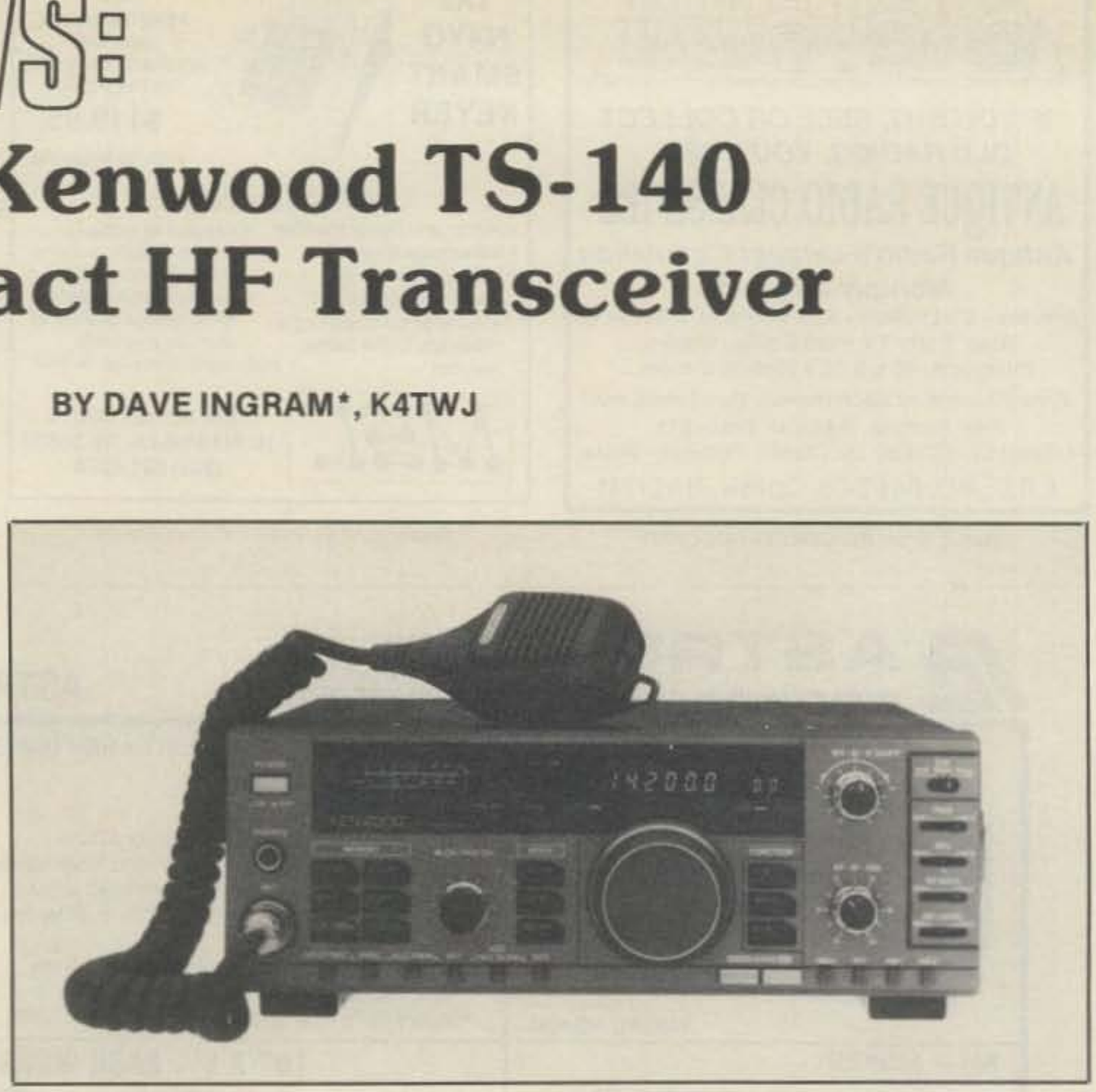
CQ REVIEWS:

The Kenwood TS-140 Compact HF Transceiver

BY DAVE INGRAM*, K4TWJ

Several years ago Cadillac added a small automobile called the "Cimarron" to their line of quality vehicles. The compact car sported many features and appointments similar to its full-sized counterparts, but it exhibited two rather attractive differences: small size for easy handling and a lower price tag for affordability. Today those same concepts of big-time performance in a small package are making hot news in amateur transceivers. The results are what I call "lighthearted fun rigs"; they are perfect for fixed, portable, or mobile operations in a truly enjoyable and free-style manner. A recent example of those statements is Kenwood's new TS-140S HF transceiver featured in this *CQ* magazine review.

The Kenwood TS-140S is a full 160 through 10 meter all-mode transceiver with 100 watts output, general-coverage reception from 50 kHz to 35 MHz, 31 memories, scanning, speech processor, and semi or full CW break-in operation. The rig measures 3¾"H × 10½"W × 11"D and is priced at around $800. The rig's small size is a really big feature, especially when mobiling with today's cars, as it will fit into spaces simply too tight for larger rigs like the TS-430S or TS-440S. After removing the ashtray and cigarette lighter in our Mercury Topaz, for example, the TS-140S squeezed in without an inch to spare. Its internal heat sink and rear top-ventilated fan, however, are still open to free air flow under the dash for cooling. In my opinion, the trade-off of a built-in antenna tuner for reduced depth is a logical compromise. I simply don't endorse compensating for an improperly set antenna (with a tuner) if I can get to the radiator for adjustments. I understand the TS-140S's attractive price is due to robot rather than human assembly. Robots usually exhibit exquisite quality control and cost-effective results. Other manufacturers will surely follow suit.



Kenwood's TS-140S HF transceiver is a deluxe little gem in an attractive package.

First Opinions

Initial ad pictures of the TS-140S do not do it justice. The rig is silver-gray in color just like the TS-430S or '440S. Its appearance reminds me of a "little TS-940S." An internal speaker is mounted in the cabinet's right top area, a carrying handle is included on the right side, and the RF amplifier's built-in heat sink leaves the rear panel "clear" for fitting in tight spots. The 32 front-panel controls are laid out for easy operation, with a subpanel of controls on the right side and a recessed bank of switches along its bottom area.

Although not apparent at first glance, several of the rig's front-panel switches serve double duty for providing some "big rig" capabilities. Holding the "CW/N" button when switching on the TS-140S, for example, lets you choose "beeps" or Morse code announcements of selected modes and memory actions. Similarly, holding the "CLEAR" button toggles between 100 Hz and 10 Hz resolution in the main display (see fig. 1). Likewise, holding the RIT button selects 10 or 20 Hz RIT resolution, and the "SCAN" button toggles its "hold" function on/off. During scanning the RIT knob also changes to vary scan speed. Obtaining a "key down" or full-carrier signal for checking an antenna or tuning a linear amplifier is also easy: switch to CW with full QSK, then press the mike's push-to-talk bar. No shorting plug or closed key required. Very nice! Holding the main tuning knob's rear ring while slightly turning its front rubberized grip varies its tension in precise steps to suit your hand.

The rig's "M CH/VFO CH" knob selects memories while in the memory mode, and shifts frequencies in 10 kHz steps while in VFO mode. The latter function would be great for mobiling if it was modified for 100 Hz step-tuning. Ten kHz jumps are quite wide! Fortunately, however, the TS-140S can be step-tuned in 10 Hz increments from its mike for laid-back (lazy?) mobiling. Kenwood also has an optional sun-visor-mounted boom mike, a gearshift-fitted PTT box with up/down tuning buttons that interface with the TS-140S for "hands free mobiling." Remember that item if you drive a manual-shift or get enterprising ideas about adding remote control to the TS-140.

Continuing our first-impression views, the TS-140S dual width and adjustable noise

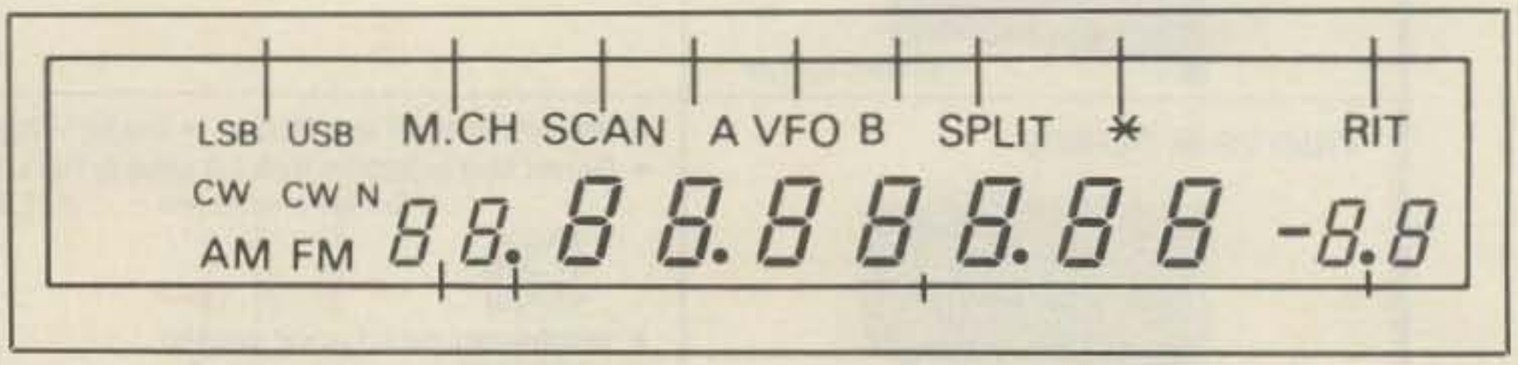


Fig. 1– Overview of the TS-140S multifunction display. Various illustrated functions are operated by front-panel controls.

*Eastwood Village No. 1201 So., Rt. 11, Box 499, Birmingham, AL 35210

blanker is a very good feature in a low-cost rig. It does an admirable job in minimizing both mobile and home power-line noises, and "zaps the woodpecker" right out of existence. The unit's front-panel-adjustable power output control works on both CW and SSB—a very useful feature we are glad Kenwood finally included in their transceiver designs. Many linear amplifiers need only 60 or 70 watts for delivering their full output. Additional power can create splatter, and reducing mike gain to decrease power defeats a speech processor's effectiveness. A separate power output control solves the dilemma. It's also a dandy way to limit your battery drain when operating portable or working extended-mobile without running the car's motor. Hold your output to 25 or 30 watts, and you can enjoy one or two hours of operating from a motel or shopping-center lot . . . and still have enough "juice" to start the car.

The TS-140S speech processor, incidentally, does a good job of increasing talk power without adding distortion. Everyone we contact compliments the TS-140S transmitted audio. Double-checking their comments on our auxiliary transceiver (a Collins KWM-1 with a 3.1 kHz mechanical filter) confirms they're right. The '140 sounds really good, even with its supplied "generic response" mike.

A Closer Look

A brief study of the TS-140S specifications shown in fig. 2 indicates it is a lot of rig for the money, and a couple of days of on-the-air operations confirm it's a sharp little performer. Since most of us are mainly interested in how a rig performs under actual in-shack situations or how it compares to similar units rather than how it measures in laboratory tests, some special checks were made with you in mind. Our unit's transmitter puts a solid 105 watts into the antenna on 160 and 80, 102 watts on 40 through 15, and 93 watts on 12 and 10 meters.

The CW full break-in has a reed relay. It's approximately as "noisy/quiet" as a TS-940S and only a gnat's hair louder than an ICOM 761. That's with the TS-140S's internal linear amplifier relay switched off (as it arrives factory-set). If you "go inside" and switch on the relay, you'll probably switch to semi break-in to avoid the added noise. It becomes quite noticeable. Since I run mixed modes, I quickly found an alternate linear switching method. During transmit, 12 volts at 10 ma is output on pin 7 of the TS-140S's rear "accessory" connector. This voltage does not depend on the previously mentioned relay, so I use it to control an external Radio Shack 12 volt relay, which in turn keys my amplifier. The relay is simply unplugged from the TS-140 for full (and quiet) break-in activities.

Another rear socket, incidentally, is included for interfacing RTTY and Packet systems without front-panel hook-ups. Separate input-level controls are included for rear-panel and mike signals. These adjustments, along with the relay switch, CW sidetone, "beeper" level, etc., are on the "bottom layer" of the TS-140S's unique "swing open" chassis. This design may seem a bit intimidating, but it is actually quite clever and easy to "get into." Just watch to avoid pinched wires when swinging it closed.

Specifications \ Model				TS-140S	TS-680S
General	Mode			J3E (LSB, USB), A1A (CW), A3E (AM), F3E (FM)	
	Antenna impedance			50 ohms	
	Power requirement			12 to 16 VDC (13.8 VDC reference)	
	Grounding			Negative	
	Current drain		Receive mode with no input signal	1.5 A	
			Transmit mode	20 A	
	Operating temperature			−10 to +50°C (+14 to +122°F)	
	Frequency stability			Less than ±10 PPM	
	Frequency accuracy			Less than ±10 PPM	
	Dimensions (W×H×D) (Projections included)			281×107×305 mm (11-1/16"×4-7/32"×12")	
	Weight			6.1 kg (13.4 lbs)	
Transmitter	Frequency range		160 m band	1.8 to 2.0 MHz	
			80 m band	3.5 to 4.0 MHz	
			40 m band	7.0 to 7.3 MHz	
			30 m band	10.1 to 10.15 MHz	
			20 m band	14.0 to 14.35 MHz	
			17 m band	18.068 to 18.168 MHz	
			15 m band	21.0 to 21.45 MHz	
			12 m band	24.89 to 24.99 MHz	
			10 m band	28.0 to 29.7 MHz	
			6 m band	———	50.0 to 54.0 MHz
	Output power	160 m band – 15 m band	SSB	110 W •1	100 W •1
			CW	100 W •1	
			AM	40 W •1	
		12 m band	SSB · CW	100 W	
			AM	40 W	
		10 m band	SSB	100 W	95 W
			CW	95 W	
			FM	50 W	
			AM	40 W	
		6 m band	SSB · CW · FM	———	10 W
			AM	———	4 W
	Modulation		LSB, USB	Balanced modulation	
			FM	Reactance modulation	
			AM	Low level modulation	
	Spurious radiation (CW)		1.9 MHz to 29.7 MHz	Less than −40 dB	
			50 MHz to 54 MHz	———	Less than −60 dB
	Carrier suppression			More than 40 dB (with 1.5 kHz reference)	
	Unwanted sideband suppression			More than 50 dB (with 1.5 kHz reference)	
	Maximum frequency deviation (FM)			±5 kHz	
	Frequency response (−6 dB)			400 to 2600 Hz	
	Microphone impedance			500 ohms to 50 kΩ	
Receiver	Circuitry			Double conversion superheterodyne	
	Frequency range			500 kHz to 30 MHz	500 kHz to 30 MHz 50 MHz to 54 MHz
	Intermediate frequency			1st: 40.055 MHz, 2nd: 455 kHz	
	Sensitivity	LSB, USB, CW (at 10 dB S+N/N)	500 kHz to 1.62 MHz	Less than 3.98 μV	
			1.62 MHz to 21.5 MHz	Less than 0.25 μV	
			21.5 MHz to 30 MHz	Less than 0.25 μV	Less than 0.18 μV •2
			50 MHz to 54 MHz	———	Less than 0.16 μV •2
		AM (at 10 dB S+N/N)	500 kHz to 1.62 MHz	Less than 39.8 μV	
			1.62 MHz to 21.5 MHz	Less than 2.5 μV	
			21.5 MHz to 30 MHz	Less than 2.5 μV	Less than 1.78 μV •2
			50 MHz to 54 MHz	———	Less than 1.58 μV •2
		FM (at 12 dB SINAD)	21.5 MHz to 30 MHz	Less than 0.35 μV	Less than 0.18 μV •2
			50 MHz to 54 MHz	———	Less than 0.18 μV •2
	Selectivity		LSB, USB, CW	−6 dB: 2.2 kHz, −60 dB: 4.4 kHz	
			AM	−6 dB: 6 kHz, −50 dB: 18 kHz	
			FM	−6 dB: 12 kHz, −50 dB: 25 kHz	
	Image ratio			More than 50 dB	
	1st IF rejection			More than 50 dB	
	IF SHIFT variable range			More than ±1.2 kHz	
	RIT variable range		10 Hz STEP	More than ±1.2 kHz	
			20 Hz STEP	More than ±2.5 kHz	
	Squelch sensitivity (FM)			Less than 0.32 μV	
	Output			1.5 W across 8 ohms load (10% distortion)	
	Output load impedance			8 ~ 16 ohms	

Fig. 2– Technical specifications of the Kenwood TS-140S. Additional notes are in the text.

The TS-140S's receiver is really hot. Whether you can work 'em or not, you can sure hear 'em . . . especially on 10 meters. Whew! The receiver's high gain (and everyone's unnecessary kilowatts) on lower frequencies tends to increase background and band noises, so the receiver's attenuator is most useful (yes, Virginia, there is a point of diminishing returns).

Since everyone wants to know if a new rig is a step up from their present transceiver, we *carefully* ran some "tee-connected/side-by-side comparisons." (I do not suggest trying this yourself. New rigs cycle through transmit if AC power is lost for a second, and the other rig's receiver is "RFed.") We tuned in the same DX stations on the same frequencies with the same antenna connected to the TS-140S, a TS-930S, an ICOM IC-761, and an IC-735. In 90 percent of the trials we could not hear one station on one transceiver that we could not copy on another rig. Special filters, tunable bandwidths, notches, etc., make some copy easier, true, but all modern/in-production transceivers are top performers.

Tee-connecting the TS-140S with an older transceiver like Drake's TR-4, however, was a different story. Many stations were indeed weaker and more difficult to copy on the vacuum-tube rig. Truthfully, however, it's all a matter of what you like. Regenerative receivers and TNT transmitters still work DX today just like they did 50 years ago. The operator, not the rig, makes the difference. Yes, indeed! Brother Dave "tells it like it is"!

The Memories and Their Use

The TS-140S sports 31 memories that are divided into three groups and selectable by the front panel's M/CH knob. Memories 0 through 9 are usual fixed-frequency types for storing your favorite operating spots. Memories 10 through 19 store separate transmit and receive frequencies for working 10 meter FM repeaters and split-frequency DXing. The TS-140S runs 50 watts output on 10 FM, incidentally, and 10 memories are more than sufficient for joining all the action.

Memories 20 through 30 include a clever tuning arrangement that's dandy for contesting or "superoperating" as discussed in my October 1987 *CQ* "World of Ideas" column. Each of these memories can be programmed with a desired range's upper and lower limits, various bands can be stacked in adjacent memories according to your preference, and then they can all be operated like separate VFOs. Memory 20 could be programmed with 14.000 to 14.070 MHz CW, for example; Memory 21 with 14.150 to 14.300 MHz SSB; Memory 22 with 28.600 to 28.700 MHz FM, etc. When a memory is tuned to its high limit, coverage "wraps around" to its lower limit, and you are ready to tune the band again. Set several memories to the same range, tune each to a different DX station, then switch between them with the M/CH knob for rapid-fire/retune as you work 'em DXing. They're great!

Circuitry Overview

As I have pointed out in previous *CQ* columns and reviews, overviewing a rig's block diagram is the most accurate and unbiased means of evaluation. Understanding that fact, let's step through the TS-140S diagram shown in fig. 3. The dotted lines indicate circuits on each PC board. The receiver is dual conversion with up-conversion: the first IF is 40.055 MHz, and the second IF is a nominal 455 kHz.

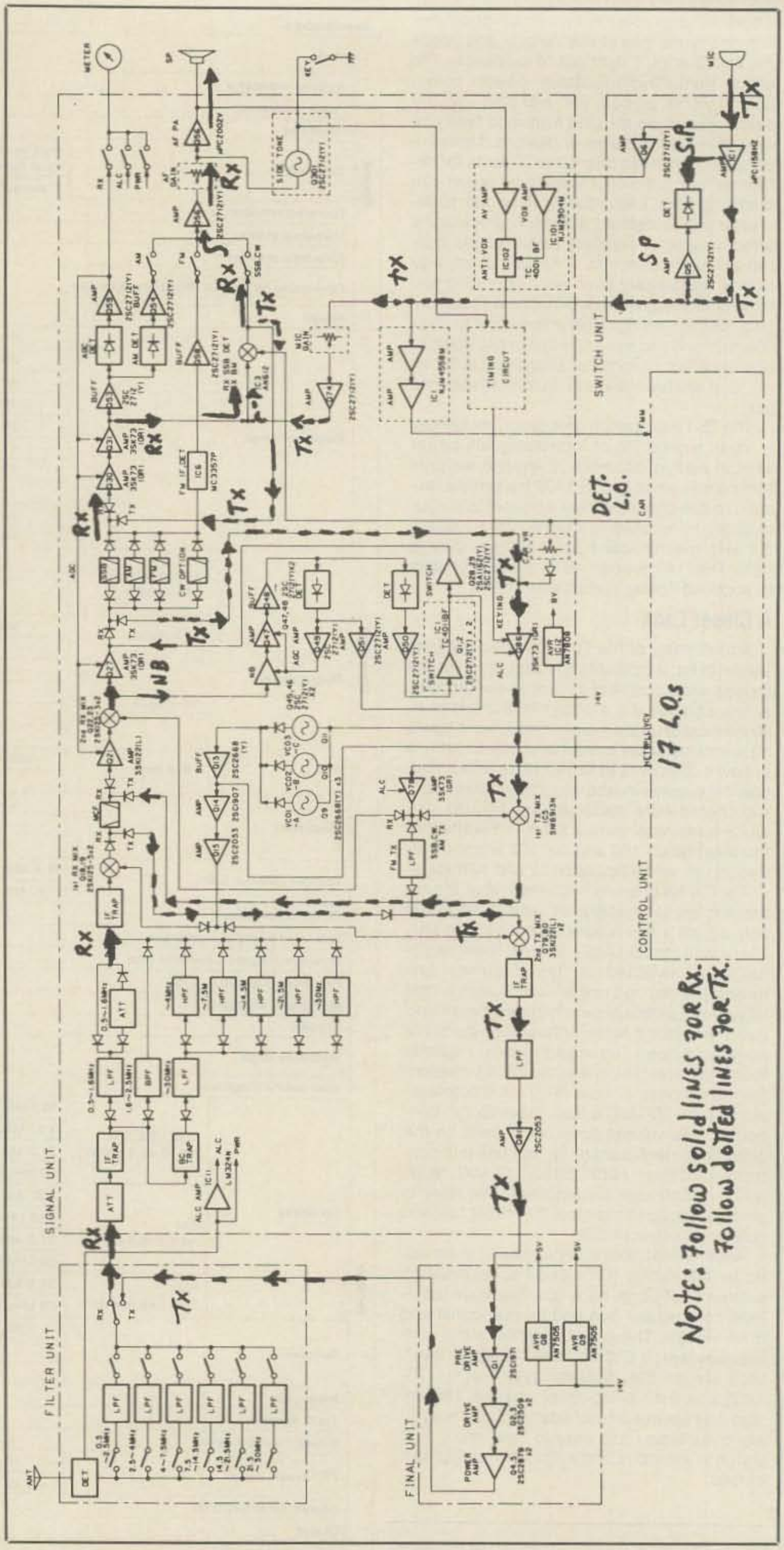


Fig. 3– Block diagram for the Kenwood TS-140S.

Numerous popular types of transistors are apparent in the receiver and transmitter. Digital tuning is used with the microprocessor controlling precise "divide by N" steps of four loops in the PLL, all of which are referenced to a master oscillator.

Starting at the block diagram's left top area, incoming signals from the antenna pass through low- and high-pass filters and into the balanced Direct Feed Mixer, Q18 and Q19. This is a very effective and popular design, typically responsible for the TS-140S's 102 dB dynamic range. The resultant 40 MHz converted signal passes through a monolithic crystal filter and on to the second balanced mixer, Q22 and Q23. The resultant 455 kHz signal from that low-noise mixer has two paths. One goes down to the noise blanker circuitry and switch and then returns to "gate off" IF amplifier Q27's output during noise pulses. The other path proceeds through Q27, an SSB/CW/FM or optional narrowband CW filter, and on to IF amplifiers Q30 and Q31. The inclusion of 3SK73 MOSFETS in IF stages and 2SK125s in mixers, incidentally, reflects the use of popular high-performance and time-proven devices. After clearing Q31, the signal proceeds through the SSB/CW detector/IC3 (AN612, a "new" device), on through Q56, and to the speaker.

During transmit, microphone-input audio is amplified by IC-1 (right bottom of block diagram) and then passed through the mike gain control to Q74 (Q5 was the speech processor). The signal proceeds through IC-3 (this chip is an SSB/CW heterodyne product detector on receive and an SSB balance modulator on transmit), which nulls its RF carrier. The output signal then passes through the 455 kHz SSB filter (exit one sideband) and on to Q86 (again, a popular 3SK73 device). The output signal is then upconverted to 40 MHz by IC-5, passed through the monolithic crystal filter, and directed to Q79 and Q80. This second mixer down-converts the signal to a desired amateur band signal, which in turn proceeds through Q81, Q1, Q2, and Q3 (drivers), Q4 and Q5 (the RF "final"), through a low-pass filter, and on to the antenna.

The section labeled "control unit" in the block diagram's bottom middle generates mixer heterodyning signals for frequency selection. Rotating the main tuning knob causes a behind-the-front-panel flywheel to break two LED beams. Phototransistors sense those interruptions, which are then encoded and passed to the microprocessor. That unit then sends "divide by any number/N" data to the PLLs. Through phase detectors, dividers, and VCOs, the resultant heterodyne/mixer injection signal is caused to change in 10 Hz (or 100 Hz or 1 MHz) increments and thus tune the transceiver.

All of the previously discussed TS-140S circuitry is contained on six internal circuit boards. Clever stacked assembly also allows one layer of circuit board to fold out (like opening a book) for internal servicing and adjustment.

Operating the TS-140S

The TS-140S is a stout little performer, and its small size makes it an ideal traveling companion. My XYL, Sandy, WB4OEE, and I use it at home, mobile, and portable during trips to the Gulf Coast. I like its "big rig frills" and Sandy likes its easy operation. After setting its recessed right-side controls, most activity can be handled with only three knobs. Careful adjustment of the mike gain and RF output are necessary, however, as they are quite sensitive and it's easy to overdrive the ALC. I must agree with Sandy about the '140S's good looks. It mentally adds 3 dBs to the rig's enjoyment.

Except for the previously mentioned "touchy controls," the only drawback I've noticed is lack of SWR metering. It's not always convenient to use my other rig for checking antennas. I really should not complain, however, as Kenwood is doing well selling this much transceiver at this low price. U.S. dollars have low value against Japanese yen, and the exchange rate continues to decrease.

Our first on-the-air QSOs netted many unsolicited reports of exceptionally good transmit audio, and the compliments continue today. The little rig just sounds good! Receiver audio is also excellent and full-bodied.

The IF shift is good for general operating, but serious CW enthusiasts will want to add the optional YG-455CN 250 Hz filter for big-time DXing. Another nice option is the HS-7 micro earphones. They are tiny in-the-ear jobs without a headband. You can roll them up and tuck them in a shirt pocket . . . even use just one for mobiling.

That wraps up my thoughts. Now let's get a second opinion.

Sandy's Opinions

The TS-140S is a big little rig, and I'm enjoying it almost as much as the diamond ring I could have selected instead. I've worked at least 20 new countries within the last few months, and that's on just 10 meters SSB. Most of my DX calls were also answered on the first try (and I have learned if I'm not answered on the second call to give up because *they* don't hear *me*). I have worked 48 states on 10 SSB and 40 CW with the rig (Georgia and Arkansas, where are you?). This is my first big experience in HF DXing and I love it. (OSCAR satellites are my favorite interest, however. Hopefully, we will have teamed our Ten-Tec converter with the '140S and be on Phase IIIC by the time you read this.)

The rig's noise blanker works great. It would be almost impossible to operate from my location most of the time because of power-line noises. The '140S's blanker lets most signals come through relatively clear.

Summary

Overall, we think Kenwood has another winner in their TS-140S. It is an economical rig that is as easy on your insurance premium as it is to operate, and it can easily form the center of a small, yet globe-spanning setup. Small-size transceivers are really enjoyable units. They may not have all the "mental clout" of big rigs, but they work DX the same way, and they fit into spaces where you can't fit a big rig. Overall, that means more fun time on the air, and that's what we all enjoy!

For more information on the TS-140S and its accessories, contact Trio-Kenwood Communications at 1111 West Walnut Street, Compton, CA 90220, or any of their nationwide dealers advertising in *CQ* magazine. CQ

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