Product Review Column from *QST* Magazine

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Product Review

Conducted By Paul K. Pagel,* N1FB

Kenwood TR-7800 2-Meter FM Transceiver

At first glance, one wonders if an FAA license is required to operate Kenwood's new TR-7800 2-meter fm transceiver. After a few minutes of twiddling knobs and pushing buttons, however, it becomes apparent that the TR-7800 design promotes ease and convenience of operation rather than complexity. Many seem to feel that mobile-style fm rigs are going the way of the dinosaur — a solid-state manifestation of Darwinism. Certainly, synthesized "handi-talkies" offer greater utility, right? Sure, "handi-talkies" are the ultimate in portability, but have you seen one that produces a 25-watt punch? Or one that has 15 memory channels and permits scanning the entire band or only the memories? Or one with a priority channel that can be monitored while listening to another frequency and an invert function that allows the operator to monitor the input frequency of a repeater at the touch of a button? I'd like to see an HT that *could* do all these things. No, mobile-style fm rigs will not be the study of paleontologists for quite some time to come!

Installation and Operation at K1CE

The review unit shipped to ARRL Hq. was first installed at my station for base-operation testing. The antenna used was a Cushcraft Ringo Ranger perched at a lofty 75 feet[1] above Talcott Mountain in Connecticut. Several contacts were made using area repeaters and simplex channels. The TR-7800 was put through its paces, and performed well. Every function, every operational nook and cranny was explored during the several-month review period, and all received consistently high marks for reliability.

Audio reports were solicited from amateurs on many *different* repeaters (repeaters vary greatly respective to audio quality) and simplex frequencies. In *all* cases, audio reports received were similar to: "Sounds clean and full," "Takes full advantage of the superior audio quality of fm," and from a young woman "You sound very nice" (I think she meant the rig!).

Mobile Installation and Operation

It's one thing to operate a rig in a warm, stable location such as a ham shack, but quite another to ask it to perform to the same standards in a hostile environment. Could the TR-7800 endure severe cold, bumps, grinds and jolts? To find out, I subjected it to these conditions by installing the unit in my 1972 Volkswagen "bug." If the TR-7800 could survive in my car, it could survive just about anywhere! Installation was simple. A slide-in mobile bracket bolts easily to the underdash. A 5/8-wavelength whip antenna was chosen for the mobile application — a good, standard aerial used by many 2-meter enthusiasts. Again, the rig performed superbly, this time while operating during countless excursions on Connecticut's highways (some say the nation's worst roads). The only difficulty I experienced occurred when driving at night — the keyboard used for frequency entry is difficult to read because it is unlighted. The problem is easily circumvented by programming your set of frequencies into the memories *prior* to departure or while stopped at a rest area: It'll keep you from driving off the road. The digital readouts, however, are bright and easy to read except under conditions of high ambient light, a problem shared by other rigs employing such readouts.

I found on several occasions that the 25 (plus) watts was a boon to establishing reliable communications through distant repeaters. In fact, I used the rig to check into my favorite vhf traffic net, which used a Boston repeater almost 100 miles (160 km) away.

Features and Controls

All of the TR-7800's operating controls are conveniently located on the front panel. The ON/OFF switch is incorporated in the VOL/SQL control. Power output is switchable, HI/LOW. Low power output is adjustable up to 5 watts.[2] The keyboard (4 × 4 matrix) is used to enter operating frequencies, initiate the scanning function, select transmitter offset frequencies and program the memories. The keyboard also operates as a Touch-Tone pad for use with autopatch and other repeater functions. The KEY/M. SEL is a two-position push switch that engages either the keyboard or the memory channel selector for use in selecting the method of frequency call up. The REV switch is used to allow the operator to listen to the input frequency of a repeater without a time-consuming effort. This is a particularly useful feature in that the operator can determine instantly whether or not a transmitting station is within simplex range. A STEP switch determines the steps, 10 kHz or 5 kHz, during automatic scan and frequency selection. The memory-channel selector is used to select the desired memory channel, and the CH indicator displays the channel number.

There are 15 memory channels. Of these, channels 1 through 13 store frequencies with simplex or ± 600-kHz shift. The remaining two channels, 0 and 14, are "odd" split channels for storing transmit and receive frequencies, which are entered individually. Channel 0 is the priority channel. The PRIORITY ALERT switch is used to check the priority 0 channel. When the switch is depressed, the priority channel will be checked at about four-second intervals, regardless of the KEY/M. SEL switch position; a tone sounds when the priority channel is in use. A PRIORITY OPER switch is used to call up the priority 0 channel.

An LED display indicates the operating frequency in four digits: For example, 146.940 MHz is indicated as 6.940. Replacing the traditional S/RF meter is an LED level meter that indicates transmitter output and received signal strength. The greater number of LEDs that are illuminated, the higher the indicated level — this took a little getting used to. But once the rig was in operation for a few days, reading the meter became second nature. In fact, the aesthetics of the display are quite appealing —

[1]meters = feet × 0.3048.

*Assistant Technical Editor

[2]ARRL lab tests showed the TR-7800 "sweeps hot" from the receive to transmit frequency. The microprocessor does not have a transmit-delay circuit.

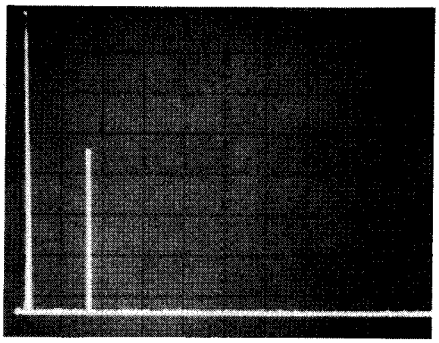


Fig. 1 — Spectral display of the TR-7800 transmitter output. Vertical divisions are each 10 dB; horizontal divisions are each 100 MHz. The fundamental has been reduced in amplitude approximately 33 dB by means of notch cavities; this prevents analyzer overload. Power output is 30 watts at a frequency of 146.52 MHz. A similar test at a power output of 4.4 watts also resulted in a clean spectral display. Tests were performed in the ARRL lab. The TR-7800 complies with current FCC specifications for spectral purity.

Kenwood TR-7800 Serial No. 010149

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency range: 144.000-147.995 MHz.	Readout: 143.900-148.995.
Mode of operation: Fm (F3).	As specified.
Current drain: 0.4 A in receive mode — no input signal; 6 A in HI transmit mode; 2.5 A in LO transmit mode.	Not measured.
Size (HWD): 2-1/2 × 6-7/8 × 8-1/16 in.	
Weight: 4.63 lb.	
Transmitter power output (at 13.8 V, 50-ohm load): HI, 25 watts; LO, 5 watts (adjustable).	HI, 35 watts; LO, 5 watts (adjustable).
Spurious suppression: HI, −60 dB; LO, −53 dB.	HI, −75 dB; LO, −53 dB.
Receiver i-f: 1st i-f, 10.695 MHz; 2nd i-f, 455 kHz.	
Receiver sensitivity: Better than 0.5 μV for 30 dB S/N; better than 0.2 μV for 12 dB SINAD.	0.13 μV/20 dB quieting.
Squelch sensitivity: 0.16 μV (threshold)	0.06 μV.
Audio output (8-ohm load), more than 2 watts.	1.5 watts.
Meter: Red LED.	Red LED, 5/16 in.
Sensitivity (μV/S9): Not specified.	2 μV.

Note: mm = inches × 25.4, kg = pounds × 0.4536.

the meter lends an avionics look to the rig. The TONE switch is for control of a user-supplied tone generator. On the rear panel are the SO-239 antenna connector, dc power input terminal, an external backup power input connection used for retaining memories (for internal memory retention power, four AA NiCad batteries must be user supplied and installed in the battery holder), external speaker jack and final-amplifier heat sink. On the microphone are three switches: The DWN switch steps both the keyboard and the memory frequencies (to the next lower frequency), while the UP switch operates in a similar fashion stepping the frequency or memory channel. The PTT switch also acts to disengage the scan function. Extended frequency coverage is included (143.9 to 148.995 MHz) for those of the "MARSian" persuasion. An AUTOSCAN function allows the operator to scan the entire band or just the preprogrammed memory channels.

The transmitter finals are protected by VSWR sampling circuitry. As reflected power increases (higher SWR), transmitter drive is reduced, thus decreasing input to the final amplifier. This in turn protects the final transistors. The sensitive receiver is a benefit when listening for weak signals.

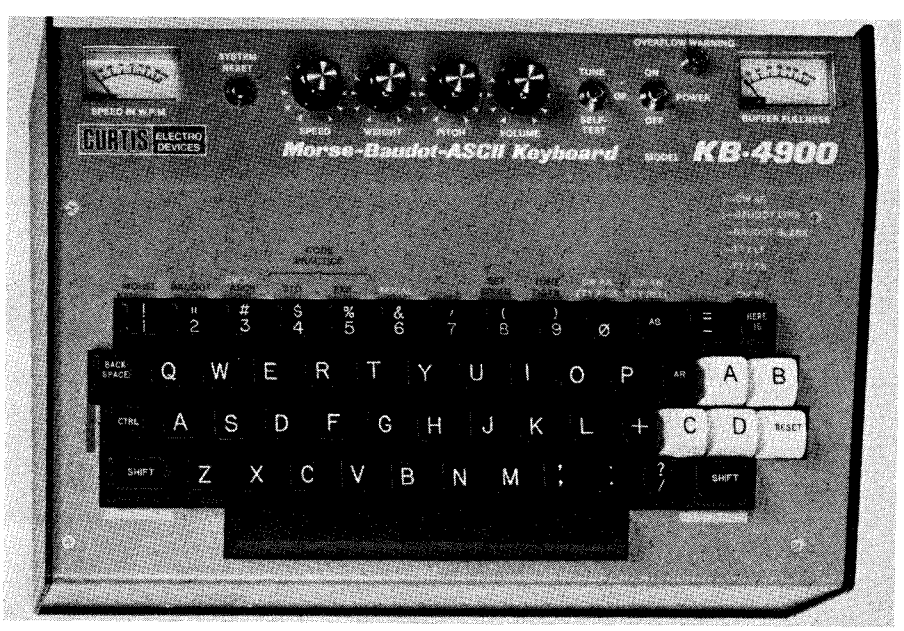
A complete and easy-to-understand instruction booklet describes the TR-7800's operation in detail. The unit itself comes packaged with microphone, mobile mounting bracket, dc power cord, spare fuse, miniature external speaker plug, warranty card and manual. Optional accessories include a matching dc power supply KPS-7, external speaker SP-40 and charger BC-1, which is used as a memory backup power supply when the main power supply is off for extended periods.

I have owned and operated a number of different 2-meter fm transceivers produced by various manufacturers, and I'd recommend the TR-7800 to any amateur looking for a 2-meter rig with more than "bare bones." I think every amateur enjoys a few "bells and whistles" occasionally if only to "keep up with the Joneses." The TR-7800 is a product of Trio-Kenwood Communications, Inc., 1111 West Walnut St., Compton, CA 90220. Price class: $400. — *Richard Palm, K1CE*

CURTIS KB-4900 KEYBOARD KEYER

☐ Some say that an amateur is "cheating" if he or she sends cw by means of a KB (keyboard keyer). Others have been known to say, "I wouldn't be caught dead using a keyboard." This reviewer has made similar statements on a couple of occasions! But, is it a cheating game to use a KB? Definitely not, and here's why. Take, for example, the case of an individual who can copy Morse at, say, 50 wpm, but lacks the dexterity or brain/hand coordination to send *good* (that's the key word here) cw at more than 25 or 30 wpm. The change from a bug or paddle to a KB can remedy the situation almost instantly, allowing for a period of off-the-air familiarization and practice with the new keyboard unit. It isn't necessary to be a touch typist: Many "hunt-and-peck" typists can easily grind out 50-wpm text on a keyboard. If the KB data is buffered (stored), proper spacing is assured, and perfect cw can be possible! The name of the game *should* be "good cw," and by whatever means practical: The cleaner the cw, the easier and more accurately it can be copied. Nothing is more frustrating than trying to copy at moderate or high speeds when the other guy or gal is sending with a "banana-boat swing" (NN GT = CQ), running the characters and sentences together, using excessive weighting or forming the dashes too long with respect to the dots. Cw "butchery" is rampant, even though there is widespread use of keyers and paddles. A keyboard keyer can be used to correct these problems. It must be said, however, that many paddle users can send cw that sounds as good as that from a keyboard!

The Curtis KB-4900 has a multitude of useful "bells and whistles." It provides Morse (5 to 80 wpm), Baudot (45.45 baud/60 wpm) and ASCII (110 baud) output. The buffer and memory will accommodate 256 key strokes with the memory soft-partitioned into four sections. These sections are available to the operator as memory keys (white) A, B, C and D at the lower right of the keyboard. For example, one could program memory A to read CQ CQ CQ de W1AW K. Memory B might contain DE W1AW K for tailending, with QRZ DE W1AW stored in memory C and so on. The memories, plus the built-in incrementing serialization feature (0 to 9999), would enable the amateur to operate an entire cw contest without using



the main part of the keyboard for any function other than inserting the call letters of the station worked. The time saved would be used for logging and "dupe" checking.

Other Features

Morse practice is available from the KB-4900. In practice-mode 1 there are random-length groups of random characters generated and sent in a never-repeating sequence. The desired speed can be chosen by adjusting the speed control. Practice-mode 2 delivers pseudo-random, five-character groups of Morse. These groups are always the same, and answer lists are contained in the owner's manual. The eight lists are available from the keyboard by inserting the numbers 1 through 8 in message memory A. In both modes the operator can insert extra space between the letters by pressing the CTRL key, followed by the 5 key. Also, the numbers and punctuation can be eliminated in either mode by placing an "N" after the "R" (or numbers 1 through 8) in message memory "A."

A standard paddle or bug type of key can be plugged into the KB-4900 to permit sending *conventionally,* if indeed that is a proper term for it today! Break-in operation is thus available by employing the BUFFER HOLD function of the keyboard.

PTT control is included for transmitter switching in all modes. The PTT release time is 0.5 seconds. Analog controls are provided for sidetone pitch, sidetone volume, weighting and speed. Also, analog meter readout (separate meters) is included for monitoring the Morse speed from 5 to 80 wpm and for observing the amount of data contained in the buffer (0 to 256 key strokes). A buffer-overflow warning light is located adjacent to the buffer meter.

Special prosigns $\overline{AS}$, $\overline{SK}$, $\overline{BT}$, $\overline{AA}$, $\overline{KN}$ and $\overline{KA}$ are included on the KB. Most of the European and commercial prosigns are also provided.

Another feature is a built-in, 24-hour clock that permits transmitting the time in Morse, Baudot or ASCII. In Morse, for example, the output would be 22R18, whereas on ASCII or Baudot it would be 22:18 for the same hour and minutes. This real-time clock is an optional accessory.

Inputs and Outputs

The KB-4900 contains a sidetone oscillator and speaker. The speaker can be used to monitor the output from a receiver by routing it to the audio input jack (8 ohms) of the KB. There is a jack for single- or twin-lever paddles and another for a manual "straight key." These inputs are optically isolated. A 12-volt dc input is available to permit battery connection. This prevents erasure of the memories during interruptions of the power service.

Keyboard outputs are provided for the key line (300 V, 500 mA max., mercury relay), PTT (same ratings) and the loop (same ratings, but optically isolated). There is a TTL TTY output (TTL level, sink or source 5 mA) and a speaker/headphone jack (8 ohms). The 117-volt ac line connects at the rear of the KB by means of a TV "cheater cord."

Some Final Comments

There are many subtle "goodies" associated with this unit, but descriptions are beyond the scope of this review. Additional information is available from the manufacturer.

The reviewer's KB-4900 has been in daily operation from 160 through 10 meters, with dc power input to the transmitter as great as 1 kW from 80 through 10 meters. At no time was there evidence of rf getting into the KB and disturbing the performance. No functional glitches have been observed in the overall performance of the keyboard, and on-the-air signal reports have yielded many compliments about the "perfect cw" generated by the KB-4900 (operator typos excepted, of course!).

An interesting psychological advantage seems available to this reviewer when using a keyboard, and others have reported similar experiences: Seldom-used, long words are much easier to spell on a KB than when sending them with a bug or paddle at the higher speeds. This may result from having the letters be visible to the operator when the word is formed. Poor spellers won't benefit from this phenomenon, however! In summary, the reviewer gives the KB-4900 a four-star rating. — *Doug DeMaw, W1FB*

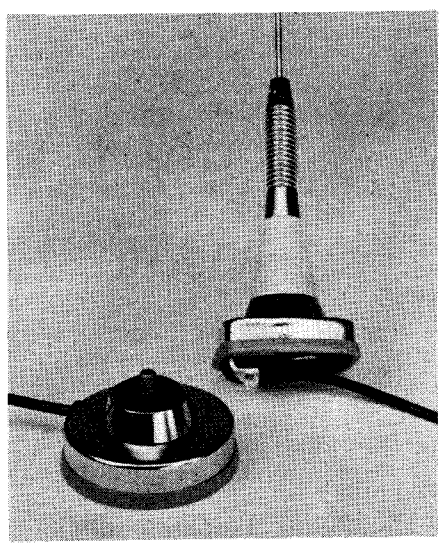
DECIBEL PRODUCTS DB702 2-METER ANTENNA

☐Another Decibel Products contribution to the array of 2-meter mobile whip antennas is the DB702, a 5/8-wavelength aerial that offers a choice of mounting arrangements. Should you prefer a permanent through-the-roof mount, the DB702E-11 is available. For those not willing to drill holes in their 1937 Bentley, a magnetic mount unit (DB702E-17) or a "no-holes" trunk-lip mount (DB702E-16) may be purchased. The ease with which the magnetic mount antenna can be removed and replaced makes it a good choice if you don't wish to have the antenna vanish under mysterious circumstances!

Antenna assembly is simple: screw the coil, whip and spring onto the mount of your choice. A length of coaxial cable with a PL-259 connector already attached is supplied for use with most contemporary 2-meter rigs.

The antenna was road tested with the "mag" mount and did not detach from the vehicle at highway speeds. It is aesthetically appealing and appears to be ruggedly constructed. An easy-to-read instruction manual and a chart to be used for cutting the whip to size are included. It's good practice to start a bit long and cut off a small piece of the whip at a time until the best SWR is achieved.

The DB702 series is a product of Decibel Products, Inc., P.O. Box 47128, Dallas, TX 75427. Price class: DB702E-11, $45; DB702E-16, $53; DB702E-17, $55. — *Richard Palm, K1CE*



Curtis Electro Devices KB-4900 Keyboard Keyer Serial No. 1026C

Manufacturer's Claimed Specifications

Speed: Morse, 5 through 80 wpm; Baudot, 45.45 baud (60 wpm); ASCII, 110 baud.
Buffer and memory: 256 key strokes.
Keyboard: 54 key alphanumeric plus space bar, punctuation and prosigns $\overline{AA}$, $\overline{KN}$, $\overline{BT}$, $\overline{AR}$, $\overline{AS}$, $\overline{SK}$ and $\overline{KA}$. Also includes European and commercial prosigns. Individually replaceable, gold-inlaid key contacts. Debounced and two-key lockout feature.
Other keying: Manual "straight key" or external paddle (iambic with dot and dash memories).
Size (HWD) and weight: 4-1/2 × 12 × 8-1/2 in., 5.5 lb.
Colors: Light gray panel, black side panels, lettering in white, yellow and red.
Power requirements: 117 V ac at 50-60 Hz or 12 V dc at 500 mA; 234 V ac at 50-60 Hz avail. on order.
Price class: $400.
Manufacturer: Curtis Electro Devices Inc., Box 4090, Mountain View, CA 94040, tel. 415-494-7223.

Note: mm = inches × 25.4; kg = lb × 0.4536.

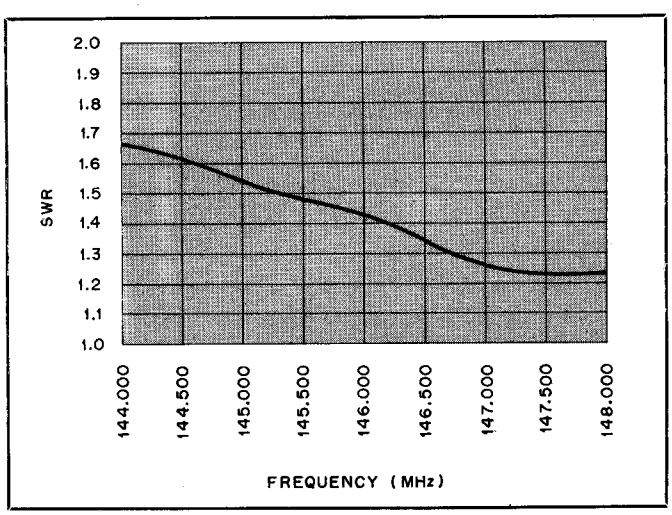


Fig. 2 — SWR curve for the DB702E-17 antenna.

GC ELECTRONICS LIFT-IT TRANSFER SHEETS

☐ Are you one of the many would-be "homebrewers"? Does the absence of a readily available pc board prevent you from undertaking a project you'd otherwise attack with enthusiasm? Sure, the pattern reproductions are nice, but photographing them is a step and expense you don't want to bother with. If only you could produce the required positive or negative from the pattern in the book. . . . Well, now you have no excuse! This easy-to-use method will lift the artwork and will make your pc-board reproductions more convenient and less costly.

One package of the GC Electronics Lift-It Transfer Sheets (catalog no. 22-288) contains two 8-1/2 × 11 inch[3] transfer sheets and one similar size Mylar exposing mask. This is enough material to make a number of boards, depending on their individual sizes.

To lift the pattern from the printed page, simply cut the transfer film to a size slightly larger than the desired pc pattern, peel away the protective backing and apply the film directly to the paper. Take care to place the transfer film correctly the first time because once the film touches the paper, it cannot be lifted — they're bonded for life! I found that it's a good idea to tape the desired pattern or page so that it cannot be moved as the film is being applied. This prevents the pattern from jumping up to meet the film (because of static electricity) as the film is brought closer to the paper.

Once the film is in contact, a smooth, blunt instrument (I used the back of a tablespoon) is used to burnish it in place and to force out any air bubbles from between the paper and film. Then place the pattern/film sandwich in a dish of warm, soapy water for 15 or 20 minutes. This causes the paper to absorb the water and to become crumbly when rubbed between your fingers. Don't use any abrasives — just your fingers. Let the film dry, and apply a piece of the Mylar backing to it. There you have it, a proper pc pattern positive that you can use with either the positive or negative pc board processing methods. Easy, isn't it?

If you'd like to preserve your *QST* copies or other publications and hate to take a pair of scissors to the page or otherwise alter it, you might photocopy the desired artwork. Good "lifts" can be made from photocopy paper. In fact, the density of the resulting positive might be somewhat better than that from the publication page depending on the papers used, photocopier reproduction density and so on.

Lift-It Transfer Sheets are available from your local GC Electronics distributor. If there's no distributor near you, contact GC Electronics, 400 S. Wyman St., Rockford, IL 61101. — *Paul K. Pagel, N1FB*

VOCOM TELESCOPING 5/8-λ ANTENNA FOR 2-METER PORTABLES

☐ "So, what is that? A 5/8-wave antenna for a hand-held?" I asked Sandy when he brought it in for advertising-acceptance examination. He smiled and said that I was correct! Correct, heck: I was being a smart aleck. Wisecracks flew back and forth around the office that day about the absurdity of putting such a large antenna on a hand-held. Then we tested it with an IC-2A. The performance was amazing. We were able to make contacts through repeaters that couldn't even be keyed with the "rubber duck," and we got good signal reports, too! Results of informal tests with various radios were consistent with the initial check.

We do not have facilities for testing and measuring antenna patterns accurately, but we did make a few informal observations about relative field strength. We used a receiver with an S-meter that was connected to a step attenuator through double-shielded cable. A 2-meter "rubber duck" was attached to the input of the attenuator. Another operator with an IC-2A was stationed about 200 yards away. The second operator made three transmissions with the IC2-A: first, with a "rubber duck"; second, a quarter-wavelength whip and third, the VoCom. We observed a 3-dB increase in field strength from the "rubber duck" to the quarter-wavelength whip. We observed a 6-dB increase from the quarter-wavelength whip to the VoCom. That is 9 dB from the "rubber duck" to the VoCom! Keep in mind that these are merely rough comparisons of the antennas. Nevertheless, these measurements are consistent with my on-the-air impressions of the difference in performance. VoCom has made a believer out of a skeptic in my case!

A fundamental rule of the universe is, "There ain't no such thing as a free lunch." Most modern portables are quite small and lightweight. The extra gain of the VoCom has its price — the length of the antenna and, consequently, the convenience of operation. Instead of 6 to 19 inches (152 to 483 mm), the full length of the antenna is 47 inches (1190 mm). This results in a package that can be unwieldy at times. Additionally, in an average room, it may be impossible to stand with the portable near your mouth while the antenna is fully extended. The leverage of the fully extended whip against the base of a female BNC connector (only one model has a male BNC connector) on a radio could be enough to damage the case after prolonged abuse. To some extent, the spring in the base of the VoCom will absorb this pressure. As far as I can tell, these are the only drawbacks to the antenna.

My opinion is that the VoCom antenna can be a useful tool for the 2-meter fm operator. Some care should be exercised in its use. If you happen to be about as graceful as a wounded rhino, and as clumsy as a New Year's Eve reveler, then you should stay with your "rubber duck" for safety's sake. If, however, you are on the fringe area of your favorite repeater, you may want to consider the VoCom. Used selectively and judiciously, this antenna shouldn't harm your radio, while at the same time it will extend the range of your portable. Price class is $25. Additional information may be obtained from VoCom Products Corp., 65 E. Palatine Rd., Suite 111, Prospect Heights, IL 60070. — *Peter O'Dell, KB1N*

[3]mm = inches × 25.4.

MACROTRONICS M8000 RTTY SYSTEM

☐Macrotronics' M8000 is a disc-based RTTY system for the Radio Shack TRS-80 computer. It utilizes fully the capabilities of the disc-driven computer, providing features that the serious RTTY operator requires and desires.

More than 50 commands and subcommands provide versatile system configuration and operation. To configure the system, the user may select ASCII at 110 baud or the Baudot code at 60, 66, 75 or 100 wpm. He or she may vary the rate of transmission to simulate UT-4 operation, choose to ignore returns to conserve the display space on the CRT, vary the carriage width from 15 to 72 characters per line, enter the time and date and enable the automatic 10-minute identifier and select fast, slow or no sync idle (diddles). Other functions include automatic line numbering, line labeling, narrow or wide shift for the cw identifier and the ability to create three canned messages that may be saved on disc.

The operations commands are more numerous. To transfer between the transmit and receive modes, simply press the CLEAR key. Not only will the program change modes, but your ham radio equipment will also be switched between modes. While the system is in the receive mode, the user may be typing a response into the buffer, which is displayed below the received text on the CRT. If the transmitting station asks a question requiring an instant response, the user may stop typing into the buffer, answer the question and resume buffer typing without losing the text previously buffered.

At any time, the user may transmit a "quick brown fox" message, a line of CQs, the time and date, the station identification in RTTY and/or cw and any of the canned messages saved on disc. Disc-based commands include displaying the disc directory, saving and playing back received, previously transmitted or keyboard-created messages and sending and receiving disc files in hex format. A word processor such as Electric Pencil or Scripsit may be used to edit or create M8000 messages on disc. The M8000 also includes an extensive subprogram that allows the user to set up an "electric mailbox" with WRU capabilities.

Performance

The M8000 performed flawlessly during two months of on-the-air testing on both 20 meters and a 2-meter RTTY-bent repeater. Documentation includes a command summary chart and with it at hand, it did not take long to master the numerous commands.

One program quirk involved the use of the IGNORE RETURN command. My line printer (an IDS 440 Paper Tiger) must receive a line return before it will print a line. With IGNORE RETURN enabled, the line printer will not print automatically. To obtain hard copy, the user must disable the IGNORE RETURN function or switch to the transmit mode and send a line return.

Each M8000 sold is personalized with the purchaser's call sign and/or name (48 characters maximum). This serves two objectives — the user's call is included in the program for all station identification functions and personalized software will not likely be stolen.

The minimum hardware requirements for the M8000 are a TRS-80 computer (Model I or III) with 32 k of RAM, one disc drive, TRSDOS 2.3 and a Macrotronics interface (M80, CM80, or TM80) or an RS-232C interface. With some radio equipment, an afsk generator and an RTTY demodulator may be necessary or desirable.

The M8000 package includes one discette containing a personalized copy of the M8000 software, a module that is installed on a Macrotronics interface to make it M8000-compatible and a three-ring binder containing full documentation. The package costs $150 and may be obtained from Macrotronics, Inc., 1125 North Golden State Blvd., Suite G, Turlock, CA 95380. — *Stan Horzepa, WA1LOU.*