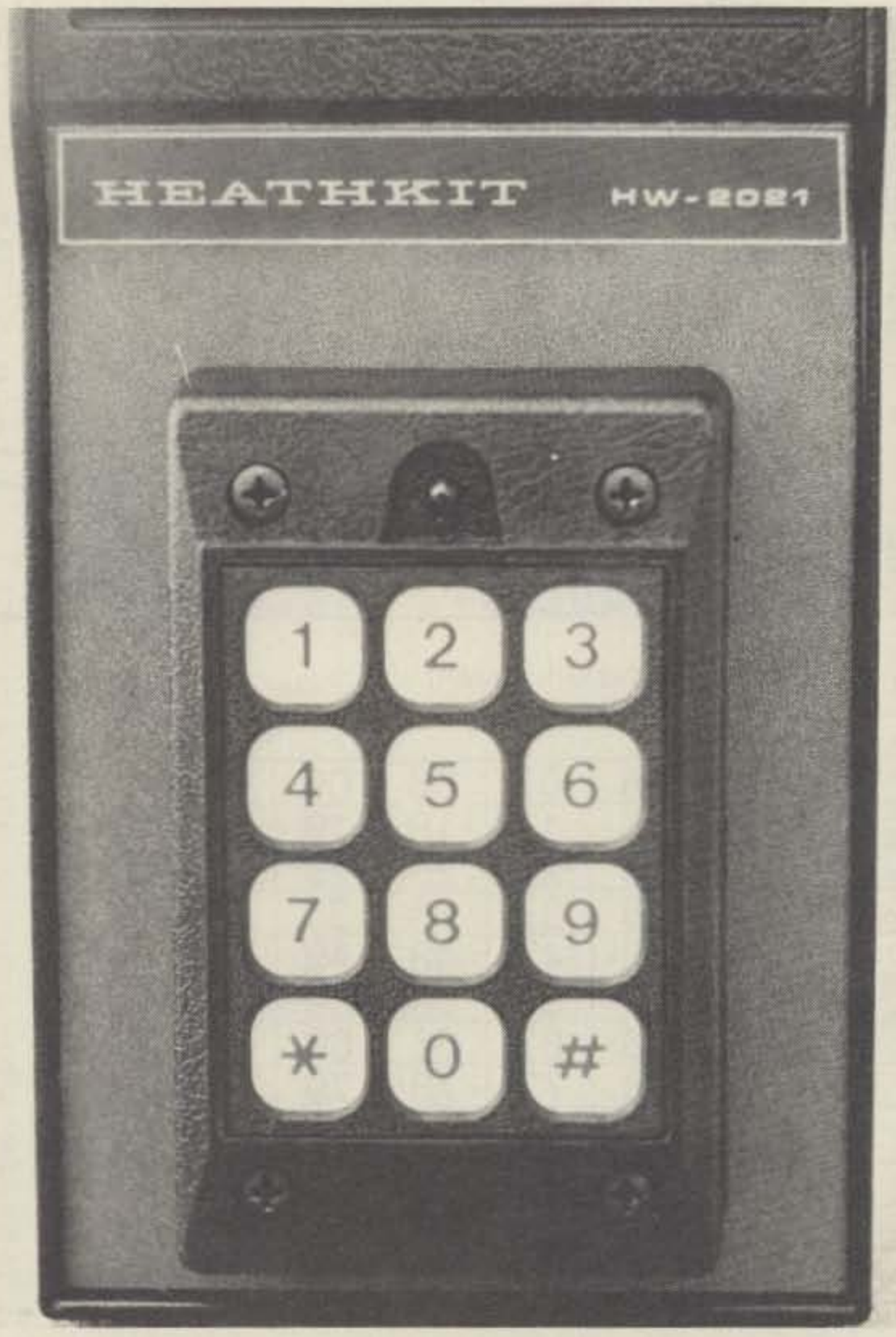
J. R. Johnson WA5RON
4558 Ave., Apt. #205
Austin TX 78751

Rock Steady

—touchtone™ stability for Heath's HW-2021



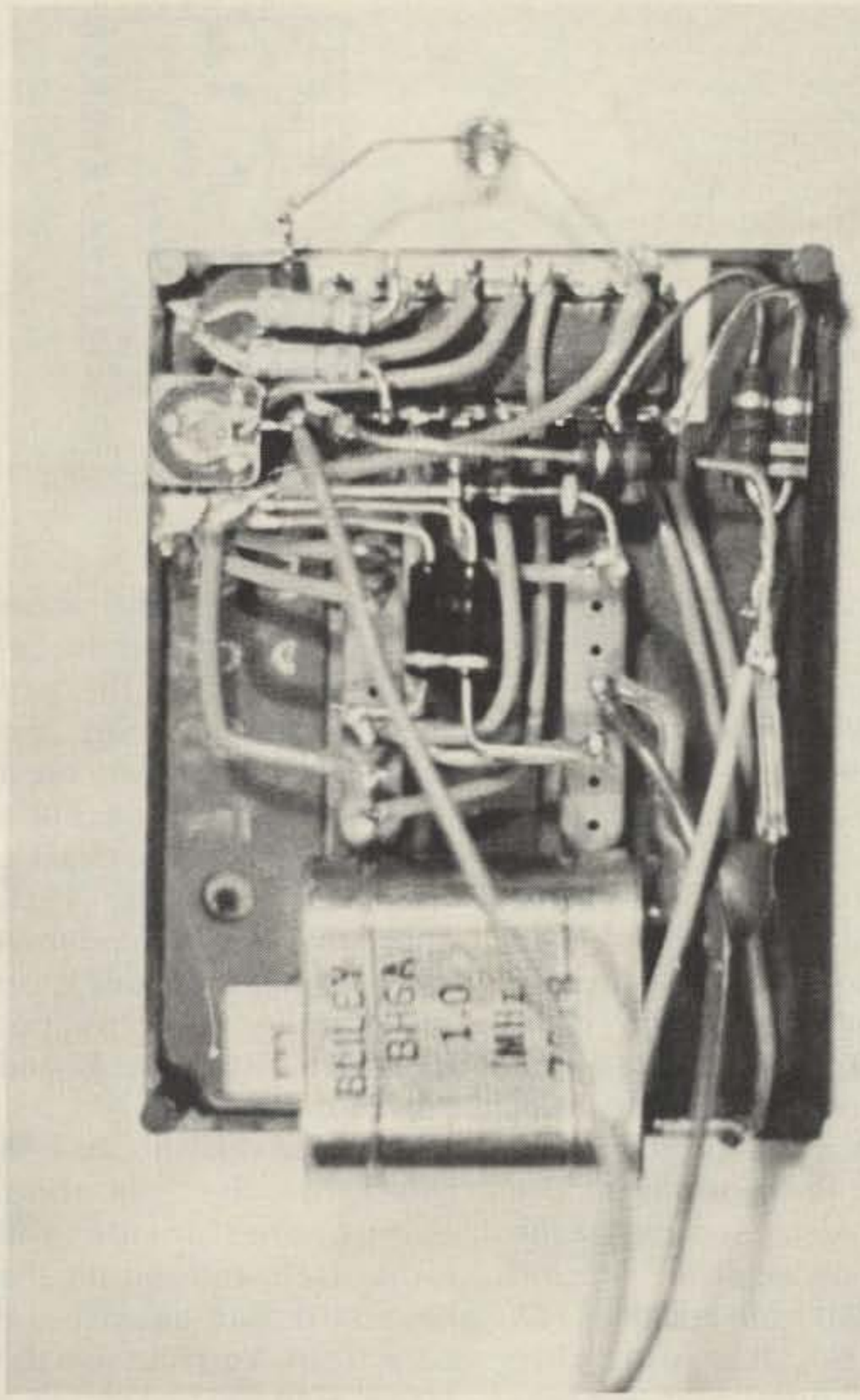
The HWA-2021-3 autopatch encoder modified for crystal frequency control.

As K4JEM reported in his review of the Heathkit HW-2021 handie-talkie,* the rig is a definite winner, considering its cost and its features, but the accessory touchtone™ encoder from Heath leaves a lot to be desired. I had heard from many of my friends on 2 meters of the troubles that they had encountered trying to tune the encoder's tones on frequency, with or without a frequency counter. Several gave up and sent their new rigs to a Heath service shop to be tuned. The rigs that have made it on the air seem to lack reliability in accurate number dialing, and their owners report that the frequency of the tones varies with time and probably temperature changes as well.

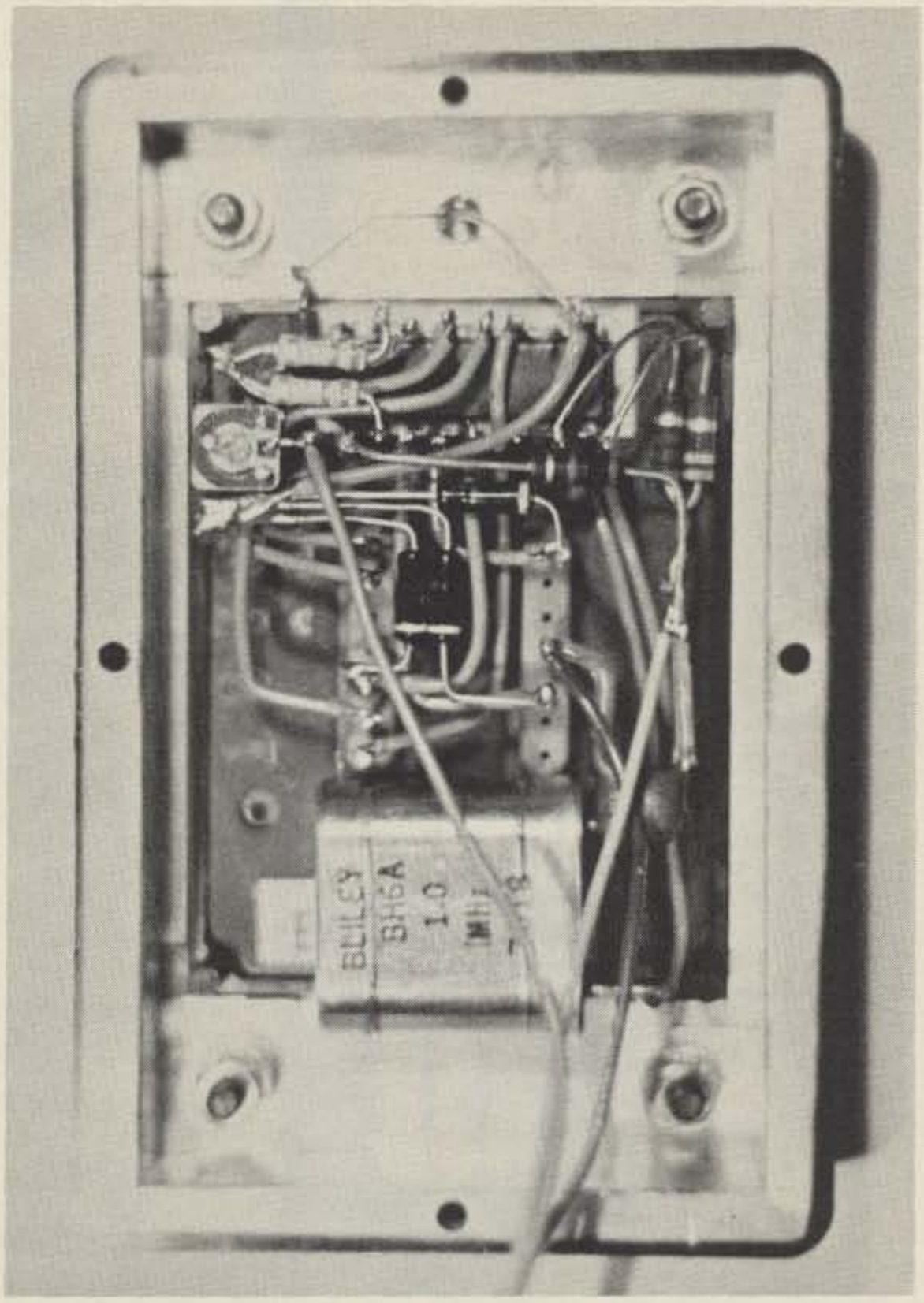
Allen found a problem with the values of capacitors supplied with the HWA-2021-3 kit, but, beyond that, it looks to me like any tone encoder circuit employing NE555 oscillators controlled by resistance-capacitance networks will suffer instabilities due to environmental factors that will make them only marginally suitable for tone encoding. This seems especially true in this handie-talkie application, which one expects to carry outdoors in hot and cold weather, and particularly unnecessary considering the availability of crystal-controlled circuits. Therefore, I expect that there are a number of Heathkit 2021 owners who have installed the encoder accessory but are not happy with it.

I volunteered to build the HW-2021 kit for a fellow ham who had purchased the encoder kit as well. I knew that I didn't care to go through the problems that others had had in getting the encoder to work, nor did I want to build a device for my friend that would be unreliable in the future.

*"Heath HW-2021 Review," S. M. Allen K4JEM, *73 Magazine*, August, 1977, p. 160.



Components mounted and wired on the back of the 12-button keyboard.



Keyboard is cemented into the plastic case. Metal coating must be removed from inside edge of case for cement to adhere properly.

When the transceiver was finished, I decided to use the HWA-2021-3 enclosure and keyboard, but replace the NE555 circuit with a Motorola MC14410 tone generator. The MC14410 is controlled with a 1000 kHz crystal for more than adequate frequency precision and stability and has enough audio drive for the HT's input circuit.

I wanted to preserve the function of the LED that Heath put on the encoder to let the user know that he is pressing a key (you can't hear the tones) and have a finished product that outwardly appears to be "stock" Heathkit and interfaces with the HT in the same way as the original HWA-2021-3. The modification described is rather extreme, in that one discards the printed circuit board and most of the electronic components that come in the kit. All you save are the plastic case, keyboard, LED, 10k audio level pot, ribbon cable, screws, and perhaps a resistor or two.

The schematic shows the design I came up with to generate tones and light the LED. The circuit draws no current unless a key is pressed, connects to the HW-2021 with the same three wires that Heath designed into their kit, and requires only an audio level adjustment. With a good quality crystal, there should be no problems with tone frequency.

The photographs show how the circuit is assembled on the back of the Chomerics keyboard. Lay the keyboard face down and attach the Motorola chip and crystal with some strong rubber cement. The chip goes at the top, with pins 1 through 8 along the top edge of the keyboard. The crystal (HC6/U size) is cemented at the bottom of the keyboard. Using the upturned IC legs, the crystal pins, and the pins on the keyboard back as tie points, all components are soldered together using

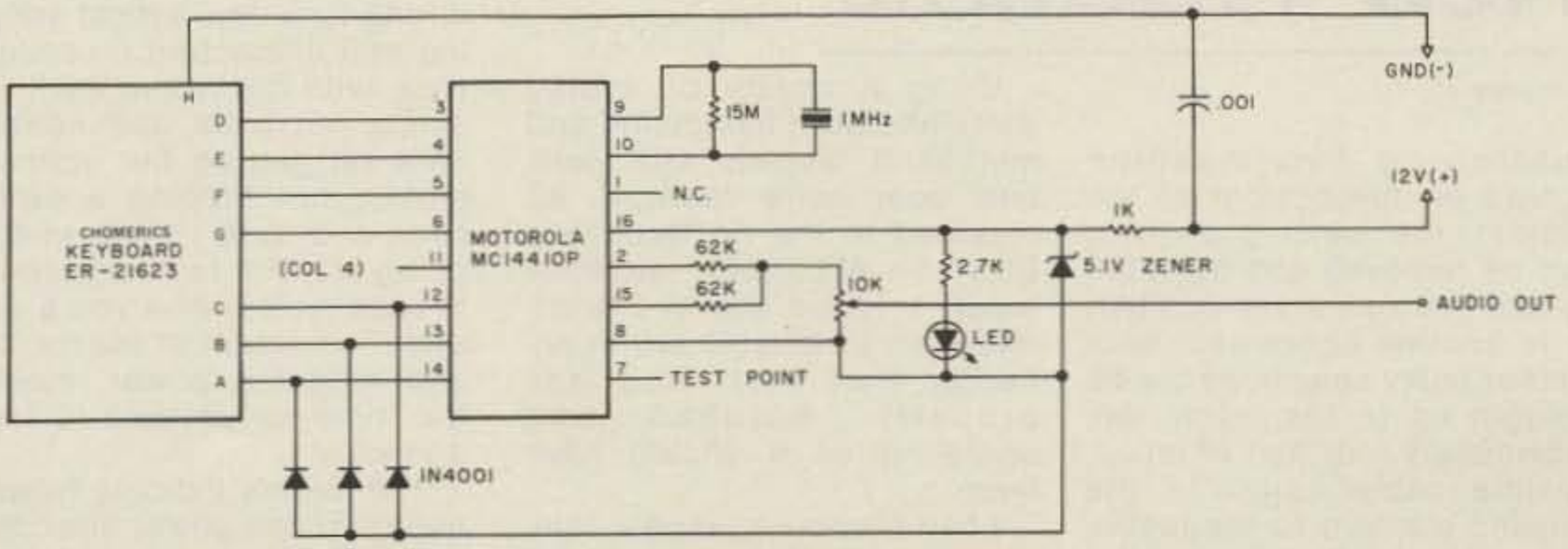
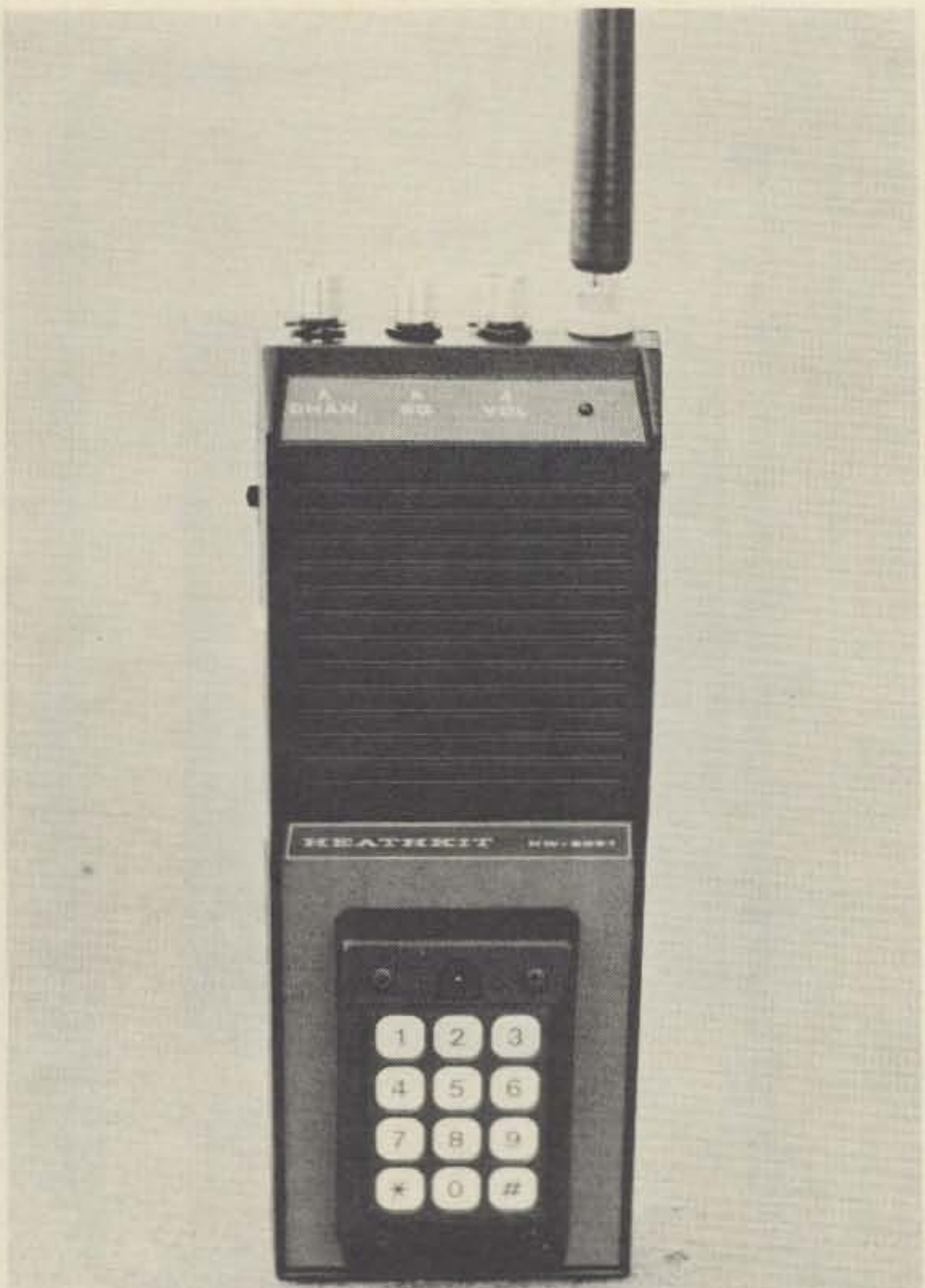


Fig. 1. Schematic and pinouts for modernizing the HWA-2021-3.



Completed HW-2021 with modified encoder pad. The internal improvements are not outwardly visible.

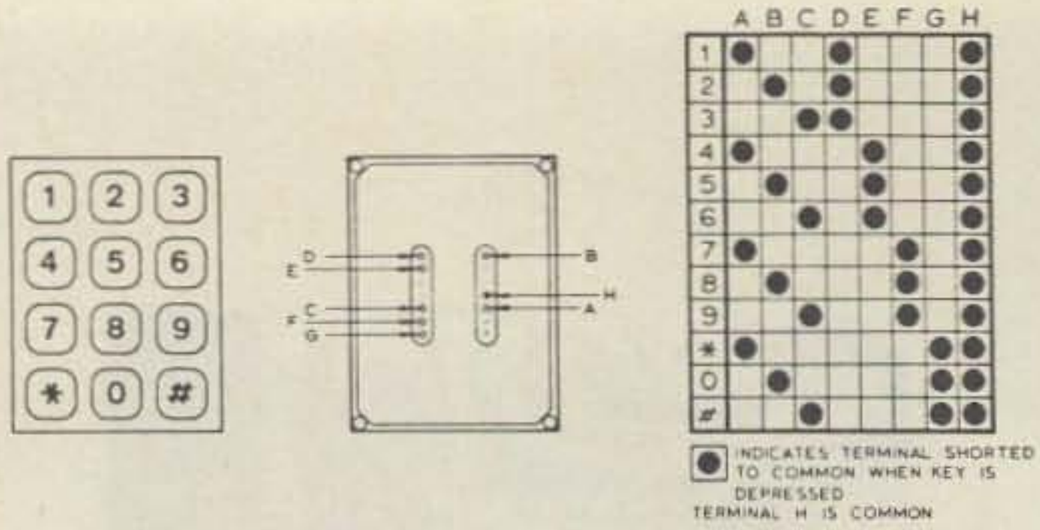


Fig. 2. Terminal connection diagram and code chart for Chomerics ER-21623 keyboard.

small solid wire. The LED sticks out on its leads and resistor in position for fitting into its hole when the keyboard is mounted in the plastic case. When soldering, be careful not to overheat the keyboard connections, as plastic parts can melt, ruining your keyboard. Solder quickly, using a low-wattage pencil with a clean tip. When the wiring is completed, attach the 3-wire ribbon and connectors supplied by Heath and connect it to your transceiver. Test the encoder on the air and have another station help you set the audio level to make sure everything is working. It will be easier to work on any problem now before the keyboard is cemented into the case.

If everything checks out, prepare the plastic case by scraping the metallic coating from the inside edge of the large square opening. The edge of a sharp knife or a fingernail file can be used, but take care not to remove any plastic and enlarge the hole. Also scrape some metal away from around the small hole for the LED. Locate the machine screws, nuts, and washers that would be used to hold the circuit board to the case in the original kit and mount them in the case. These screws now serve no function except to fill the holes for appearance's sake. Set the keyboard assembly into the case to make sure that everything fits properly, then remove it and coat the keyboard edge with a toluene-base plastic cement. Fit the keyboard into the case again, checking that the cement evenly fills the gap all around, and set the assembly face down on a nonadhering surface. Put a drop or two of the plastic cement behind the LED, and leave your encoder to dry overnight. Mount it on the handie-talkie as per Heathkit instructions, and you're in business.

It is also possible to find room for the electronic components inside the radio itself and mount the keyboard flat against the case front. You can use the larger size keyboards or a 16-button pad. The fourth column connection from a 16-key pad goes to pin 11 on the chip, and you will need to wire an additional 1N4001 diode to this pin as well. If you haven't purchased the HWA-2021-3 kit but are considering adding touchtone to your rig, I would recommend buying the keyboard and parts and rolling your own for a neat, slim appearance. ■

New Products

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unscrewing two machine screws on the bottom of the cabinet, the sensing element can be removed and installed behind the operating position or in another convenient spot so that bulky coax need not be brought up to the meter. Approximately four feet of small, flexible cable connects the sensing element to the meter, allowing a wide range of installation positions.

Using a variety of endfed wires and both monoband and multiband dipoles with coax and open wire feeders, all matched to the rig through a DenTron MT-2000A antenna tuner, I found the W-2 wattmeter an invaluable aid in ensuring that everything was properly matched and operating as it should have been.

I had previously used a combination swr/relative power meter that required constant switching back and forth between the forward, reflected, and power output positions during tune-up—a most annoying and distracting procedure. Now, with the W-2 in the line, I simply sit back and concentrate on getting the optimum match, not flipping a switch back and forth to see what is going on. The two large, easy-to-read meters give you a constant indication of the forward and reflected power, making the tune-up process quicker and safer.

The meters indicate forward and reflected power directly in Watts. To convert the reflected power reading into swr, you simply refer to the easy-to-use swr calculator in the operating manual or the graph on the handy card that can be posted on the wall or some other convenient spot close to the operating position. However, you'll quickly become familiar with the conversion factor and won't even need to check the manual or card to know what the swr is.

The W-2 sensor element has a slide switch to select the forward wattage (200 or 2000) to be measured. The reflected power stays at 200 Watts. The sensing element should be connected

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