BY ROBERT W. LLOYD

SEVERE WEATHER WARNING ALERTER

Low-cost add-on to weather receiver sounds the alarm if a weather "alert" is broadcast

TORNADOES, hurricanes, and other severe weather disturbances often strike in the middle of the night or at times when most people are not normally listening to the radio or watching TV. Consequently, they receive no advance warning and are unaware of the impending danger.

Residents of areas where disturbances often occur have taken to listening to transmissions from the National Weather Service stations operating on 162.40 or 162.55 MHz in most parts of the country. The receivers used for this purpose generally range from low-cost battery-powered units to vhf/FM scanners. There are also some expensive receivers with special circuitry to alert police stations, etc., to a forthcoming severe-weather announcement by the NWS.

The under-$15 circuit described here will enable you to duplicate the special alert provisions of the costlier NWS receivers. It decodes the 1050-Hz warning tone used for the alert (when it occurs) and automatically activates the normally quiet receiver. This puts your low-cost unit in the same class as the professional weather warning systems.

Circuit Operation. The circuit (Fig. 1) is essentially a controller for relay *K1*, whose normally open contacts are between the receiver audio output transformer (secondary) and the loudspeaker. Thus the speaker is normally disconnected and resistor *R1* provides a substitute load. Capacitor *C1* is used to isolate diodes *D1* and *D2*, which provide signal clipping to prevent overdrive of *IC1*. Capacitor *C2* isolates the diode clip-

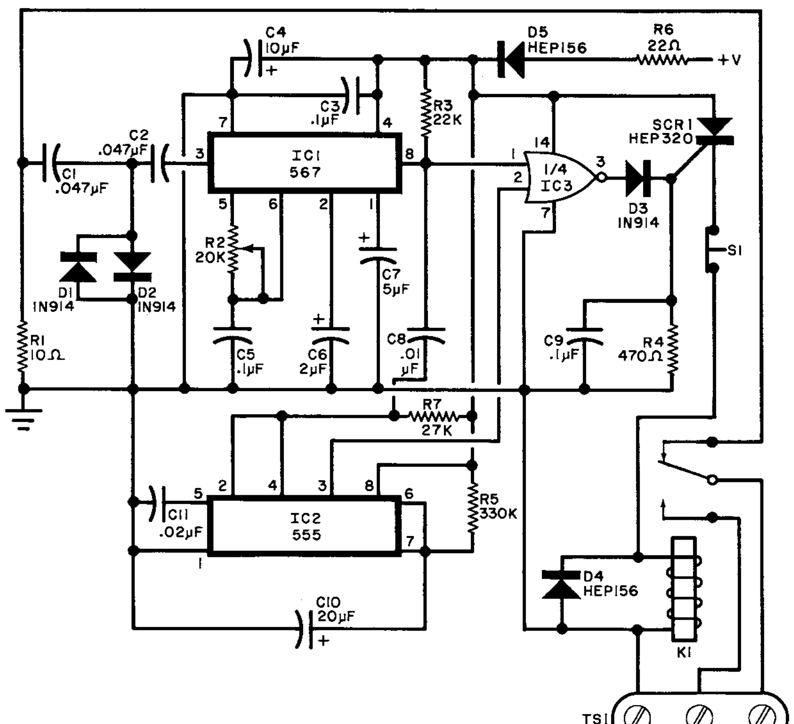

Fig. 1. When IC1 receives the alert and IC2 times out, the SCR turns on the speaker.

PARTS LIST

- C1, C2—0.047-µF Mylar capacitor
- C3,C9—0.1-µF disc capacitor
- C4—10-µF, 15-V electrolytic capacitor
- C5—0.1µF Mylar capacitor
- C6—2-µF, 15-V electrolytic capacitor
- C7—5-µF, 15-V electrolytic capacitor
- C8—0.01-µF disc capacitor
- C10—20-µF, 15-V electrolytic capacitor
- C11—0.02-µF disc capacitor
- D1,D2,D3—1N914 diode
- D4,D5—HEP156 rectifier diode
- IC1—567 phase-locked loop
- IC2—555 timer
- IC3—4001 CMOS
- K1—6-12-V, 500-ohm coil, spdt relay (Radio Shack 275-004 or similar)
- R1—10-ohm, 5-W resistor
- R2—20,000-ohm trimmer potentiometer
- R3—22,000-ohm, ½-W resistor
- R4—470-ohm, ½-W resistor
- R5—330,000-ohm, ½-W resistor
- R6—22-ohm, 1-W resistor
- R7—27,000-ohm, ½-W resistor
- S1—Normally closed pushbutton switch
- TS1—Three-connector terminal strip
- Misc.—Suitable enclosure, power supply (see text), mounting hardware, IC sockets, etc.

per from *IC1*, since any dc component at the input to *IC1* could cause false decoding.

Trimmer potentiometer *R2*, in conjunction with *C5*, determines the decoding frequency (1050 Hz) while *C6* determines the bandwidth and *C7* sets the decoder timing. When not decoding, the output of *IC1* (pin 8) is high. When *IC1* receives a tone within its locking range, the output drops low. This output is applied to one input of a gate in *IC3*. The output is also coupled through *C8* to trigger *IC2*, a 555 timer.

The timer is required because false alarms can be produced by random receiver noise or voice announcements which occasionally are at 1050 Hz. Since the signals producing false alarms are usually of short duration, but the real alert tone is transmitted for at least 15 seconds, some form of timing circuit is needed.

The output of *IC1* is connected to pins 2 and 4 of *IC2*. When a pulse appears, *IC2* resets and starts its timing cycle. Resistor *R5* and capacitor *C10* set the length of the cycle (about 10 seconds). When *IC2* times out, its output (pin 3) goes low and is applied to the input of *IC3*. When (and only when) the two inputs of *IC3* are both low, its output goes high.

As long as the 1050-Hz tone is not present at the input of *IC1*, the circuit idles, with *SCR1* not conducting and the relay deenergized. When the 1050-Hz signal is received from NWS, the output of *IC1* goes low and *IC2* starts timing. At the end of the timing cycle, the output of *IC3* goes high and *SCR1* starts to conduct through the relay coil. Then the loudspeaker is connected to the receiver's audio output and the weather bulletin is heard. Diode *D4* reduces the back emf generated across the coil and *D5* prevents damage due to application of reverse power supply. Pushbutton switch *S1* is used to reset the decoder and turn off the speaker.

Construction. Parts placement is not critical and the circuit can be assembled on perforated board or a pc board. Sockets for the IC's are suggested. Do not install the IC's before reading the following instructions on tuning. Any enclosure of suitable size can be used.

The circuit operates from a 6-12 volt dc supply. In the nondecoding state, the current requirement is about 12 mA at 6 V. If your receiver power supply is in this voltage range, uses a negative ground, and can tolerate the current drain, you can power the alarm circuit from this source. If you have a battery-operated receiver, build a low-power dc supply between 6 and 12 volts.

If you have a transformer-operated, tube-type receiver, consider picking off the 6.3-volt filament supply (if one side is grounded) and using a silicon rectifier diode and a filter capacitor (about 1000 µF).

Testing. Start with the IC's out and the circuit not connected to the receiver.

Install *IC1* in its socket and connect a dc voltmeter between pin 8 and ground (positive side to pin 8). Turn on the dc power and note that the voltmeter indicates close to the supply voltage. Connect an audio signal generator ground to the circuit ground and the hot side to the TRANS terminal on *TS1*. With the relay deenergized, you should now have a signal on the input of *IC1*.

Set the signal generator as close as possible to 1050 Hz. Adjust *R2* until the voltmeter reading drops to near zero, indicating that *IC1* is decoding. Remove the signal generator, and the voltmeter should go back to the supply voltage reading. Perform this step several times to make sure that *IC1* is operating with each application of 1050 Hz. Turn off the audio generator and the dc power.

Remove IC1 from its socket and install *IC2* in its socket. Connect the dc voltmeter between pin 3 of *IC2* and ground. Turn on the dc power. Connect a jumper to circuit ground and touch the other end to pin 2 of *IC2*. Note that the voltmeter reading is the supply voltage. After about 10 seconds, the voltmeter should drop back to near zero, indicating that *IC2* has

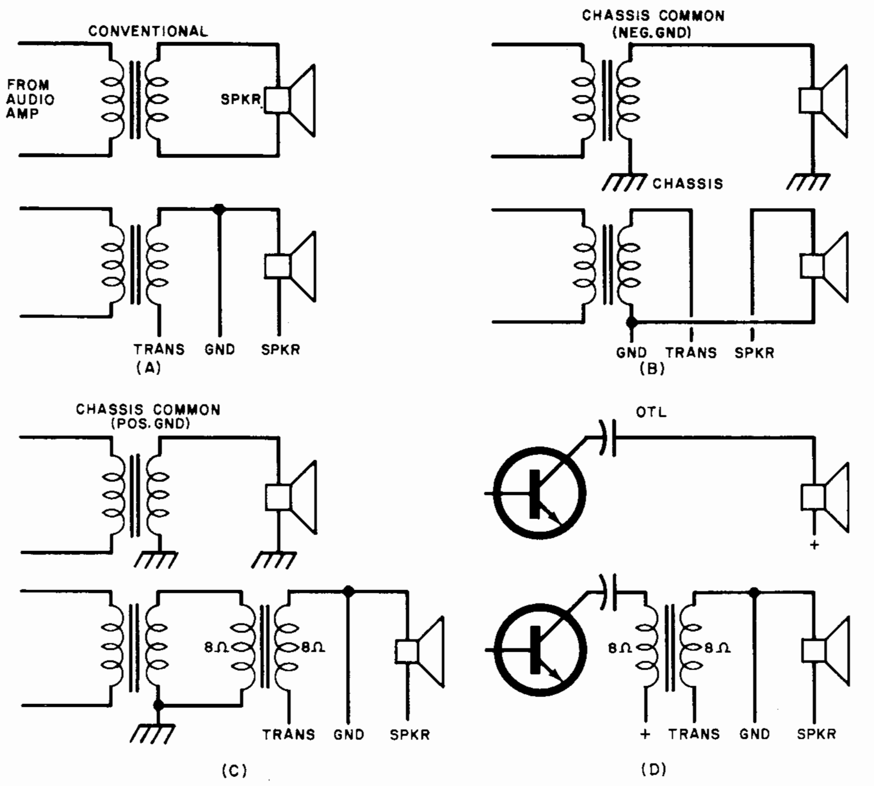

Fig. 2. Typical connections to the weather receiver speaker.

timed out. If the timing is too short, increase the value of *R5*. Conversely, if it is too long, reduce the value of *R5*. Check the timing cycle several times to make sure it is in a range of 7 to 14 seconds. Turn off the power supply and remove the jumper.

Remove *IC2* from its socket, and install *IC3* in its socket. Connect one end of a jumper to circuit ground and the other end to pins 1 and 2 of *IC3* simultaneously. Relay *K1* should close and lock in. Remove the jumper, depress *S1*, and note that the relay opens. Repeat this operation, ending with the relay closed. Remove the jumper, and connect it between the supply and either pin 1 or 2 of *IC3*. Depress *S1* and note that the relay opens and remains open after the switch is released. Remove the jumper and the dc supply.

Once all tests have been made, install all of the IC's. Apply the dc supply and put the 1050-Hz signal from the audio generator on the input. After *IC2* has timed out, the relay should close. Remove the signal input, depress *S1*, and the relay should open and remain open. The circuit is now ready for installation.

Installation. Connections to the weather receiver will vary depending on the receiver. Some typical connections are shown in Fig. 2. Note that a 1:1 8-ohm transformer is used for isolation in case the chassis of the receiver is used as the positive side of the supply (especially if you use the receiver power supply for the alerting circuit). The isolation transformer is also used in case the circuit is OTL.

If the receiver is used for other than weather reception, install a switch across the SPKR and TRANS terminals on *TS1*. Then be sure the switch is open to use the alerting circuit.

Operation. Turn on the weather radio. Tune it to your local NWS station and allow it to warm up so that it doesn't drift (assuming it doesn't have afc). Depress *S1* and you are ready to receive an alert warning. Since the speaker is now silent, you can turn up the volume to make sure that, if the alarm comes during the night, the sound will be sufficient to awaken you.

If you leave the receiver and the alerting circuit on 24 hours a day, it will be triggered between 10 and 11 a.m. each weekday when the NWS test signal is transmitted.

When a severe weather alert is broadcast, it is repeated every 10 minutes until the alert is over. This means the alarm will sound each time until you shut down the system. ◈

MORE ON WEATHER ALERTER

The "Severe Weather Warning Alerter" (May 1976) was most interesting. I highly recommend it as an add-on to low-cost vhf weather receivers, but a few comments are in order. Perhaps the National Weather Service Office in author Lloyd's area used a 15-second alert tone at the time the article was prepared, but the new nationwide standard is now a 10-second tone. Therefore, for the Alerter to work effectively under these conditions, the value of *C10* should be reduced.

During severe weather warning conditions, the warning is repeated every couple of minutes, but the alert tone is sent only *once*, with the initial broadcast. If a new warning is required, another warning tone is sent with its initial broadcast. Our latest directive stipulates that tests of the warning signal be conducted every day, including weekends, between 10 AM and 1 PM.

Incidentally, Congress has recently designated the NWS vhf broadcast network as a primary means of disseminating attack warnings. These would also be preceded by an alert tone. — *John R. Hughes, Jr., National Weather Service, Detroit, MI.*