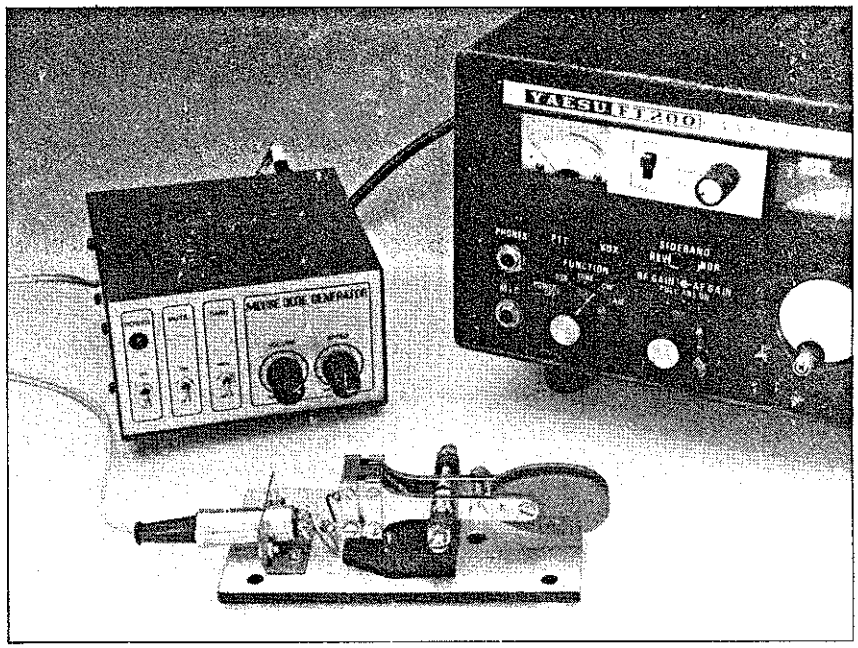
MORSE CODE GENERATOR



Ideal for both the morse trainee and the experienced operator, this low-cost, versatile, generator with relay output provides automatic timing, at a user-defined speed, of audible dots and dashes.

by D. McBright

In this circuit, four 74HC series ICs are used to produce either a string of dots, or a string of dashes. The dash has three times the length of a dot. Spacing between characters is equal to one dot. Characters are selected by shorting either of two contacts of a paddle-type key to ground. The generator allows the string of 'automatic' dashes to be replaced by dashes whose length and frequency are controlled by the operator, whilst the string of dots remains unchanged. The frequency of the dots ranges between about 130 and 910 per minute. A variable-level sidetone is available at a fixed frequency to enable the operator to hear the characters he is sending.

Output from the generator is a normally-open relay contact for connecting to the CW transmitter. A switch is included to disable the morse relay and so reduce the current consumption while practising. The morse generator is powered by a 9 V battery or by a mains adaptor with an output between 8 and 15 VDC. An internal voltage regulator supplies 5.6 V for the integrated circuits.

Circuit description

The circuit diagram is given in Fig. 1. When counting, the first divider, IC_1, divides the clock signal supplied by N_1 by 16. The oscillator operates at 128 times the dot frequency, and uses the hysteresis of a CMOS NAND gate, N_1, to give a charge-discharge cycle for R-C network (P_2+R_8)-C_8. The second divider in the circuit, IC_2, uses its first 2 stages to divide by 4; the third stage to produce dots or the first third of dashes; the fourth stage — in conjunction with the third — to produce dashes. Gates N_4 and N_3 are the respective inverters, and N_6 inhibits the final two-thirds of the dashes when dots are required. Between counts, divider 1 is reset to 15, and divider 2 is reset to 3 so that, when the appropriate contact is shorted, a character is started on the next positive edge from the oscillator. The maximum delay between a contact being actuated and the start of a character is approximately 3.5 ms at the slowest dot speed.

When either of the 2 key inputs of 3-input NAND gate N_5 is connected to ground, the load inputs of the dividers are taken logic high, and counting is started. The third input of N_5 is used in conjunction with feed-back diodes D_1 and D_2 to ensure that any character is completed if a key contact is broken early (this does not apply to dashes in the manual mode). However, a full-length dash will only be obtained if the contact is released after the first third of the character is completed, otherwise a dot of the correct length is produced.

Two of the three inputs of NAND gate N_7 mix the pulses from the dot/dash inverters, N_3 and N_4, whilst the third is keyed only in the 'manual dash' mode to make non-automatic dashes. Automatic or manual operation is selected by toggle switch S_1. The output of N_7 controls the sidetone oscillator set up around N_2, and the relay driver, T_1. Optimum sound output from the passive piezo-ceramic buzzer Type PB2720 from Toko is stated to be at a frequency between 3 and 3.5 kHz. Reasonable sound levels are, however, obtained at lower frequencies also. The sidetone oscillator frequency can be adjusted to individual taste by altering the value of R_7 between 68 kΩ (min.) and 220 kΩ (max.).

A stabilized +5.6 V is provided by a 5 V/100 mA regulator, IC_5, whose output voltage is raised by 0.6 V with the aid of a conducting silicon diode, D_3, connected between the common terminal and ground. As already noted, the circuit can be powered from a battery of a mains adaptor with DC output. In stand-by mode, the generator draws 6-7 mA from a 9 V supply; with the relay muted and characters selected, current consumption rises to about 10 mA. Total current consumption with the relay actuated depends mainly on the coil resistance.

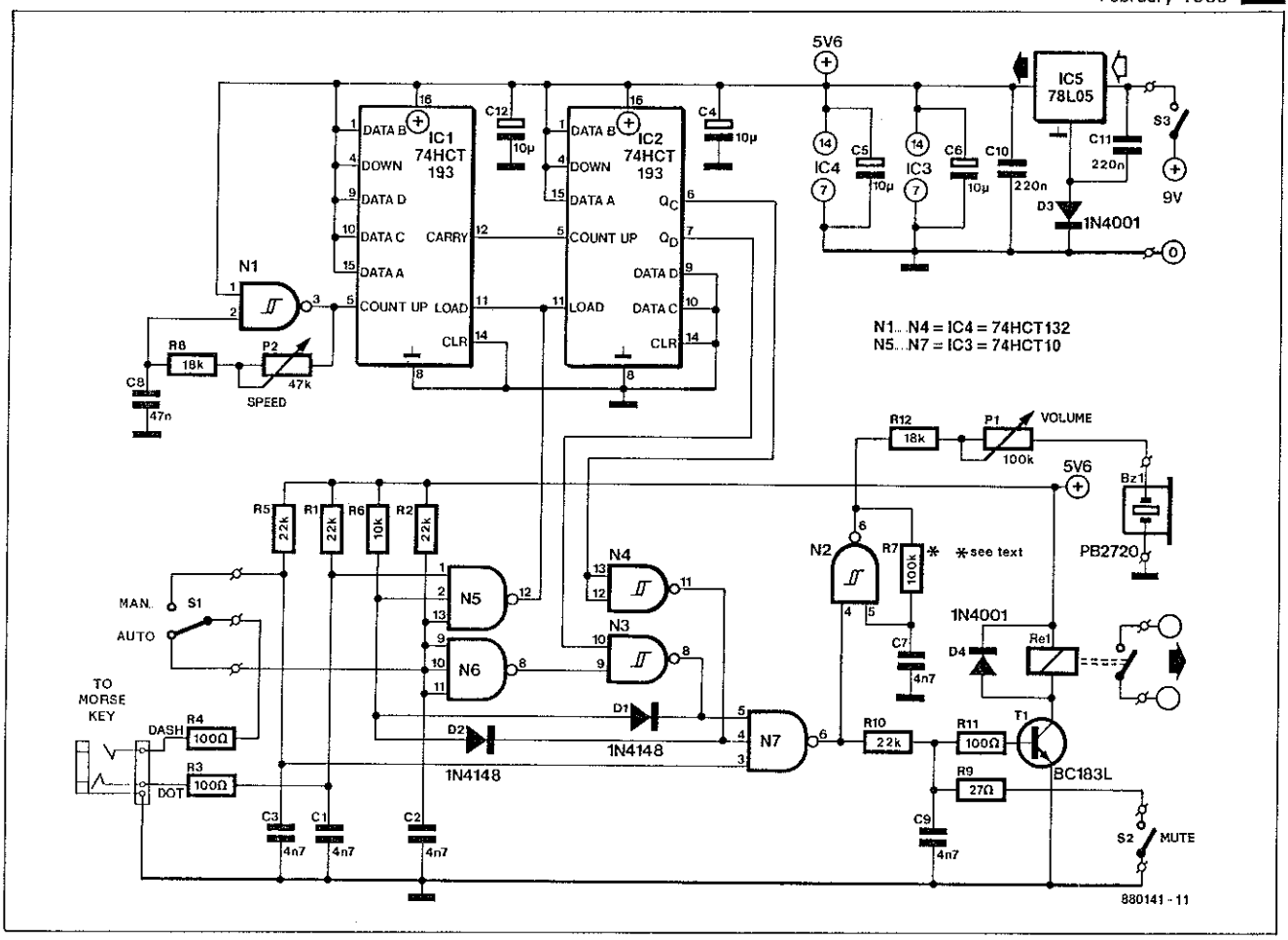


Fig. 1. Circuit diagram of the morse code generator with relay and sounder output

Construction

The generator is conveniently built on a small piece of veroboard or other prototyping board. Construction and wiring are straightforward. All ICs are fitted in sockets, and solder terminals are provided for the wires to the external controls. Whatever type of relay is used, a diode to suppress back-EMF *must* be provided as shown in the circuit diagram (this diode is integral to most, but not all, types of DIL reed relay operating from 5 V). The coil resistance of Re1 should not be lower than about 500 Ω.

The accompanying photograph shows the completed morse code generator connected to an all-mode SW transceiver Type FT-200 from Yaesu. The generator is fitted in a small metal enclosure, with all controls mounted onto the front panel and connected to the board via wires and solder terminals. The piezo buzzer is glued in place behind the vent holes at the inside of the top lid of the enclosure. The paddle-type key is connected to the generator via a short length of stereo screened wire and a 3.5 mm stereo headphone plug (fitted on to the rear panel) and mating socket. The screening of the wire is connected to the centre contact of the paddle.

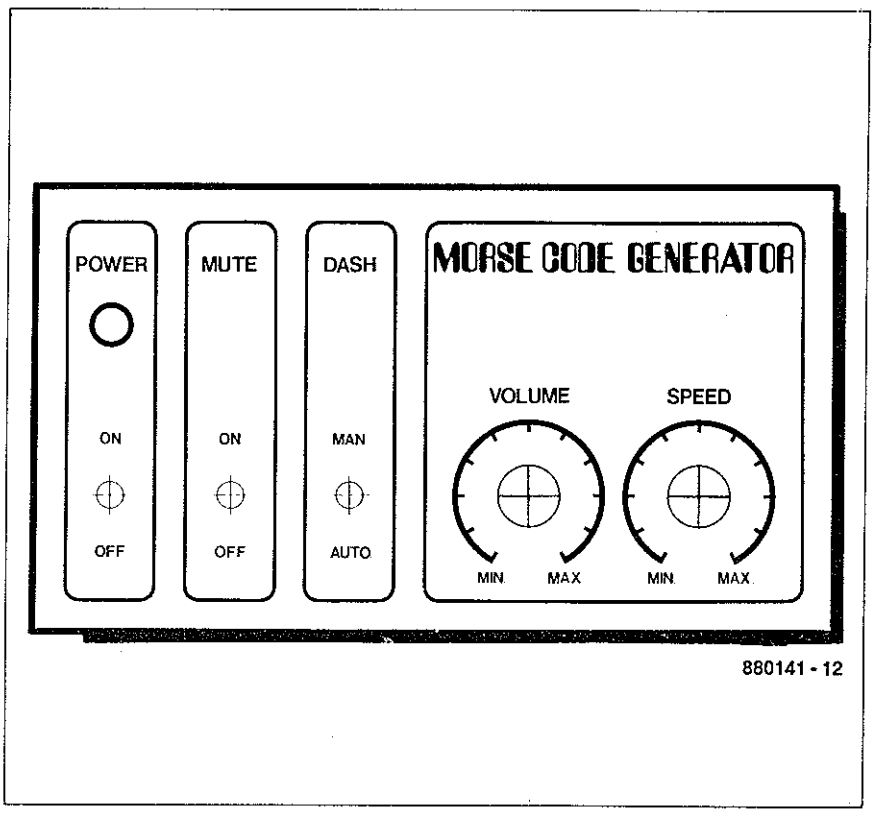


Fig. 2. Suggested front-panel layout.