LOW-COST CW ELECTRONIC KEYER

KANG K.P.S.

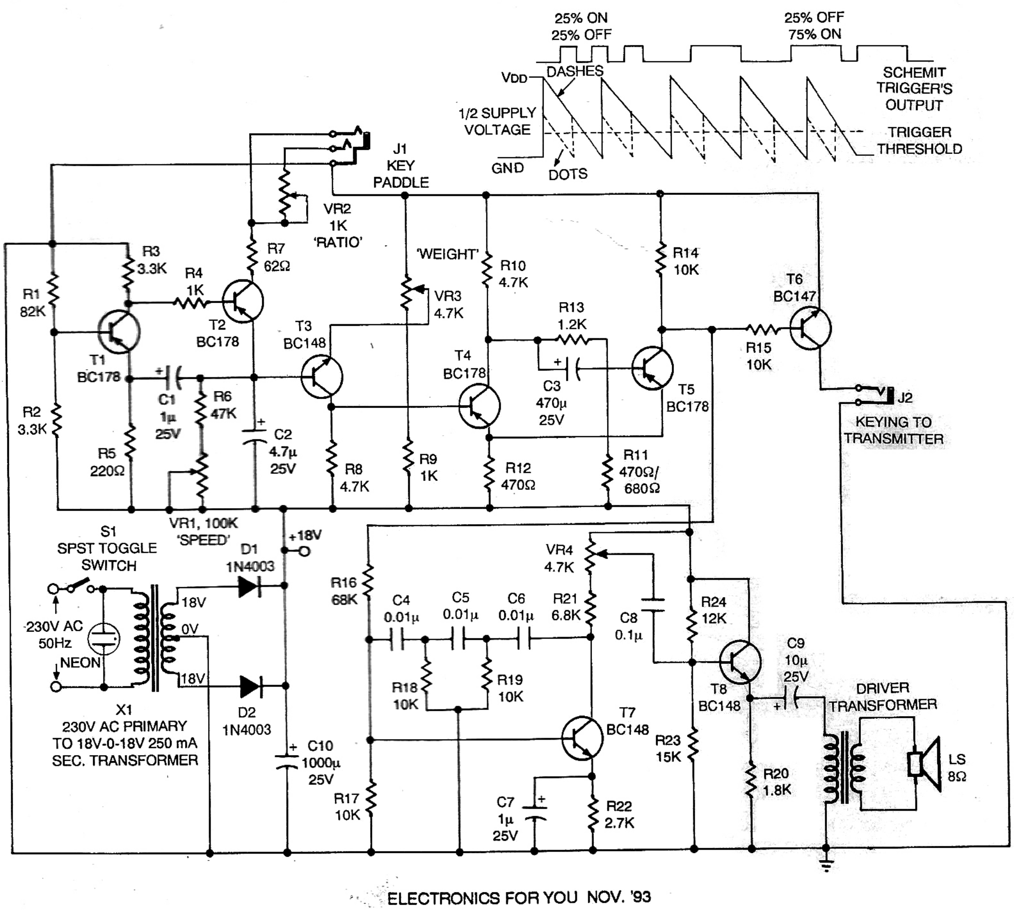
The ultimate in transmission of CW (carrier wave) signals is accomplished when an operator uses a fully automatic electronic keyer which helps in sending near-perfect code.

Many CW operators would prefer to use an electronic keyer. But the high cost of sophisticated automatic units is somewhat prohibitive while the cheaper versions incorporate too many circuit compromises to make their use worthwhile.

The more expensive electronic keyers are rather complex devices which use flip-flops, steering diodes and sometimes relays too. The complexity of such units necessitates the use of many expensive components. Therefore, these keyers are out of reach for the average radio amateur.

The electronic keyer described here is believed to be excellent on these grounds, fully automatic and still low in cost. It uses ordinary components. A simple multimeter is all that is needed to adjust it. Once the 'ratio' and 'weight' controls are correctly adjusted, the only control to be varied is 'speed' which can be adjusted to suit the needs of operator. The speed can be set at 8 wpm to 40 wpm. A pleasent tone confirms to the operator precisely what he is sending.

The master timer for the keyer is a Sawtooth generator consisting of transistors T1 and T2. When either of the paddle leads is grounded via key con-



tacts, dots and dashes are formed. When the key is in open position, T1 conducts but T2 is biased off because of the conduction state of T1.

When the key/paddle is pressed in either the dot or the dash position, T2 conducts slightly and starts charging C2. As the capacitor charges, the voltage change is coupled from the emitter of T2 to the emitter of T1 through feedback capacitor C1. The voltage change is amplified by T1 and applied directly to the base of T2, further increasing its conduction. The net result is that C2 charges even more. The whole charging cycle takes place very rapidly. When this happens, T2 ceases to conduct. The base-emitter circuit of T2 is reverse biased by charge on C2. The capacitor now discharges through VR1 and R6, when the charge drops sufficiently, the entire cycle repeats. The wave shape is a sawtooth with a very fast rise time at the leading edge and a long or slow decay time following. As long as the key contacts are closed in either position, the master timer will oscillate.

In dash position, capacitor C2 charges to nearly the full supply voltage. In dot position, it never charges to the full supply voltage due to resistance VR2 in the dot lead. In fact, when ratio control VR2 is set properly, the charge on capacitor C2 is one half the supply voltage. Since the rate of discharge is almost same in dash and dot positions, the frequency of oscillations in dot position will be twice as fast as that in dash position. This is graphically illustrated in the diagram.

The ratio control (VR1) varies the speed of dots with relation to speed of dashes. This is accomplished by varying the amplitude of sawtooth wave in the dot position from the amplitude in the dash position.

As speed control (VR1) varies the discharge time of capacitor C2, the speeds of both dots and dashes can be varied at the same rate.

Transistor T3 operates as a phase invertor and also as an amplifier. The DC potential at its collector is directly coupled to the base of transistor T4. This DC level is adjustable with VR3 which serves as weight control, effectively setting the length of the dots, dashes and the spaces.

Transistors T4 and T5 form a Schmitt trigger, which can be thought of as a switch that closes when the input DC level reaches a predetermined level and turns off again when the level drops below that point. Weight control VR3, sets input triggering point of the Schmitt trigger. The figure below the circuit diagram illustrates the input and ouput waveforms of the Schmitt trigger. Time relationships between the dots, dashes and spaces are also shown.

The Schmitt trigger drives the base of transistor T6 directly. T6 is used as a switch inserted directly in the keying circuit of the transmitter. This transistor can handle currents up to 40 mA and is suitable for most valve transmitter too in cathode keying mode.

In case of more current, as in solidstate transmitters, two or more transistors can be paralleled with a series resistance of about 10k in each base circuit. The maximum collector voltage should be no more than 30 volts for this transistor. A keying relay however can be used directly in the collector circuit of T6.

The side-tone circuit employs transistor T7 as a phase-shift oscillator operating at about 800 Hz. This frequency can be varied to suit individual taste by simply changing capacitors C4, C5 and C6—all of which should however be equal in value. An increase in their value lowers the frequency while a decrease raises the frequency. Variable resistor VR4 serves as a volume control.

The oscillator is coupled to emitter-follower stage, which matches the output transformer X2. This offers some degree of isolation between the oscillator and the speaker, besides providing some power gain.

The keyer can be constructed on a piece of veroboard and housed in an attractively styled cabinet measuring 25 cms x 10 cms x 10 cms. Speaker and controls may be mounted to the front panel. A 24V transformer with simple diode rectifier is incorporated to power the circuit.

Before attempting to operate the keyer, confirm that there is no error in wiring. Turn the unit on and measure the power supply voltage, which should be 20 volts. Insert the lead of multimeter in jack J2, i.e. between the collector of T6 and ground. Close the paddle and adjust weight control for 75 per cent of full-scale meter deflection. The speed control should be set at maximum speed. Now close the key in dot position and adjust the ratio control for 50 per cent of full scale deflection on the meter. The unit is now set up and ready for use.

If any trouble is encountered with the making of dots (due to faulty key contacts), insert a 0.25μF capacitor across key contacts.

FERROUS METAL DETECTOR

PRADEEP G.

Using the circuit described here one can detect and confirm the presence of ferrous material in such small items as laminated cores, ferrite rods, toroid cores etc by placing the objects at the gap between coils L1 and L2.

Coils L1 and L2 are windings of a 0-12V, 500 mA type battery eliminator transformer whose core has been carefully removed. The metal to be detected should be placed at the 2.5cm x 2.5cm gap formed on removal of the core.

When a ferrous material is placed