

CQ REVIEWS:

The Kenwood TS-850S HF Transceiver

BY JOHN J. SCHULTZ*, W4FA

When I first looked at the TS-850S, I had the impression that Kenwood took a TS-940S and TS-440S, boiled them down together in a pot, added many of the new features from the TS-950S and a bit of "spice" to the brew, compacted the mixture, and then the TS-850S came out of the mold! The "spice" refers to a few features not even included in the TS-950S.

The size of the TS-850S is about 400 cubic inches more than the TS-440S and roughly that much less than the TS-940S. Its weight of 24 lbs. falls somewhat in between that of the 44 lbs. for the TS-940S and 14 lbs. for the TS-440S. The TS-850S is one of the neatest transceiver packages Kenwood has come out with to date. Considering that it replaces the venerable and popular TS-940S, Kenwood simply had to make the TS-850S something special.

Specifications

Well, a transceiver is just a transceiver, isn't it? No, not quite. Table I presents the specifications for a *basic* TS-850S—that is, performance that you could expect if you just purchased the basic transceiver without any of the various options available such as optional filters, digital processing, etc. The specifications show a transceiver with all modes, including FM, as standard, 100 memory channels, extremely good frequency stability, excellent spurious characteristics, good selectivity for all modes, 100 watts nominal output on CW/SSB, 100 kHz to 30 MHz general-coverage receive, etc. One can't discern from the specs all of the special features (bells and whistles, if you like) of the TS-850S, but all of the special features, of which there is an enormous amount, shouldn't overshadow the fact that the basic TS-850S is a very good basic transceiver.

Although I'll try to highlight some of the main features of the TS-850S as we go along, let's take a quantum leap forward just for the fun of it.



Kenwood's TS-850S HF transceiver.

On most state-of-the-art transceivers such as the TS-850S manipulations of the front-panel controls can select various features. But then there are the variations or *modifications* to the front-panel-selectable features to even more closely suit individual operator preferences. What to do to provide an operator the opportunity for what amounts usually to a one-time preferred setting of these modifications? The usual solution is to instruct the operator to hold down some front-panel keys while the main power switch is toggled from off to on. The TS-850S has a far neater solution. The feature to be modified is called up according to a displayed number. Then the desired *modification* is made.

A brief look at the modification list for the TS-850S provides an insight into the enormous number of features built into the transceiver. Table II provides such a listing. There's no need to cover every feature, but you can see that the listing is very, very comprehensive. You can modify everything from VFO frequency steps, to the 10 Hz frequency display resolution, to the FSK shift range, RIT/XIT range, frequency display for VHF/UHF transverters, recording times for an optional digital record/playback unit, etc.

One of the handiest modifications I like is No. 03 in the table. It means that the VFO, besides being continuously tun-

able, can also be stepped in 1, 5, or 10 kHz steps. Setting up the control on the radio for 5 kHz is extremely handy for SWL purposes. Another nice touch is that the RIT/XIT range, No. 17 in the table, can be modified. They are illustrations of some of the "spice" I referred to earlier.

Don't get confused by the foregoing if you have not had much exposure to the latest generation of transceivers. The TS-850S has an enormous array of features selectable "up front" by front-panel controls. I was only talking about *modifications* possible to those features for readers who might appreciate the sophistication involved. Now let's get back to a more conventional look at the TS-850S.

Operating the TS-850S

If we could sit down together and discuss the TS-850S, we would certainly have to turn it on and exercise some of the front-panel controls. However, I think we can accomplish something useful by taking a look at the front-panel layout, as presented in fig. 1, and just discussing some of the main control functions. It presents a very good insight into the capabilities and operating conveniences provided. When videotapes at 50 cents each replace magazines just think of the fun we'll have, but in the meantime. . . . Fig. 1

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| IC-228A/H FM | 9.00 | Call \$ |
| IC-28A/HT | 9.00 | Call \$ |
| IC-2GAT 2m | 9.00 | Call \$ |
| IC-900 SFA | 9.00 | Call \$ |
| IC-3S AT 22 | 9.00 | Call \$ |
| IC-2S AT 2M | 9.00 | Call \$ |
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CIRCLE 123 ON READER SERVICE CARD

| Specifications | | Model | TS-850S | | | |
|---|--|--|----------------------|------------------|--------|------|
| General | Mode | J3E(LSB, USB), A1A(CW), A3E(AM), F3E(FM), F1A(FSK) | | | | |
| | Memory Channels | 100 | | | | |
| | Antenna impedance | 50 ohms With AT-850 Antenna Tuner 20~150 ohms | | | | |
| | Power requirement | 12 to 16 VDC (13.8 VDC reference) | | | | |
| | Grounding | Negative | | | | |
| | Current drain | Receive mode with no input signal | 2A | | | |
| | | Transmit mode | 20.5A | | | |
| | Operating temperature | -10°C to +50°C (+14°F to +122°F) | | | | |
| | Frequency stability | Less than ±10 PPM | | | | |
| | Frequency accuracy | Less than ±10 PPM | | | | |
| | Dimensions [W×H×D] (Projections included) | 339×135×375mm (13-11/32"×5-5/16"×14-3/4") | | | | |
| | Weight | With AT unit | 10.9kg (24lbs) | | | |
| | | Without AT unit | 9.4kg (20.7lbs) | | | |
| Transmitter | Frequency range | 160m band | 1.8 | to | 2.0 | MHz |
| | | 80m band | 3.5 | to | 4.0 | MHz |
| | | 40m band | 7.0 | to | 7.3 | MHz |
| | | 30m band | 10.1 | to | 10.15 | MHz |
| | | 20m band | 14.0 | to | 14.35 | MHz |
| | | 17m band | 18.068 | to | 18.168 | MHz |
| | | 15m band | 21.0 | to | 21.45 | MHz |
| | | 12m band | 24.89 | to | 24.99 | MHz |
| | | 10m band | 28.0 | to | 29.7 | MHz |
| | | Output power | 1.9~24.5MHz | SSB, CW, FSK, FM | MAX | 100W |
| MIN | 20W | | | | | |
| AM | MAX | | | 40W | | |
| | MIN | | | 10W | | |
| 28MHz | SSB, CW, FSK, FM | | MAX | 100W | | |
| | | | MIN | 20W | | |
| | AM | | MAX | 40W | | |
| | | | MIN | 10W | | |
| Modulation | SSB | | Balanced modulation | | | |
| | FM | | Reactance modulation | | | |
| | AM | | Low level modulation | | | |
| Spurious radiation | | Less than -60dB | | | | |
| Carrier suppression (with 1.5kHz reference) | | More than 40dB | | | | |

Table 1—Specifications for a basic Kenwood TS-850S.

shows the front panel broken down into fields. The "P" numbers refer to pages in the TS-850S's instruction manual where the controls in each field are explained in detail.

Just taking an overview of the controls, particularly the rotary ones, you can see some of the features. A keyer is built-in and its speed and also the weighting can be varied (between about a 1:2.5 and 1:4 dot-dash ratio). Sidetone monitoring is available with adjustable level in the SSB and FSK modes. RF speech processing is built-in. The controls in the P12 and P15 fields are generally self-explanatory. Note the neat idea that noise blanker 1 has a variable level control, while noise blanker 2 has a variable blanking pulse

width control. The tone control refers to the received audio. A separate "High Boost" switch in field P10 influences the transmit audio. Fortunately, Kenwood retained in the TS-850S their very effective slope tune feature (lower right corner of field P15). It's an extremely useful anti-QRM device especially if various of the optional IF filters are not installed. For just casual CW operation, for instance, it obviates the need for an optional CW filter, although dedicated CW fans will still appreciate the steeper skirts possible with a narrow filter.

Let's take a look at field P13, since it has a lot of interesting features. The meter switch toggles through the bargraph meter displays for transmit—SWR, ALC,

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WARNING

Don't be fooled by antennas that are also sold with a windom label. Most of them use a 1:4 balun. That balun will never work. You'll always need a tuner with those fake windoms. The laws of physics make sure that it doesn't work, despite what the manufacturer promises you. Honestly, why buy an antenna that needs a tuner to operate?

Here's Proof

Read what our satisfied customers wrote us about their genuine Garant Windom Antennas. All originals are on file for your inspection, as the FTC requires it. Fred, W8YFK: "I purchased one of your GD-9/2KW antennas. It works great. Nine bands, no external tuner. Who could ask for anything more?" Howard, W3HM: on his GD-9/2KW: "Service was fast. The antenna is first class. It does all it was advertised to do. Now, I have one antenna, one feedline and all (9) HF amateur bands for the first time in 27 years of hamming. The xyl likes that too." John, KA3SDQ on his GD-8/500W: "Prompt delivery, helpful phone ordering and information, combined with a quality product. Garant truly has an unbeatable combination." Don, N01GE: "I am very pleased with the shipping speed, service and the GD-8/500W antenna. This is my only antenna for 10 to 80 meters. What a great performing antenna. I am very pleased." John, W0HBE: "I was extremely anxious to put my new GD-8/500W on the air. The instructions make the assembly fast and simple. I was impressed by the low SWR on all bands and comparison tests have proved to me that the Garant GD-8 windom is far superior to any other wire antenna." Paul, N1PL, on his GD-8/500W: "The antenna is dynamite on 20 meters." Charles, W9JLZ: "Garant GD-8/500W antenna performs very well on all bands. Great antenna. Get great signal reports." Michael, N8BED: "Order received promptly as promised. GD-8/500W works as promised, using your measurements. No trimming required." Herbert, WD9GBH: "My GD-9/500W works fine. Great multi-band antenna." For more letters with genuine call signs see our free data report.

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CIRCLE 94 ON READER SERVICE CARD

| Specifications | | Model | TS-850S |
|---|--------------------------------|---------------------------|---|
| Unwanted sideband suppression (with 1.5kHz reference) | | | More than 40dB |
| Maximum frequency deviation (FM) | | | Less than ± 5 kHz |
| Frequency response (-6 dB) | | | 400 to 2600Hz |
| XIT variable range | 10 Hz step | | More than ± 1.2 kHz |
| | 20 Hz step | | More than ± 2.4 kHz |
| Microphone impedance | | | 600 Ω |
| Circuitry | | | Triple conversion superheterodyne |
| Frequency range | | | 100kHz to 30MHz |
| Intermediate frequency | | | 1st : 73.05MHz, 2nd : 8.83MHz, 3rd : 455kHz |
| Sensitivity | SSB, CW, FSK (at 10dB S + N/N) | 100kHz~500kHz | Less than 0.2 μ V |
| | | 500kHz~1.62MHz* | Less than 4 μ V |
| | | *1.62MHz~24.5MHz | Less than 0.2 μ V |
| | | 24.5MHz~30MHz | Less than 0.13 μ V |
| | AM (at 10dB S + N/N) | 100kHz~500kHz | Less than 2 μ V |
| | | 500kHz~1.62MHz* | Less than 32 μ V |
| | | *1.62MHz~24.5MHz | Less than 2 μ V |
| | | 24.5MHz~30MHz | Less than 1.3 μ V |
| FM (at 12dB SINAD) | 28MHz~30MHz | Less than 0.25 μ V | |
| Selectivity | SSB, CW, FSK | -6dB:2.4kHz, -60dB:3.8kHz | |
| | AM | -6dB:6kHz, -60dB:15kHz | |
| | FM | -6dB:12kHz, -60dB:24kHz | |
| Image ratio | | | More than 80dB |
| 1st IF rejection | | | More than 80dB |
| Notch filter attenuation | | | More than 40dB |
| RIT variable range | 10 Hz step | | More than ± 1.2 kHz |
| | 20 Hz step | | More than ± 2.4 kHz |
| Squelch sensitivity | SSB, CW, FSK, AM | 100kHz~500kHz | Less than 2 μ V |
| | | 500kHz~1.62MHz* | Less than 20 μ V |
| | | *1.62MHz~30MHz | Less than 2 μ V |
| | FM | 28MHz~30MHz | Less than 0.25 μ V |
| Output | | | 1.5W across 8 ohms load (10% distortion) |
| Output load impedance | | | 8 ohms |

and Compression. Separate bargraph displays remain dedicated to an S-meter scale on receive and a power output scale on transmit. It's almost the same as the excellent bargraph meter display used on the TS-950S. The two filter switches allow independent selection of any of the 8.83 MHz and 455 kHz filters in any mode (except FM where only 6 and 12 kHz bandwidths for the 455 kHz IF can be chosen). The filter selection last used is memorized for the mode used and also the VFO used for the last band used. The filters used are displayed in a field above the switches. There is, however, no separate display for the optional 1.8 kHz SSB filter if it is installed. Since it fits into one of the slots reserved for the optional 500

or 270 Hz 8.83 MHz CW filters, you'll have to remember that when 500 or 270 illuminates, it represents the narrow SSB filter.

The numeric keys allow for direct keypad entry of any frequency into either of the two VFOs or into any memory channel (which can also be chosen by numeric entry). However, notice that the numeric keys have a notation above them for the dual purpose that they serve. The 1 through 6 keys have the secondary function of controlling the optional DRU-2 digital recording unit. This unit can be used to record CW or voice messages (from the built-in keyer or station microphone) and then play them back for transmit. Three record/playback segments are available—8, 8, and 16 seconds (unless

Several of the functions of this transceiver can be changed at the time the transceiver is turned ON. Repeat to release each function.

1. Press and hold the LSB/USB key while you turn on the POWER switch.
2. A number will appear in the display.
3. Select the desired number by rotating the M.CH/VFO CH control.
4. Change the function by pressing the UP/DOWN switch.
5. Function selection can be turned off by pressing the CLR key, or by pressing the POWER switch OFF and back ON.

| No. | Programmable functions | Initial state |
|-----|--|---------------|
| 00 | Beep tones: ON/OFF | ON |
| 01 | Audible mode announcement: ON(Morse code)/OFF(Beep tones) | ON |
| 02 | Audible alarm: ON(Morse code)/OFF(Beep tones) | ON |
| 03 | M.CH/VFO CH control step frequency selection: 10 kHz/5 kHz/1 kHz | 10 kHz |
| 04 | M.CH/VFO CH control step frequency selection: 10 kHz/9 kHz (AM mode only) | 10 kHz |
| 05 | TUNING knob step frequency selection: 100 Hz/10 Hz (AM and FM mode only) (Except the FINE function is ON.) | 100 Hz |
| 06 | UP/DOWN switch step frequency selection: 1000 kHz/500 kHz/1 kHz (When 1 MHz key is ON.) | 1000 kHz |
| 07 | 10 Hz display resolution: ON/OFF | ON |
| 08 | SSB AUTO mode shift: ON/OFF | ON |
| 09 | Meter peak hold: ON/OFF | OFF |

| No. | Programmable functions | Initial state |
|-----|--|---------------|
| 10 | Automatically increments the memory channel data time each time you enter a frequency into memory. | OFF |
| 11 | FSK transmission key short : OFF(SPACE)/ON(MARK) | OFF |
| 12 | The shift range of the FSK mode can be set to 170, 200, 425, or 850 Hz by using the UP/DOWN switch. | 170 Hz |
| 13 | You can switch between FSK mode receive tones high (2125 Hz) and low (1275 Hz). | 2125 Hz |
| 14 | Program scan hold: ON/OFF | OFF |
| 15 | Storing the band frequency before the UP/DOWN switch is pressed : Required(ON)/Not required(OFF) | ON |
| 16 | Determine whether to change the frequency with the tuning knob (ON) or not (OFF) when the standard memory channel is recalled to RX VFO. | OFF |
| 17 | RIT/XIT variable range : 1.27 kHz/2.54 kHz | 1.27 kHz |
| 18 | Select the sub tones | 88.5 Hz |
| 19 | Sub tones : b(Tone burst)/c(Continuous tones) | c |
| 20 | Antenna Tuner : ON(AUTO)/OFF(MANUAL) (When the SW 1 switch is INT.) | ON |
| 21 | Auto weight function : ON/OFF (When the ELECTRONIC KEY switch is ON.) | ON |
| 22 | Reverse mode: ON/OFF (When Auto weight function is ON.) | OFF |

| No. | Programmable functions | Initial state |
|-----|---|---------------|
| 23 | Select the Manual weight (When Auto weight function is OFF.) | 3.0 |
| 24 | Bug key: ON(Used)/OFF(Not used) (When the ELECTRONIC KEY switch is ON.) | OFF |
| 25 | When split is selected, the temporary display of the transmit frequency can be turned on and off. | ON |
| 26 | Display for the 50 MHz converter : ON/OFF | OFF |
| 27 | Display for the 144 MHz converter : ON/OFF | OFF |
| 28 | Display for the 430 MHz converter : ON/OFF | OFF |
| 29 | Change the REC 1 recording time to 8 or 16 seconds. (When optional DRU-2 is installed) | 8 seconds |
| 30 | Change the REC 2 recording time to 8 or 16 seconds. (When optional DRU-2 is installed) | 8 seconds |
| 31 | Change the REC 3 recording time to 16 or 32 seconds. (When optional DRU-2 is installed) | 16 seconds |
| 32 | Transfer function when two TS-850 are connected : ON/OFF | OFF |
| 33 | Turn on and off direct writing into VFO by the transfer function when two TS-850 are connected. | OFF |
| 34 | The IF and AF circuits of this transceiver can be switched off (mute mode) so the transceiver will not transmit even if the standby terminal is grounded. | OFF |

Table II- Optional function selections for the TS-850S.

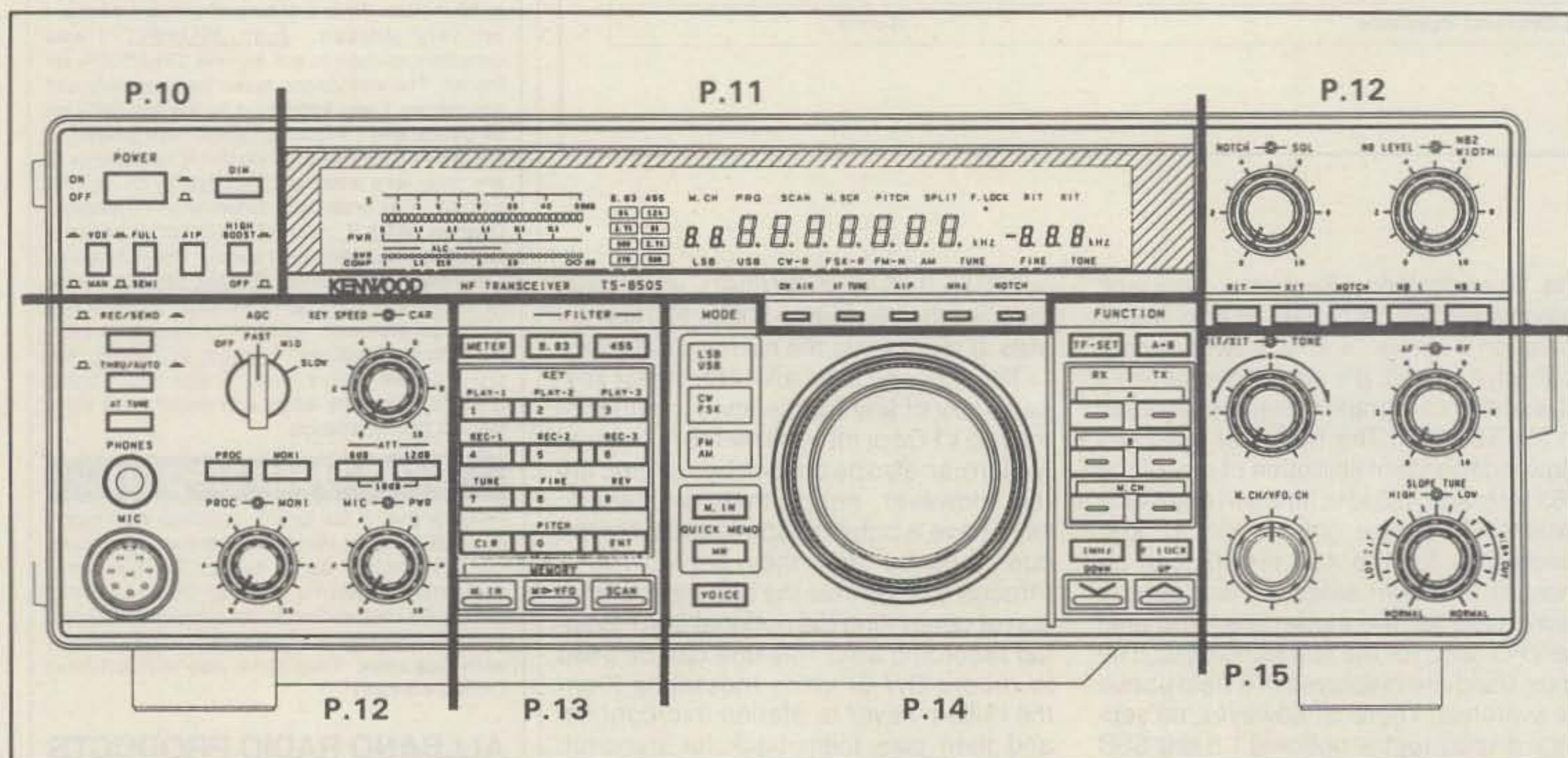
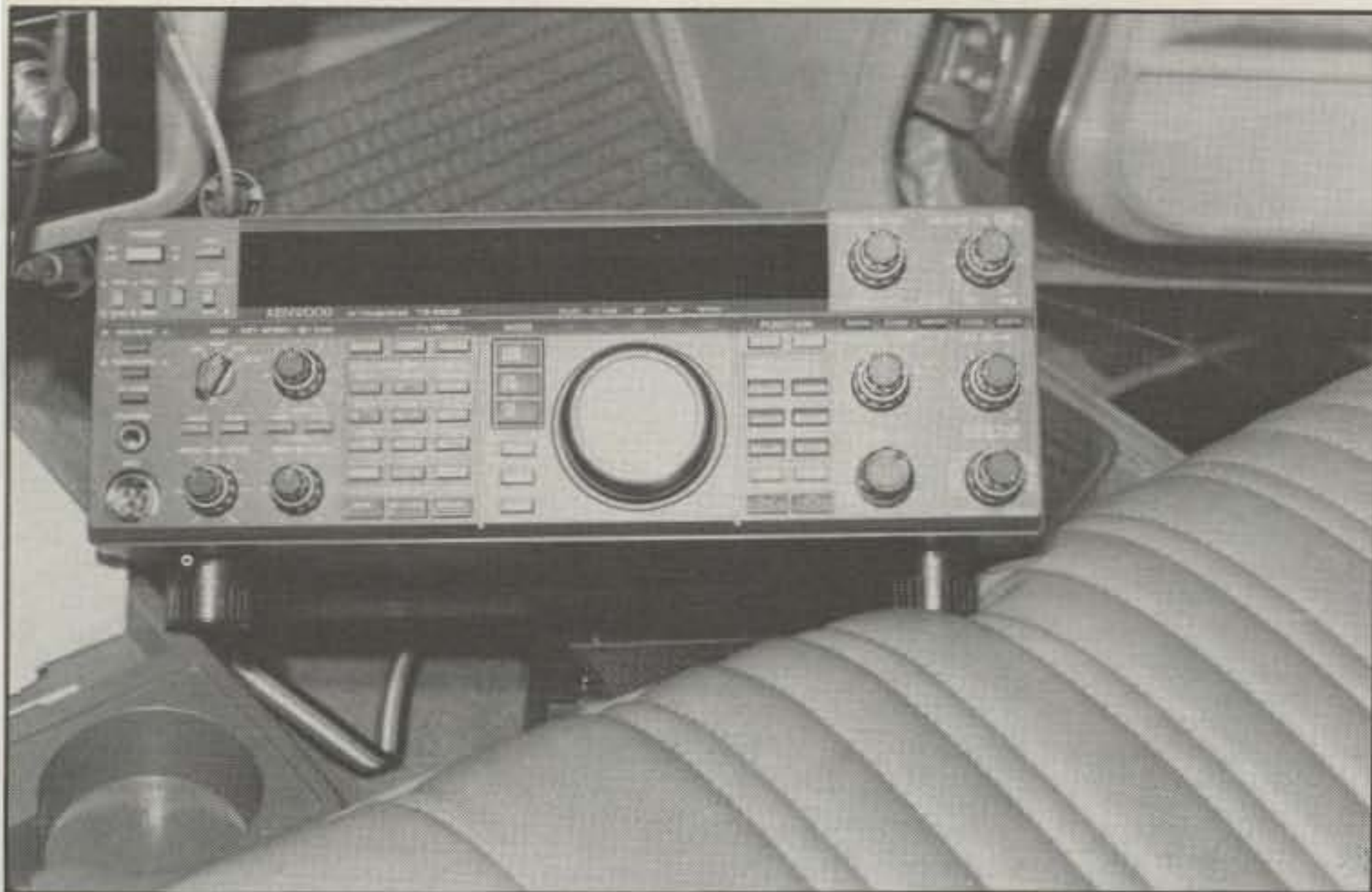


Fig. 1- Front-panel-control layout. "P" numbers refer to instruction- book pages, but are used in the text for reference purposes.



Here is the TS-850S wedged in the front seat of the author's car in a quasi-mobile installation. It does illustrate the point that the intermediate size of the transceiver makes it quite suitable for base-station or portable/mobile use.

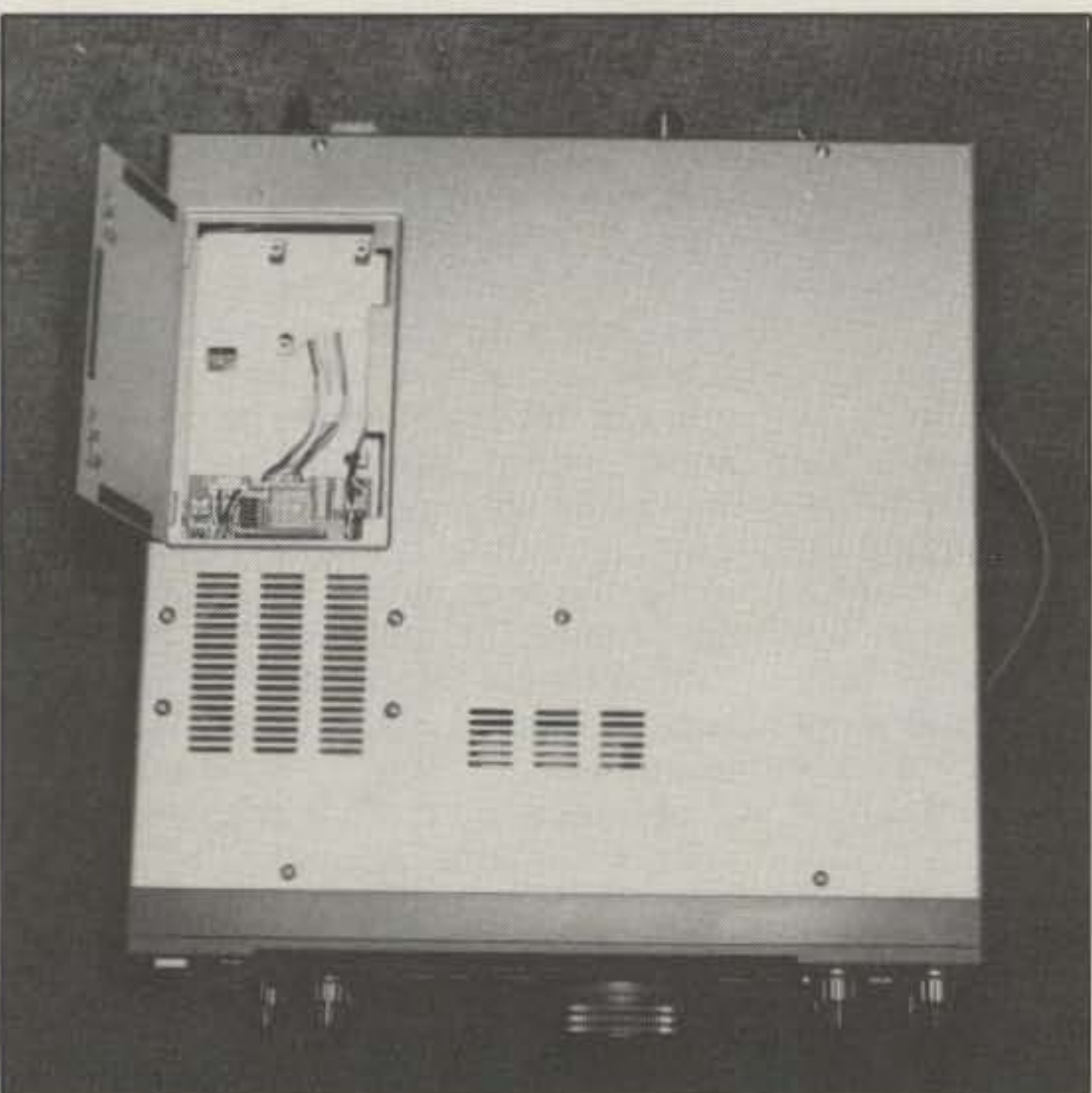
modified). The segments can be used individually or combined for maximum length. The number 7 key also has a "tune" function. In the SSB mode it reduces the power output by roughly half to facilitate tuning a linear amplifier. In the CW mode it is used to zero beat a received signal. The numeric 8 key also activates a fine-tune function. The normal tuning rate (10 kHz per tuning knob revolution for SSB/CW/FSK and 50 kHz for AM/FM) is changed to 1 kHz. The numeric

9 key is also associated with a reverse function for changing the sideband used for both reception and transmission on CW and FSK. The numeric 0 key is associated with a very neat pitch function. By using this key in conjunction with the M. CH/VFO. CH control any CW pitch from 400 to 1000 Hz can be selected in 50 Hz steps. The frequency display field displays the pitch frequency. The sidetone frequency tracks along.

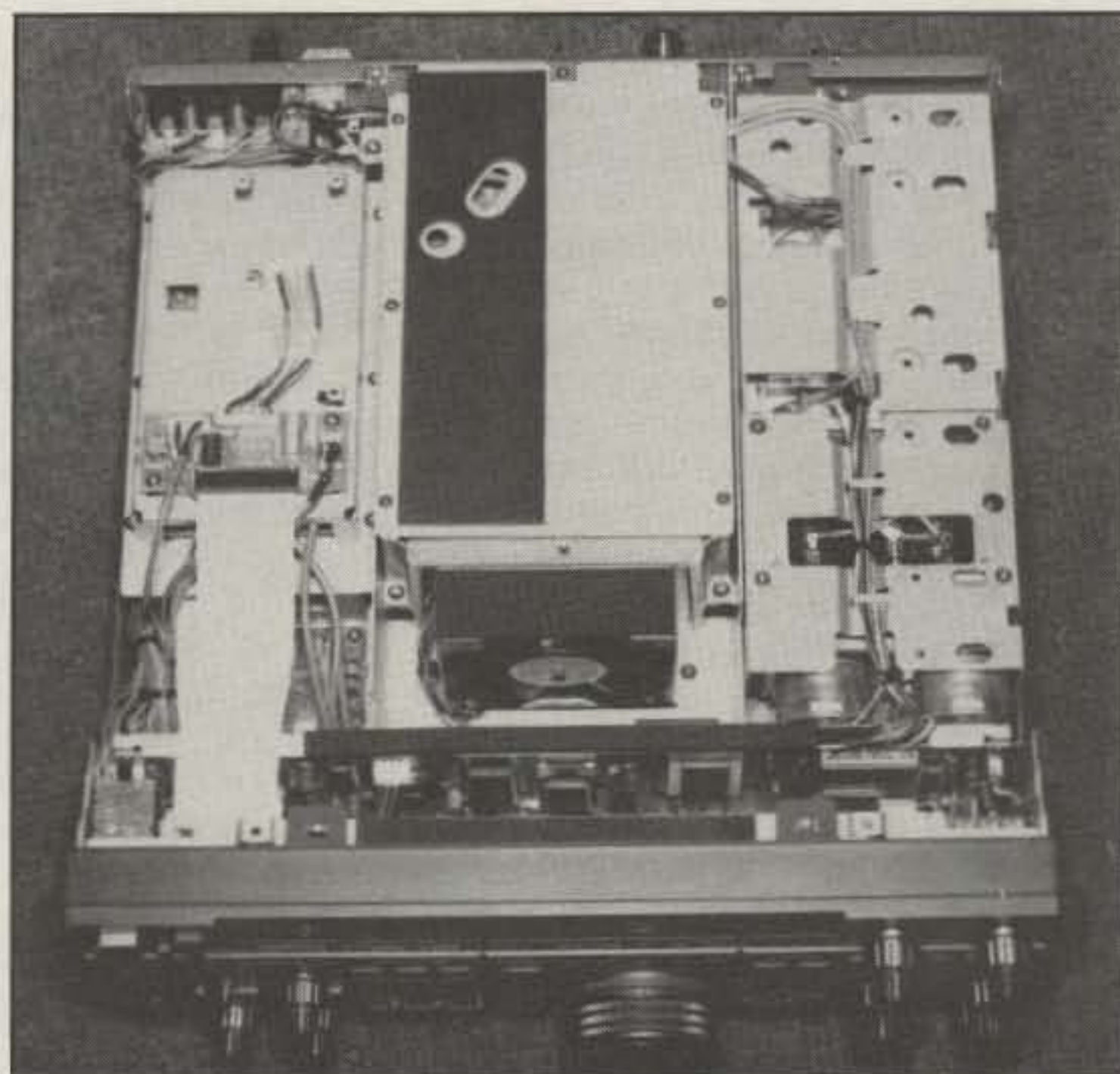
The rest of the keys are associated

with the pretty much routine functions of getting frequencies into a memory channel, or VFO, transferring data from memory to a VFO, and initiating a scan mode. Several scan modes are possible: memory channel scan (with lockout of undesired channels), group scan (memory channels 00 to 09, 10 to 19, etc.), and programmable band scan (memory channels 90 to 99 only). Each of the last ten memory channels can be programmed with individual high and low frequency scan limits. You can scan from 30.0 kHz to 30.0 MHz, if desired, and the mode and filter can be changed during scan. The scan speed is front-panel adjustable from about 20 to 700 Hz/second.

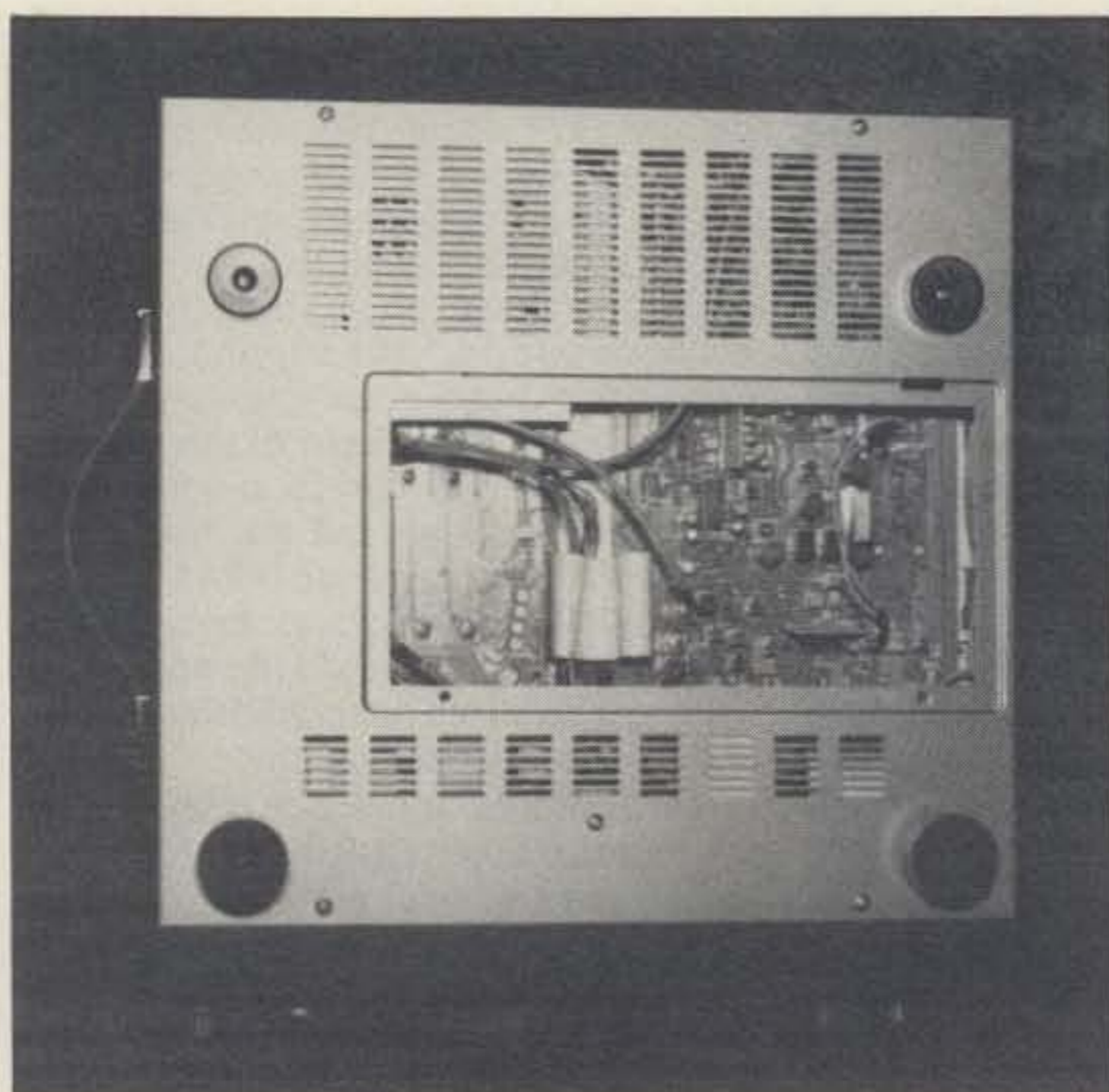
Taking a look at the field marked P14, the button marked **QUICK MEMO** immediately catches your attention. Actually, there are five stacked quick-memory channels. Each one stores *everything*—receive/transmit frequencies, modes, filters, AIP on/off, fine-tune on/off, meter selection, etc., etc. The memories are stacked in the sense that every time the **M. IN** key is depressed for a given transceiver setup, the last entry goes into memory channel 1, the data that was in 1 moves to 2, etc., and the data in 5 is lost. To recall a quick memory, **MR** is depressed and the **M. CH/VFO. CH** control rotated to the desired channel number on the display. I suppose if you are fast enough and the nets are slow-going, it would be possible to participate in almost five nets simultaneously. Of course, that's an exaggeration, but the quick memo function is the quickest way to switch among preselected operating fre-



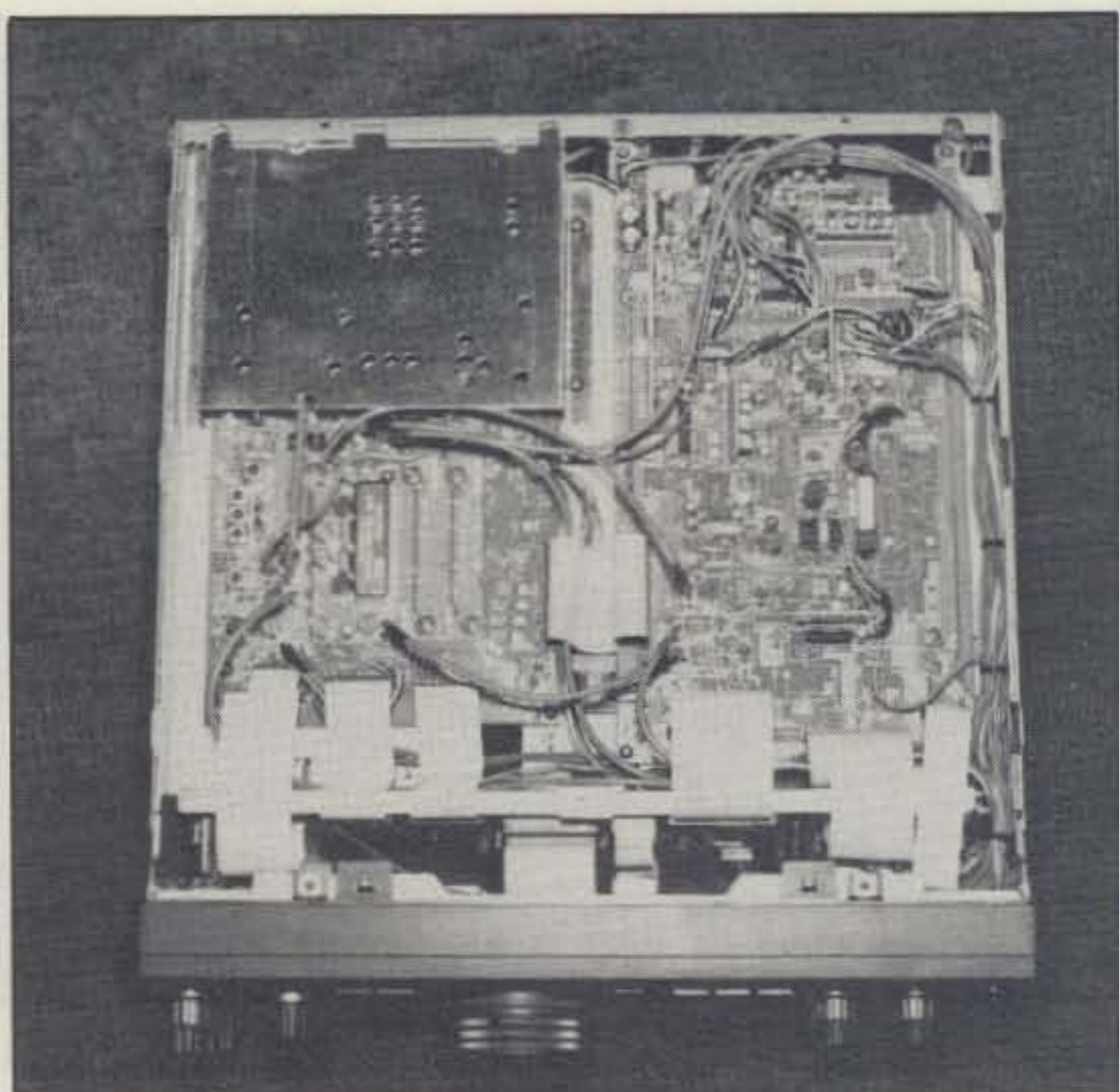
A latch cover on the top of the transceiver allows the insertion of the DRU-2 digital recorder option.



Taking off the top cover completely you can see the power amplifier/fan assembly in the middle and the automatic antenna tuner to the front right. The fan is exceptionally quiet.



Here is a nice surprise looking at the bottom of the TS-850S. A separate cover, held in place by two screws, can be removed if you want to plug in any of the optional IF filters. Space for two filters is to the left, and space for another is at the far right.



Taking off the bottom cover completely, you can see two of the large PC boards for the RF and IF sections. It is quite easy to access almost all of the circuitry in the TS-850S.

quencies. The only delay when switching between channels is due to the second or two it takes the automatic antenna tuner, if installed, to reset. Each recalled channel is immediately "tunable," since the memo data is transferred to a VFO automatically as the **M. CH/VFO. CH** control is rotated.

The rest of the controls are straightforward. The VFO system is the conventional VFO A/B one. Either VFO can be used as the receive or transmit VFO, and either can be set to any frequency within the range of the TS-850S. Data can be transferred from either VFO to a conventional memory channel. Data has to be transferred from a memory channel to a VFO to make that memory channel "tunable." That is, that's the way the radio operates when you receive it! If procedure No. 16 in Table II is executed, *surprise of surprises*, all the memory channels become tunable except for some channels in the 90-99 group which have dual frequency data stored in them. If a recalled memory channel is within an amateur band, it can be used immediately for transmit purposes. Why in the world Kenwood didn't immediately make apparent that the radio has 90-plus tunable memories sort of mystifies me.

The **DOWN** and **UP** switches function as a bandswitch and toggle through the various amateur bands unless the **1 MHz** switch is also used. In that case, the frequency increments in 1 MHz steps. The transceiver does return to the last frequency setup used on a given band even

though VFO A or B might be retuned when switching to another band.

Field P11 shows the frequency/meter/annunciator displays. The display looks a bit "crowded," but in fact, it is quite clear, since only a few displays are active at one time and multiple colors are used.

Test Results

I did some bench checks on the TS-850S, but not really extensive ones, since much of the circuitry in the TS-850S comes from other Kenwood transceivers and I didn't expect any surprises. There weren't any, as confirmed by later operating experiences.

The mundane specifications such as those for power output, spurious responses, etc., were all easily met. The front end is not noise limited, and the dynamic range slightly exceeds 112 dB using the unity gain RF preamplifier (AIP on)! It's a good, "stiff" front end with strong signal-handling capabilities such that the "weak ones" can be pulled out easily even in a crowded band. The automatic antenna tuner is only rated to handle SWRs of up to 2.5:1, but I found it could easily handle SWRs of up to 5:1 if the reactive part of the load is not too great (e.g., don't use it with an end-fed wire which is $\frac{1}{2}$ wavelength long on a given band). The automatic-tuning power level is set at 10 watts, so it is unlikely that any harm would be done to the tuner even if you tried to test match an unknown load.

On-The-Air Results

Most amateurs aren't really too concerned about a transceiver's specifications. They just want to get on the air. Well, I think first understanding a bit about the makeup of a radio makes it all that more fun when you get it on the air. However, be that as it may, the TS-850S is a fun rig to operate. Since it uses the conventional VFO A/B system, there is no confusion factor there. To use the keypad for frequency entry to either selected VFO, press the **ENT** key followed by the frequency numbers, followed again by the **ENT**. No confusion there. To get that frequency into memory, press **M. IN**, choose a memory channel, and then press **M. IN** again. Again, no confusion, and on it goes. I found the frequency selection/memory system in the TS-850S extremely straightforward to use. All the rest of the controls are clear and easy to use. I think CW buffs will find the fine-tuning rate of 1 kHz per tuning knob revolution combined with a sharp CW filter a joy to use.

SSB received audio is crisp and clear using the internal speaker. The receive tone control is of marginal use. When listening to noise you can hear the effect of the control, but it's far less dramatic when listening to a station, since so many stations on SSB tend to have a bit of "shaped" audio. The Slope Tune feature in conjunction with the notch filter provides excellent results against QRM.

However, I think anyone who does a lot of SSB contest operating would benefit from the optional 1.8 kHz SSB filter.

On the transmit side, excellent reports were received on SSB, especially when using the speech processor. In fact, I loaned the radio to Doc, KM4ZA, for a "second opinion." One of his first contacts was with a YO station who said that Doc using the TS-850S with the RF processor active had the best audio he had ever heard from a Stateside station. Almost all stations asked indicated that they preferred the audio with the "High Boost" active. The boost effect is achieved by switching in a capacitor across one of the emitter resistors in a microphone pre-amplifier stage, thus providing a boost in gain for the higher audio frequencies. It's a gradually sloping increase in gain rather than the more peaked response provided by an equalizer stage. Nonetheless, it's a very nice touch. The bargraph-type meter makes adjustment of the controls for ALC range and speech-processor compression very easy indeed. The different colors used in the bargraph display as well as in the main display (three colors in all) are very helpful for clarity.

The CW keyer functions very smoothly over a range of a few WPM to 30-plus WPM. The full break-in feature seemed to also function smoothly over the same range. Some light relay clicking can be heard, but it poses absolutely no problem. The built-in cooling fan is very quiet and remains so even after long operating periods.

The Manual

Two separate manuals are supplied with the TS-850S. One is an instruction manu-

al and the other is the "External Control Instruction Manual." An optional IF-232C interface is needed for use with a PC. The function list for PC control is shown in fig. 2.

Both manuals are very nicely organized and contain a profusion of illustrations and tables. The basic instruction manual, for instance, has very easy-to-understand setup illustrations for various modes (SSB, CW, etc.). Even if the TS-

- Function list
- AUTO INFORMATION ON/OFF setting
 - Same function as microphone UP/DOWN switch
 - VFO A, VFO B and memory frequency selection and readout
 - Filter setting
 - VFO A, VFO B and memory frequency TX/RX setting
 - Model No. readout for transceiver recognition
 - Display of transceiver's current condition
 - F.LOCK ON/OFF setting and display
 - Memory channel setting
 - Mode setting
 - Memory display
 - Memory entry
 - AIP switch ON/OFF setting
 - PITCH setting
 - RIT/XIT frequency clearance
 - RIT/XIT frequency UP/DOWN
 - METER key setting
 - RIT ON/OFF setting
 - RX : For receive operation, TX : For transmit operation
 - Scan ON/OFF setting
 - Slope tune band setting and readout
 - Meter signal output
 - Sub-tone frequency setting
 - Generation of synthesized voice
 - XIT ON/OFF setting

Fig. 2- Function list for control of the TS-850S using a personal computer. A separate manual supplied with the TS-850S completely describes the computer control interface.

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A look at the rear panel. It looks uncluttered, but it can accommodate an enormous amount of external connections ranging all the way from those necessary to control a linear to TNCs. That interesting little automobile-type fuse labeled "FUSE 3A" had me confused for a while. It's a separate fuse for a remote automatic antenna tuner (AT-300) which can be controlled by the TS-850S.

850S is your first transceiver, it should be easy enough to get it into operation. You can then ease into learning the more sophisticated manipulative features of the transceiver as time allows.

Although the concept and format of the instruction manual is excellent, a few translation tongue-twisters did find their way into the manual. "Select the meter indicate" and "the PROC switch is ON when the SSB mode" are examples. One can sort out the meaning of the sentences when read in the context of the instruc-

tions. However, the excellent technical quality of the transceiver is not quite matched by the quality of the literature that describes it.

Accessories

The TS-850S can be used with the whole line of Kenwood accessory items, including the new SM-230 Station Monitor. Some items such as the SM-230, various optional IF filters, VS-2 Voice Synthesizer, SO-2 TCXO, IF-232C Interface, etc.,

are all available on the market. However, some accessory items such as the PS-52 Power Supply, DRU-2 Digital Recording Unit, DSP-100 Digital Signal Processor, and AT-300 Remote Automatic Antenna Tuner were developed just for the TS-850S. The radio has instantly become so popular that the accessory items were not available at the time of this writing. Some of them, at least, will be covered in a follow-up article.

Summary

HF transceivers have come a long, long way in the last decade or so. They have become increasingly packed with features and a maze of operating controls and indicators that would seem to rival those on a small jetliner. The new transceivers do perform, however, and are a lot of fun to operate. In the background all of the major manufacturers seem to have realized that until we get into a new age of spoken-command-driven equipment, those HF transceiver front-panels have to strike some balance between quickly learnable ease of basic operation and access to the more sophisticated "bells and whistles" functions.

If there were a Golden-Mean award, I'd give it to the TS-850S. Electrically, the unit has about every feature you would ever need. On the receive side there are plenty of selectivity features. On the transmit side the processor, monitor, and audio high boost all make for interesting SSB, while I think CW buffs have been well treated with semi/full break-in, selectable pitch, and a built-in keyer with adjustable weight. The frequency-manipulation possibilities are not quite as enormous as on a TS-950S, but hey are enormous enough, I would think, to satisfy most operators' needs and then some. Mechanically the unit also has very excellent "balance." The most-often-used controls are large in size and operate very smoothly. All the controls are up-front except for seldom-adjusted ones associated with the VOX feature. On the debit side I would cite the odd omission of an "in-use" indicator for the optional 1.8 kHz filter, since it is bound to be a popular option. I would also like to see some display-field prompting for things like setting the scan modes.

No one HF transceiver is ever going to be perfect, I hope, or I won't be able to have fun continuing to write reviews. But on a features-to-price ratio I'd rate the basic TS-850S as being a value par excellence. One should not regard it as a junior version of the TS-950S nor a modified version of the discontinued TS-940S. It can well stand on its own as a full-fledged HF transceiver.

The TS-850S is priced at \$1900 and is manufactured by Kenwood U.S.A., P.O. Box 22745, Long Beach, CA 90801-5745.

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