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February 1984

Heath SS-9000 HF Transceiver

Kantronics Interface And Software

RC-850 Repeater Controller By Advanced Computer Controls, Inc.

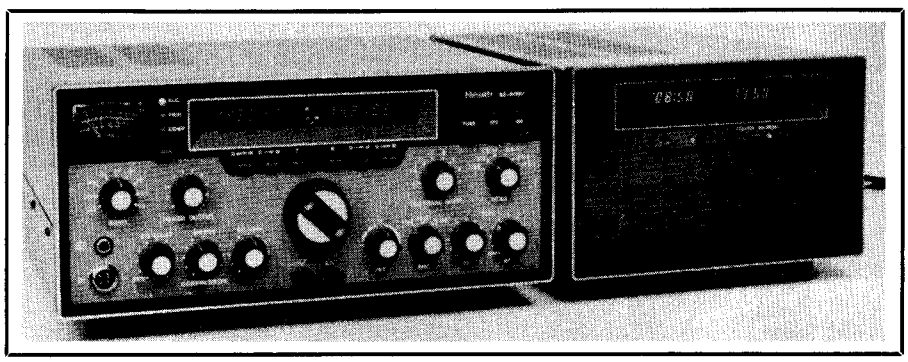
Conducted By Paul K. Pagel,* N1FB

The Heath SS-9000 HF Transceiver

☐ When the Heath SS-9000 was offered to me for product review, I was delighted. Recent months had seen my Amateur Radio activities take a back seat to an interest in computers. I could not resist the temptation to use a microprocessor-controlled HF rig complete with an RS-232-C interface! Before the radio arrived, I started to acquaint myself with its operation by reading through the owner's manual several times.

The manual is brief and to the point, especially when explaining operational theory. Several large diagrams are included, all aimed at making the transition to on-the-air operation fast and easy. You're guided through an explanation of the various controls and their functions, and operation of the radio. A small but helpful "In Case of Difficulty" chart is included. A large portion of the operator's manual is devoted to computer interfacing. Although Heath apparently took great pains to write this section, they assume that a large percentage of the readers own Heath/Zenith computers. Little information is put into the non-Heath/Zenith section. It would be advisable to have a thorough understanding of the system's capabilities before attempting to interface the SS-9000 with another type of computer. A reasonably good grasp of software development would also be helpful. The radio comes with a demo software program stored on a floppy disk. More about this later.

Heath has made some aesthetic changes to its product line. The standard green/gray color combination has been changed to a more subtle two-tone brown. Certainly not what I was accustomed to, but I did find it to be a pleasant change.



Heath SS-9000 Transceiver

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency coverage: 1.745 to 2.055, 3.425 to 4.075, 6.925 to 7.375, 10.1 to 10.15, 13.925 to 15.008, 17.699 to 18.200, 20.925 to 21.760, 24.89 to 24.99, 28.00 to 29.700 MHz.	Receive: As specified. Transmit: As specified except 1.8-2.055, 13.925-14.425, 18.068-18.168 and 20.925-21.575 MHz.
Modes of operation: CW, SSB, RTTY.	As specified.
Frequency resolution: 100 Hz.	As specified.
kHz/turn of knob: 5 kHz.	As specified.
Dual frequency display: six digits.	As specified.
S-meter sensitivity (μV for S9): Not specified.	160 m — 100; 80 m — 54; 40 m — 50; 30 m — 58; 20 m — 42; 15 m — 42; 10 m — 64.
Transmitter RF power output: 100-W (minimum) CW/RTTY; 100-W PEP (minimum) SSB.	105-120 W dc, 160-10 m.
Harmonic suppression: 50 dB.	−55 dB.
Spurious suppression: 50 dB, (except at 17 m, 40 dB).	−60 dB.
Third-order IMD: −30 dB.	See Fig. 2.
Receiver sensitivity: (0.3 μV for 10 dB S+N/N for 40-10 m; 0.5 for 160 and 80 m.	

	80 m	*20 m*
Noise floor (MDS) dBm:	−138	−140
Blocking DR (dB):	119	118
Two-tone 3rd-order IMD DR (dB):	88 high, 90 low	91 high, 92 low
Third-order intercept (dBm):	−4.5	−2.75

Size (HWD): 6-1/8 × 14 × 13-3/4 in.†
Weight: 35 lb.

†mm = in × 25.4; kg = lb × 0.454.

Front Panel Controls

The SS-9000 front panel is neat and orderly. A single meter, located on the left side of the radio, monitors all appropriate functions. During receive, it serves as an S meter. In the transmit mode, a single push button allows the meter to monitor either ALC, PWR or speech COMPression levels. Three green LEDs indicate the function being monitored. I am quite impressed with the accuracy of the meter when used as a power-output monitor. Indicated power agrees closely to readings obtained with a Bird Model 43. Directly below the S meter are the BAND SELECT and POWER OUTPUT controls. The headphone jack accepts a standard two-conductor phone plug; impedance is 4-8 ohms. The MIC/PTT input uses a 4-pin DIN connector (supplied). Microphone impedance required is 25 kΩ. The VOX DELAY, SPEECH COMPRESSION and MIC GAIN controls are located at the bottom left of the front panel. Speech-compression reports were excellent. In fact, I was complimented on the superb sounding audio more than once. VOX GAIN, ANTI-TRIP and CW SIDETONE controls are adjusted through holes located on the right side of the cabinet.

Frequency Control

Operating frequencies are indicated on two digital displays. Frequency control is accomplished by the tuning knob or by means of push-button switches. The frequency is changed manually in 100-Hz steps, with one revolution of the tuning knob producing a change of 5 kHz. Directly below the tuning knob are two push-button switches that control the scanning function. A slow scan rate of 2.5 kHz per second to a high rate of 270 kHz per second is obtained by setting four internal DIP switches. In all, 16 different scan rates are possible.

Split-Frequency Operation

Split-frequency operation of the SS-9000 took some getting used to, perhaps because I had never used split frequencies before. After a short time, though, it became almost second nature. Four LEDs (two red for transmit, two green for receive) indicate which VFO controls the frequency. Split operation is accomplished by toggling the (T)ransmit and (R)eceive push-button controls. Four additional push-button switches control the display-to-memory and memory-to-display functions. A D→M push-button switch stores the frequency shown on the display into

*Assistant Technical Editor

memory, while the D→M switch is used to exchange the frequency being displayed with the frequency stored in memory. Both the right- and left-side VFOs have these capabilities. In all, the RAM (random access memory) stores the two display frequencies plus an additional frequency on each of the nine bands. This gives a total of 27 different frequencies that can be stored. Three AA-size batteries, located under the synthesizer board, are used as memory back-up power. I found it convenient to store my favorite net frequency into memory. Perhaps my favorite function is the automatic frequency disable. In the transmit mode, an automatic disabling feature ensures that the main tuning knob and all frequency-controlling switches are inoperable. I found it particularly comforting to know that I could not inadvertently change frequency or "swoosh" the band.

To the right of the displays is the PASSBAND SHIFT control, which changes the IF filter response. The shifts are at: −600, −400, −200, −100, 0, +100, +200 and +400. This function operates in the sideband modes only. The MODE switch selects: USB, LSB, CW-W(ide), CW-M(edium), CW-N(arrow) and R(TTY). The wide CW position uses a 2.1-kHz filter, while the medium and narrow positions utilize 400-Hz and 200-Hz filters, respectively. The lower-right side of the front panel contains the RIT and AGC controls. The RIT varies the receive frequency 250 Hz either side of the displayed frequency. It is activated by a separate push-button switch with a green LED indicating the "on" state. A similar push-button switch and LED is used for the NB circuit. The TUNE function uses yet another push-button switch to place the radio in the tune position. On the extreme right of the front panel are the AGC, RF and AF-ON/OFF controls. Fast or slow action is selectable with the AGC control.

Protective Circuits

The broadband solid-state design of the radio eliminates tune-up. When the SS-9000 is connected to a 50-ohm load, it will deliver 100 watts of power. With a high SWR condition, the automatic cutback circuit will reduce power output. Typically, an SWR of less than 2:1 assures that at least 80% of full power will be delivered. This feature was tested several times, once inadvertently, and was found to work satisfactorily. A self-diagnostic feature has also been included in the SS-9000. For example, if one of the synthesized circuits malfunctions, the radio will lock in the receive mode. A message indicating the faulty loop will then be displayed. For example, if the HFO loop becomes unlocked an HFO UNLOC message will be displayed. An internal thermal sensor and over-current protection round out the protective systems.

Rear Panel

The antenna connection (SO-239) is mounted below the band-switch motor housing. Its proximity to the housing makes it awkward to connect or disconnect the antenna lead. All cables from the power supply are connected to the rear panel. Facilities for up to four external speakers are provided! I found it adequate to use just one. Other rear panel connections include: EXT RLY (to key an amplifier), ALC IN, ALC ADJUST, T/R IN, T/R OUT, XMIT AUDIO INPUTS (for RTTY or phone patch), MUTE, REMOTE COAX SWITCH SOCKET and TERMINAL (RS-232-C).

Computer Interface

The SS-9000 cannot be fully appreciated until it has been interfaced with a computer. At times I thought it could stand up and dance. A controller circuit interfaces the front-panel controls with an RS-232-C port. As mentioned earlier, a better-than-average understanding of hardware operation and software development is required to realize the full potential of this radio. The Terminal Interface section of the operator's manual does a fair job of explaining the terminal interface, although at times it does seem to get bogged down with "technobabble." I interfaced the SS-9000 to one of the two Heath/Zenith computers used at W1AW. The demo program supplied with the radio, intended to give the operator an idea of how the SS-9000 can be computer controlled, was LOADed into the computer. I was quite surprised to see the program make use of some graphics. A representation of the SS-9000 front panel has been written into the software. The dual frequency displays almost give you the impression you're looking at the radio and not a monitor. The program is written entirely in MBASIC. I found it helpful to get a printout. This can be a powerful tool when attempting to develop a program tailored to a specific application. It's unfortunate that Heath does not include one with the demo program. An assembly-language routine, however, is provided for Heath/Zenith computer owners.

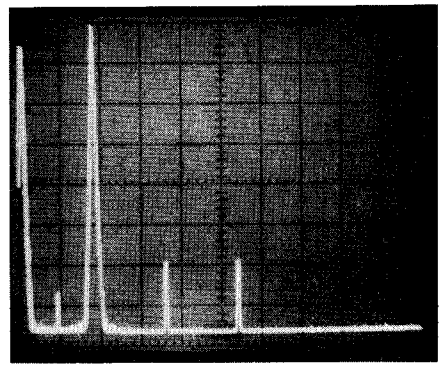


Fig. 1 — Worst-case spectral display of the Heath SS-9000. Vertical divisions are each 10 dB; horizontal divisions are each 1 MHz. Output power is approximately 100 watts on 160 meters. All spurious emissions are approximately 60 dB below peak fundamental output. The SS-9000 complies with current FCC specifications for spectral purity.

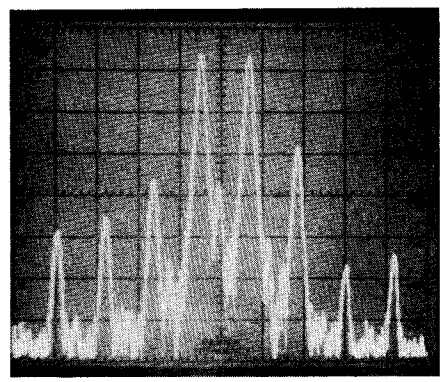


Fig. 2 — Spectral display of the SS-9000 output during transmitter two-tone IMD testing. Third-order products are about 29 dB below PEP and fifth-order products are 44 dB down. Vertical divisions are each 10 dB; horizontal divisions are each 1 kHz. The transceiver was being operated at rated input power on the 20-meter band.

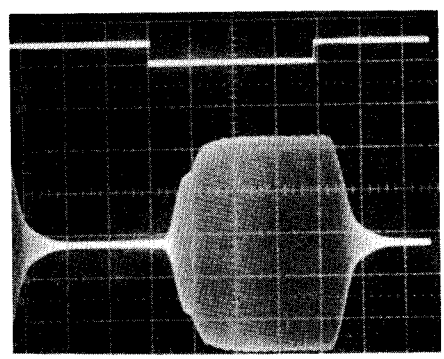


Fig. 3 — CW keying waveform of the SS-9000. Upper trace is the actual key closure; lower trace is the RF envelope. Each horizontal division is 5 ms.

One of the more useful sections of the documentation is the list of commands. All transceiver functions that are under microprocessor control can be set or changed by a specific command. For example, the MO= command displays the mode setting, while the MO=n command sets the mode function of the radio to the value of n. In this case, n can be equal to: LO(wer), UP(er), W(ide), M(edium), N(arrow) or R(TTY). Similarly, to change bands, a BA= n command would be used. Again, n is equal to the desired band of operation. If an unrecognizable command is sent to the CPU, a syntax error message in the form of ERR# n will be displayed. In this case, n is equal to one of 12 error codes. The SS-9000 will alert you if you attempt to operate out-of-band.

Buffers

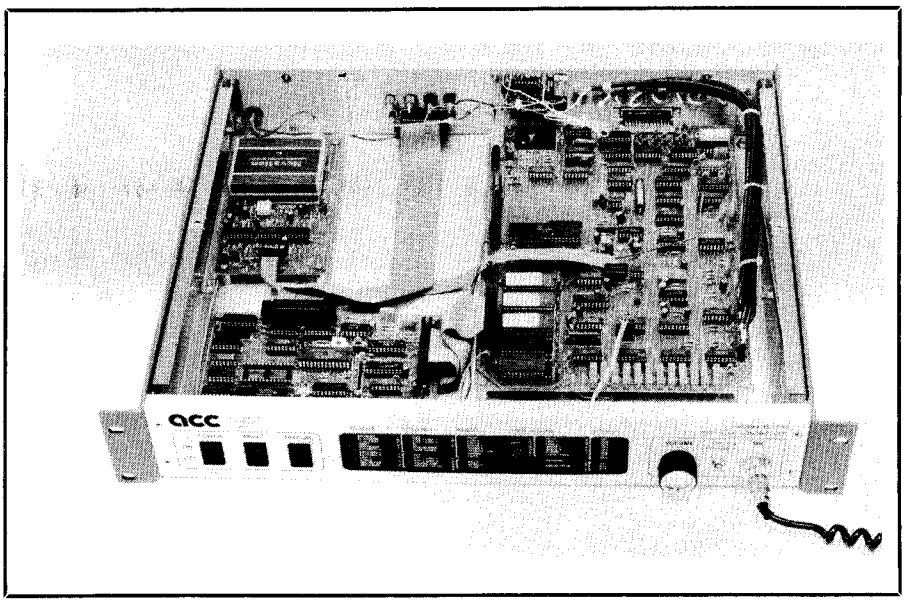
The SS-9000 uses a 16-character input and a 64-character output buffer. Although I did not have a problem overflowing the input buffer when controlling the radio with the demo program, a more elaborate program could fill it quickly. To guard against lost characters from a full buffer, a bell character indicates the character(s) not accepted. The SS-9000 can also be operated via a modem. I did not have the facilities to test this particular function, however. According to the operator's manual, if the carrier loses the audio tone from the telephone line, it forces the transceiver into the receive mode.

Power Supply

An external power supply, rated at 25 A, supplies all necessary voltages to the SS-9000. Housed in a matching cabinet, the PS-9000 includes an external speaker and two 12/24-hour digital-readout clocks. The clocks can be set independently for either 12- or 24-hour display. This is accomplished by changing internal jumper wires. Clock time is set with two FAST-SLOW push-button switches located below the display. Brightness controls for the dual display are located internally. The PS-9000 employs high-temperature and surge-current protection circuits. In the event of a short or overload, a master ON/OFF-RESET switch, located under the bottom panel will reset the system. I found that it can also be used as a master or "kill" switch to discourage any unauthorized use of the radio.

My impression of the Heath/Zenith SS-9000? I liked it! I think Heath has realized the potential of a transceiver that can be interfaced with a computer and has entered the market headfirst. Overall, I found the radio to be solid and

reliable. After I learned its operation I knew exactly what to expect from it, and it delivered flawlessly every time. All microprocessor-controlled functions of the radio worked according to the manufacturer's specifications. The potential applications for this radio are almost endless, restricted only by the user's imagination. I think Heath should supply additional software documentation to the non-Heath/Zenith computer owners. This would certainly help entice more people to take a serious look at the radio. The SS-9000 is available from Heathkit, Benton Harbor, MI 49022. Price class: SS-9000, $2800; PS-9000, $295. These units are available only assembled and tested. — *Ed Raso, WA2FTC*



RC-850 REPEATER CONTROLLER BY ADVANCED COMPUTER CONTROLS, INC.

☐ The RC-850 is the type of product that reviewers dream of — it's a delight to operate, work with and write about. Perhaps my biggest problem is deciding which features to talk about, because there are so many — and they are all top notch. Did I hear a sigh out there in hamland? "Okay, here comes another syrupy whitewash by some dimwitted reviewer who will gloss over the bad points of the system." Wrong; this product is *that* good.

The worst thing about the RC-850 is the manual. But it is not one of those skimpy little sheets that's folded once and gives you all the information you could deduce from looking at the front panel. No, this manual has so much data packed so succinctly into so few pages (just under 150) that it takes a long time to find something the first time you go looking for it.

This is a problem? The reason there is so much data included is that the RC-850 is so versatile. For the tech crew and control operators to make full use of its features, the data is necessary. (Anyway, if you are stuck you can always pick up the phone and call Ed Ingber, WA6AXX, designer of the RC-850. I called him frequently while the RC-850 was being tested at W1AW/R, and he always had the answer, no matter how crazy the question.)

For the Repeater Users

The casual user of a repeater with an RC-850 will be thrilled with what might be called the *Star Wars* functions — synthesized speech IDer with sound effects (200-word vocabulary), synthesized remote base control, various user functions that can be accessed via tone codes, etc. (Its vocabulary is expandable at an additional charge for special or unusual words.) The autopatch is really three patches in one. The Emergency Patch stores 10 phone numbers for local emergency services and each is accessed with * and a single digit. As the controller dials the number, it reads back a message telling the user what is being dialed, e.g. F I R E. The second patch is the User Autodialer, which has 90 positions that can be loaded with frequently called numbers. The RC-850 can be programmed to read out the number as it is being dialed. The third patch is the regular patch with the RC-850 detecting the tones for the phone number as the user sends them, then the controller either regenerates DTMF tones or pulses — whichever the 850 is programmed for. Again the number can be read back as it is being dialed.

A mailbox system is built into the RC-850, which allows the user to load a message for another user into the memory. When the repeater is keyed up, a tail message is generated that alerts users that there are messages waiting. One sequence of tones causes the controller to announce the call signs of the person(s) to whom the message(s) are addressed. Another tone sequence causes the message to be read out, and a third set of tones will cause the RC-850 to erase the message after it has been read. If the message is not erased within two days, the controller automatically erases it.

Another feature allows the RC-850 to be used as a pager. Why would anybody want to turn the repeater into a pager? Think about it for a second. If your system is moderately busy, you probably won't be able to monitor it and concentrate on your work. Suppose you have a decoder installed in your radio — you are available for calls directed to you without being bothered by the chit-chat. One-way transmissions are restricted in the Amateur Service, but that does not mean that two-tone sequential alerting cannot be used legally for the good of ham radio.

If the voice-response telemetry option is included in the package, the user can enter a set of tones that causes the RC-850 to read back any of 16 channels of analog meter measurements. For instance, the inside and outside temperatures can be had (assuming the sensors have been obtained and connected to the RC-850). Other possible meter readings that the tech crew can add to the system are forward and reflected power, voltage, current, signal strength, frequency error, quieting, deviation and anything else that can be measured with a meter. The sensors must be added by the repeater owner, but the programming, connections and vocabulary are included in the RC-850. The telemetry option includes sensors for supply voltage and internal temperature — other sensors may be added at the discretion of the repeater operators.

There is even a feature built into the machine for testing tone pads. A user simply enters a 5 followed by any of the other tone-pad digits (any of the 16 in the two-of-eight DTMF system). The RC-850 then reads back the sequence that followed the 5. After the carrier is released, if the RC-850 does not respond at all or omits some of the digits, the user knows he or she has problems that require additional testing.

Do casual users like these features? You bet they do. W1AW/R, operated by the ARRL Hq. Employees Club in conjunction with the Newington Amateur Radio League (NARL), has been on the air for several years as a low-power, low-profile, local-coverage machine. With the exception of NARL members and ARRL Hq. employees, few "locals" had displayed much interest in using the repeater. Once the RC-850 was on the air, locals began "coming out of the woodwork" wanting to know more about it and how to become involved. NARL has had quite a boost in membership as a result of the RC-850 being added to the repeater.

For the Tech Crew and Control Operators

Although the division of labor and lines of responsibility for maintenance and monitoring vary from one repeater group to the next, there is a clear division between those officially responsible for the operation of the repeater and those who simply use the repeater facilities. For the sake of simplicity, I am lumping the tech crew, control operators, managers, etc., into the category of *operators* — as opposed to users.

What does the RC-850 offer the operators? It offers tremendous versatility to any operator who wants to tailor the repeater's operation to the needs and desires of a group. Since virtually every operation is controlled by the on-board microprocesssor (80C85), nearly every operation can be altered by changing the software. The main operating program is stored in ROM, so as ACC updates the operating system, your old RC-850 becomes one of the new RC-850s. How much does this cost? It'll cost you the postage that it takes to return the old ROMs to ACC. As long as you promptly return the old ROMs, ACC will send you new versions of the firmware as they are released.

But the power to alter the RC-850 programming doesn't stop here. A control operator desiring to modify some aspect of operation simply dials the controller's telephone number. After announcing its identity, the controller waits for a few seconds for the calling party to enter a special multi-digit security code via a tone pad. If the correct code is not entered in a short amount of time, the controller hangs up. After entering the correct code, the operator then may modify the repeater functions by entering appropriate commands via the tone pad.

Suppose you, as the control operator, want

to change one of the phone numbers in the emergency autodialer. No problem; just dial the RC-850 and enter the appropriate commands — after you get through its security. Suppose you are having trouble with someone making unauthorized autopatch calls. Just dial the controller and change the access code. You'll have no more trips to the repeater site just to reset the talking time of day clock, assuming your repeater does have one, when switching to and from Daylight Savings Time.

Virtually everything can be adjusted or changed; this gives the operator tremendous flexibility. If you don't like something about the repeater's operation, just dial the number and change it.

Even though the RC-850 is designed for battery back-up, sooner or later there could be a total power failure. Does that mean the operator will have to reprogram every custom parameter back into the memory? No, because the RC-850 has an on-board EEPROM (Electrically Erasable PROM) programmer/eraser that permits the operator to store program changes in non-volatile memory. The operating parameters stored in non-volatile memory are called the "initialization state." Temporary adaptations can be stored in the scratch-pad RAM; they will be lost during a total power failure.

A 75-ms audio delay line on the RC-850 is used in conjunction with CMOS analog switches to mute squelch tails and, optionally, tones arriving at the receiver. Since the repeater will not retransmit tones used by the repeater users to access certain functions, such as the autopatch, this adds to the overall security of the system. Someone cannot simply listen to the output of the repeater to determine what the various access codes are.

Four classes of CTCSS access can be programmed into the RC-850 if the CTCSS option is added. Provisions are available for adding a control receiver, in addition to control over the phone line. Noise and "kerchunk" filtering is built into the system. Provisions are included for remote base linking and, with minor interfacing, repeater-to-repeater linking. The ID messages can be rotated, or one can be selected. Special messages indicate various conditions at the repeater — and, of course, the message content can be changed with a simple telephone call.

ACC has included another control option that further increases the versatility of the RC-850. The "scheduler" permits the operator to configure the repeater differently for specified times on specified days of the week, all automatically. For instance, since FCC rules require a control operator on duty for third-party traffic (autopatches), the operators might want the patches disabled from 11 P.M. until 5:30 A.M., Sunday through Thursday nights. On Friday and Saturday nights, one of the operators is around until 1:30 A.M., but no one gets up before 7 A.M., so the patches would be disabled between those hours. (Of course, the emergency autodialer could be left enabled at all times.) Or a CTCSS machine might be scheduled for carrier access during certain hours of each day. Another possibility is to change the timers to discourage long "monologue" conversations during certain hours. The RC-850 scheduler can handle these and much more complex chores, all automatically.

If the control operator has a "mean streak," the RC-850 offers a perfect vehicle for getting even with the less-than-ideal users. Just after we installed the '850, we were plagued with people who wanted to "play" with the various user functions, but who did not want to identify their stations. We don't mind them using the functions available, but this being W1AW/R, we do want things kept legal. No amount of coaxing on the part of control operators seemed to have much effect on their behavior. So I programmed in a message ID that said, "Alert! Intruder! You fail to ID. This is W1AW Repeater." This message ID was not in the normal rotation, but it could be brought up by dialing the controller and entering a special code. I leave the rest to your imagination, but let me point out that recently we have had very little trouble with stations failing to identify.

During the summer, thousands of hams stop by ARRL Hq. for a visit and a tour. Many of the visitors on their way into Newington would access W1AW/R looking for directions to Hq. Since FCC rules prohibit ARRL employees from making contacts during work hours and from using Amateur Radio to facilitate the business of ARRL, employees cannot respond to these calls while on duty. The male and female voices of the synthesizer are so realistic that a large number of visitors tried to engage the RC-850 in conversation. If a NARL member was not available to give them directions and explain that the voice was a machine, the typical response seemed to be anger directed at those "snobs at W1AW/R." We now include some sound effects in the messages to clue the uninitiated into what is happening.

Technical Considerations

First-class construction techniques are used throughout the RC-850. Components are of the highest quality. The RC-850 is state of the art through and through.

Besides the 80C85 microprocessor, the main board carries 24 kbytes of programming in PROM. Standard on the RC-850 is 2 kbytes of RAM and EEPROM — both expandable to 8 kbytes. The total memory system can be expanded to 64 kbytes.

Valid logic inputs range from 0 to 0.8 V for low and from 2.4 to 15 V for high, making them compatible with TTL and 5/12-V CMOS. Logic outputs are high-voltage, high-current VMOS compatible with TTL, 5/12-V CMOS, relays, etc. The inputs and outputs are programmable as active high or active low. Power requirements are 175 mA at 12.6 V ±10%, with the display turned off.

Although the site for W1AW/R is not the worst possible, it is far from ideal. Located in the elevator penthouse of a nearby hospital, W1AW/R with the RC-850 has been exposed to temperatures ranging from near freezing to over 150° F — according to the temperature sensor built into the voice-response telemetry board. The RC-850 was mounted within 2 feet of the elevator clutch, which draws 18 A at 28-V dc![1] We did not notice any aberations in the performance of the RC-850. There are also a number of two-way business radio transmitters in the same room, and they have not affected the performance of the controller.

Arnie Chase, WA1RYZ, who owns two RC-850s for his repeaters, recently said of Ed Ingber and the RC-850, "The boy sure has done his homework." True, and he is continuing to do it. By the time you read this, Ed will probably have a new release of firmware programming, adding even more features to the RC-850. If you are interested in having a first-class repeater, you should seriously consider the RC-850.

Price class for the main board, which includes most of the features except voice response (response is in CW) and the actual telephone interface for the autopatches is $1195; in a rack-mount cabinet (2½ × 17 × 14½-in HWD), $1549. (Logic support for the patches is included; the interface is not. If you have an autopatch now, you can use the existing interface with the RC-850 board.) Price class for a registered telephone interface is $349 and for a non-registered one is $175. The speech synthesis board without telemetry readback (talking meters) is $395; with the metering it is $595. The front panel display option is $295. A CTCSS tone encoder/decoder is $75. Local control is via a DTMF encoder microphone, which is $60. Additional information may be obtained from Advanced Computer Controls, 10816 Northridge Square, Cupertino, CA 95014, tel. 408-749-8330. — *Peter R. O'Dell, KB1N*

[1]mm = in × 25.4, m = ft × 0.3048.

KANTRONICS INTERFACE AND SOFTWARE

☐ If you're looking for a way to hook your personal computer to your Amateur Radio station, Kantronics has some quality products that will get you and your computer on the air with Morse code, Baudot and ASCII RTTY. The Interface™ , accompanying software (called Hamsoft™ and Hamtext™ are priced for the moderate budget. These products enable an amateur to use any of six popular personal computers for Amateur Radio communications: the Apple® II, II+ or //e; the ATARI® 400/800;™ the Radio Shack TRS-80® Color Computer; Texas Instruments TI-99/4A™; Commodore VIC-20™; or the Commodore 64™.

The Interface requires a power supply of from 8- to 15-V dc, at a minimum of 150 mA. Your computer is connected to the Interface using a five-conductor cable that is supplied when you buy the software. Though the Interface is designed specifically for use with Kantronics software, the instruction manual also provides information that allows Interface use with alternate software. Kantronics does not warrant the use of the Interface with non-Kantronics software, however.

I used my VIC-20 personal computer, a Yaesu FT-101ZD with the Interface and the Kantronics Hamtext software. The hook-up is extremely simple, and all the necessary connectors are supplied. The signal input for the Interface comes from the audio output of the transceiver. With my rig, making a connection to the external speaker jack mutes the FT-101ZD's internal speaker. The Interface, however, has a jack suitable for an outboard speaker.

The next connection involves attaching a shielded-conductor audio line between the MIC jack of the transceiver and the AFSK (audio frequency shift keying) output port on the back of the Interface. The PTT (push-to-talk) lines between the MIC jack and the Interface control the transmit/receive functions. The AFSK lines are used to drive the audio input of the transceiver when you are using the Baudot/ASCII modes.

The final connection between the transceiver and the Interface is for the CW mode. There is a CW KEY OUT port on the back panel of the Interface; this line goes to the key jack of your rig. This enables the CW generated by the computer to key the transmitter. Connecting the Interface to a rig is simple. It may be necessary to make modifications for its use with some transceivers, however. The instruction manual (which is well-written) shows how to make the necessary modifications for the ICOM '720 and

'730 transceivers. It also warns that modifications may be necessary in some older Drake and Swan transceivers. The manual shows how to place a readily available Radio Shack miniature relay between these rigs and the Interface to use an otherwise incompatible keying circuit. The same relay will also take care of a similar problem for keying proper CW with transceivers such as the Yaesu FT-101E, FT101EE and FT-101EX.

The Software

Kantronics has two kinds of software available. The more advanced version, Hamtext, consists of a small board that is inserted in the expansion port of the VIC-20. Hamsoft, the "stripped-down model," is also available; I used Hamtext. There is no tape or disk to load into the computer; rather, the entire program is contained in two PROMs. There is an advantage to having the software in this form: Very little of the VIC memory is used for operation, leaving most of the RAM (random access memory) free for storage and retrieval of messages. If you are using the standard 5-kbyte VIC, over 3500 bytes are available for this purpose.

Using a so-called "mother board," I expanded my VIC by plugging in a 16K expander board. That gave me nearly 20 kbytes free for messages. Kantronics warns, however, that use of an expander or mother board may affect the operation of the Hamtext program. I found no problems.

On-the-air Operation

It is necessary to study the manual and practice operating the computer with the software before actually getting on the air. The instruction manual goes through the various functions in sufficient detail, but a summary sheet of the various commands would have been helpful, too. I ended up making my own summary of the functions.

1) Initialize computer. Type: 40960 RETURN.

2) You get a menu. Type M for Morse, R for Baudot RTTY, A for ASCII.

3) Tune in a signal. When all the red LEDs on the bar of the Interface are lit, you are tuned in.

4) Once the signal is properly tuned in, the lower portion of the monitor screen becomes the receive area.

5) At the top of the screen is the status area. It tells the mode you are in, and, when you are in the Morse mode, tells you the speed at which the signal is being received.

6) When the first character of what you want to send is typed, the screen is immediately divided into four areas. The two new areas are the transmit buffer and the transmission line, which shows what is actually being sent.

Control Key Commands and Function Key Commands

The VIC 20 has eight function keys at the right of the keyboard, and the Kantronics puts seven of them to good use. F1 = receive. This is good human engineering because if anything goes wrong (for example, you see something coming up in your buffer that you don't want sent over the air), you can immediately stop everything by hitting F1 and putting the system into the receive mode. F2 = transmit. You can type into the transmit buffer when you're receiving, and when the other station turns it over to you, you can hit F2 and be on the air immediately. F3 changes speed. F4 is a break-in key. It provides a short keyboard buffer for immediate transmissions. F5 will invert the incoming RTTY or ASCII signal. I found this to be quite useful for compensating for what I detected is a shortcoming of the Interface itself. The Interface demodulates only the mark signal and assumes that the space is there. On weaker signals, the demodulator sometimes got confused. I used the F5 key to "straighten out" the confused demodulator. Of course, there are those who do run with their mark and space inverted from what is customary, but I found that to be an exception to the rule. F6 clears the transmit buffer and F7 is a printer toggle switch that I didn't use.

Some of the control keys are commands that you can actually imbed in the text you are typing into the transmit buffer. For example, if you are finished typing your text, you can enter a "CTRL E" command so when that command is encountered in the transmitter line, the program is returned automatically to the receive mode. Another useful control command I used frequently was the "CTRL I" command. When the transmission line encountered this, a CW ID is sent from one of the message storage areas.

There is a "CTRL T" to place the clock time into the transmit buffer, but I did not use it because the clock accuracy suffered whenever I went into loading or editing message storage areas. The "CTRL F" command is used for transmitting a message from disk or tape. Since I have only the tape datasette with my VIC, I did not find this useful. However, this would be very useful with a disk drive.

"CTRL J" and "CTRL M" commands can be embedded in the text to send a manual carriage return and line feed, respectively. Since the program has provisions for automatic carriage return and line feed, I didn't use the manual commands.

Control commands 0-9 designate 10 message storage areas that can be loaded with your ID, brag tape, short story about your prize-winning kumquat or whatever. If you want long-winded brag tapes, you can manipulate the number of bytes of available computer memory by "robbing" some of the bytes that are assigned to the receive buffer by default.

This is the best part of the program. Furthermore, you can load the message areas and then save them to either tape or disk; you never have to retype them. Once the messages are saved to tape or disk, initializing the computer from a "cold start" is easy. Just load in your messages.

Updates

We understand that Kantronics has recently come up with a version of software with AMTOR capability. AMTOR is a teleprinter code that provides for automatic error correction. See July 1983 *QST*, p. 11, for more information about AMTOR. Kantronics has also released an upgraded Interface unit. Check with your local dealer for details.

I found the Kantronics Interface and Hamtext to be a lot of fun and a good buy. There are, without a doubt, more sensitive and discriminating modems available, but of course you must expect to pay more. On strong and moderate signals the Interface performed adequately. The weaker signals, however, were difficult to copy. Of course, your success will depend to a great extent on the capabilities of your transceiver and antenna system.

Hamtext is excellent and should satisfy nearly everyone's radioteleprinter needs. It was easy to learn and contained a lot of helpful features.

Anyone with a popular home computer who wants to get on radioteleprinter quickly and easily should definitely consider the Kantronics products. — *Dale Clift, WA3NLO*