesium-isotope clocks, the world's most accurate time source. Headquarters staffers Steve Ford, WB8IMY, and Robin Micket, N1WAL, examined these clocks to see how well they live up to their claims.

THE TIME MACHINE

At first glance the Oregon Scientific Time Machine looks like any other alarm clock. It runs off two AAA batteries (included), and it offers an LCD display (with high-contrast blue illumination), a snooze button, push buttons to set the alarm and so on. But look closer at the LCD display and you'll see symbols not commonly found on clocks. In particular, there's one that looks like a radio tower with RF "waves" emanating from its tip. This isn't a clock radio…or is it?

Veterans of the glory days of Heathkit might remember a clever device known as the Most Accurate Clock. It monitored timing pulses transmitted by WWV and calibrated itself accordingly. Lo and behold, the Most Accurate Clock concept has returned in the Time Machine. Six times every 24 hours, the Time Machine's tiny VLF receiver listens for WWVB. When it receives the signal, it monitors long enough to recalibrate itself. If it hears WWVB but can't receive well enough to permit calibration, another symbol appears on the display to let you know that you need to move the antenna.

Does It Really Work?

I was skeptical of the Time Machine. The main unit was barely larger than my hand. How could a decent VLF receiver fit in such a small package? The separate **T**-shaped ferrite-core antenna was encased in plastic with a Velcro adhesive pad. About four feet of what looked liked RG-174 connects it to the clock.

The instruction sheet said propagation was best at 60 kHz between midnight and 4 AM local time. All I had to do was place the antenna near a window, it proclaimed, and the clock would take care of itself. Fair enough. I put the antenna on the sill of a second-story, west-facing window. If I was going to have a prayer of receiving 60-kHz signals from a 10-kW transmitter in Colorado (WWVB will increase power to 50 kW by next year), I assumed that antenna placement would be critical. I selected my time zone (Eastern) and then deliberately set the Time Machine to a grossly inaccurate time.

When the Time Machine receives WWVB's signal, the outline of the time-zone map blinks on and off. I checked at 11 PM, but nothing had happened. But I awoke the following morning and stared at the little alarm clock in amazement. It was displaying the correct time! The radio tower symbol showed that the clock had indeed received WWVB while I slept, sometime in the wee hours. (It reminded me of the children's story of the shoemaker and the elves. The shoemaker goes to bed each night, only to find finely crafted shoes on the table the next morning. In this case, you go to bed and awake with an ultra-accurate clock!)

The next night, I moved the antenna away from the window and placed it on a south-facing bookshelf. The Time Machine calibrated itself once again! Two nights later I stuffed the clock and its antenna into a clothes closet deep inside my home. That finally did the trick. The clock heard WWVB, but not well enough to calibrate itself.

Pluses and Minuses

The Time Machine works as promised, even when it's nearly 2000 miles from the transmitter site. Each night it dutifully recalibrated itself, despite late-summer thunderstorms that must have made conditions pretty rough on 60 kHz. (Too bad the Time Machine doesn't allow you to actually hear WWVB. But that "feature" would be an annoyance to most consumers!)

The large LCD display is easy to read and the clock is quite simple to program. Even the instruction sheet is well written. They caution that reception might be spotty in some areas of the country. I agree, although my experience seemed to show that the receiver was particularly sensitive.

From an Amateur Radio standpoint, the Time Machine has one main flaw: It does *not* display UTC. You are forced to select from among the Pacific, Mountain, Central or Eastern time zones—that's it. If you try to set the Time Machine for UTC, it will "correct" itself the next time it resets. Also, while the Time Machine displays hours, minutes and seconds, it will *not* do so in the 24-hour format most hams use.

The Time Machine still is a worthwhile purchase (and a terrific Christmas "stocking stuffer") if you don't mind having to translate to UTC yourself. With the Time Machine's alarm function and the technology of the NIST behind you, no one will ever accuse you of being late for the net again! Overall, it's a useful ham shack accessory and a great conversation piece. —*Steve Ford, WB8IMY*

Manufacturer: Oregon Scientific, 18383 SW Boones Ferry Rd, Portland, OR 97224; tel 800-853-8883. Manufacturer's suggested retail price, $99.95. Available in limited quantities through catalog retailers.

THE *ZEIT*

The *Zeit* radio-controlled desktop clock's slogan is: *Für Unbegrenzte Möglichkeiten!* (For Unlimited Possibilities!). The *Zeit* (German for "time") is a sleek, compact, versatile, and sophisticated clock. The unit is made of a hard black-plastic casing shaped in a forward-slanting arch. Besides its distinctive appearance, what makes this alarm clock special? Accuracy. *Exceptional* accuracy.

How Does It Run?

Two AA alkaline batteries power the clock. An internal ferrite-core omnidirectional antenna receives the radio signal from WWVB. The clock adjusts to the correct time as soon as it hears a valid time signal, and it's supposed to take your time zone and Daylight or Standard Time into account. Every day at 1 AM, the clock will try to pick up the WWVB signal. (It also checks for WWVB when you replace the batteries.) The *Zeit* uses the signal to calibrate its internal oscillator. A radio tower symbol and solid bars depict received signal strength, and you can use these as a guide when positioning the clock for best reception. According to Arcron, even without the time signal, The Zeit is accurate to within at least 0.12 second per day, and a lithium-battery-powered "clock within a clock" keeps correct time even without the regular batteries. If the clock doesn't receive a correct time signal for more than 18 days, the radio tower symbol in the display disappears. Then, you can turn on the Advanced Radio Controlled (ARC) program to manually locate a valid time signal. This forces the clock to listen for a signal, and the radio tower's "waves" indicate WWVB's present signal strength.

Features

I found the *Zeit* easy to operate and the display readily readable. Beyond being exceptionally accurate, its other features at least suggest those "unlimited possibilities." The clock displays the time in hours, minutes, and seconds—along with AM or PM designation and the time zone you have selected (Eastern, Central, Mountain, or Pacific). In addition, it can display either the date with month and day, or the "world time" of a zone you select. This is great for hams who want to have UTC readily available. It doesn't display 24-hour format, however.

The *Zeit* offers a dual alarm system. The clock also has a backlight for nighttime use. Four flush controls operate the functions. Each control has a distinct pattern of ridges or inverted dots distinguishable by touch for easy operation in the dark.

Testing

I was excited to take the clock home to try it out since Daylight Time ended the very weekend I was to test the unit. I set two other alarm clocks for 2 AM—when we were to set the time back one hour—and had hoped to see the clock make the switch to Standard Time. Much to my dismay, it did not adjust to Standard Time, although the radio tower symbol showed it was getting a good signal. I set the correct time manually, and the clock has remained accurate ever since. I later learned that the *Zeit* has to receive a special "flag" signal a day before the time change occurs in order to make the switch. I tried every other test I could think of to "trick" the clock. Every maneuver cast a positive vote for the clock's reliability.

Understandably, time-signal reception was better near windows, and not as good close to TV sets or computers, or in the middle of the house. I even tried randomly pushing the control buttons to confuse the clock, but it was unfazed. Finally, the possibility of jarring the "unlimited possibilities" occurred when the clock took an accidental drop from a $3^1/_2$-foot-high work table onto a carpeted floor. The *Zeit* emerged unscathed, time marching on. The *Zeit*—The Time…something we all need. In short, precise US and world time combined with practical features make this a nice addition to any ham shack.—*Robin Micket, N1WAL*

Manufacturer: Arcron-Zeit, 1010 Jorie Blvd, No. 324, Oak Brook, IL; tel 800-985-TIME (8463). Order direct from Arcron–Zeit. $149.95.