Controlling stepper motors

Q I have an STK6982 (ECGl736) stepping motor driver chip and a floppy drive stepping motor with five wires, black, red, white, brown, and green. Can you help me with the circuit? Thanks. — R. K.

A Discarded floppy disk drives are a great place to get stepping motors (stepper motors); the motor you describe is a very common and useful one. It runs on 12 volts at 400 mA and provides generous torque. Unfortunately, the STK6982 (ECG1736) isn't a very good chip with which to drive this motor, for reasons we'll get to in a moment.

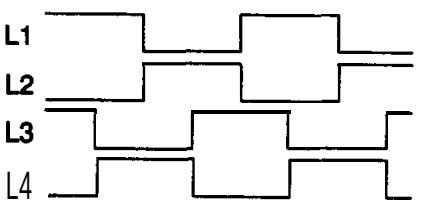

Fig. 1

To make a stepping motor rotate, you have to energize its four windings in the right sequence, as shown by the waveforms in Fig. 1. (Some other combinations will also work. A little trial-and-error is needed here.) The controller is usually used as the switch that applies voltage to the windings; on and off in this sequence.

Figure 2 shows a stepping motor controller built with ordinary, easy-to-find components. It accepts a square wave and advances the motor one step on each cycle. The square wave can come from either an external source or from an oscillator circuit, such as the one in Fig. 3.

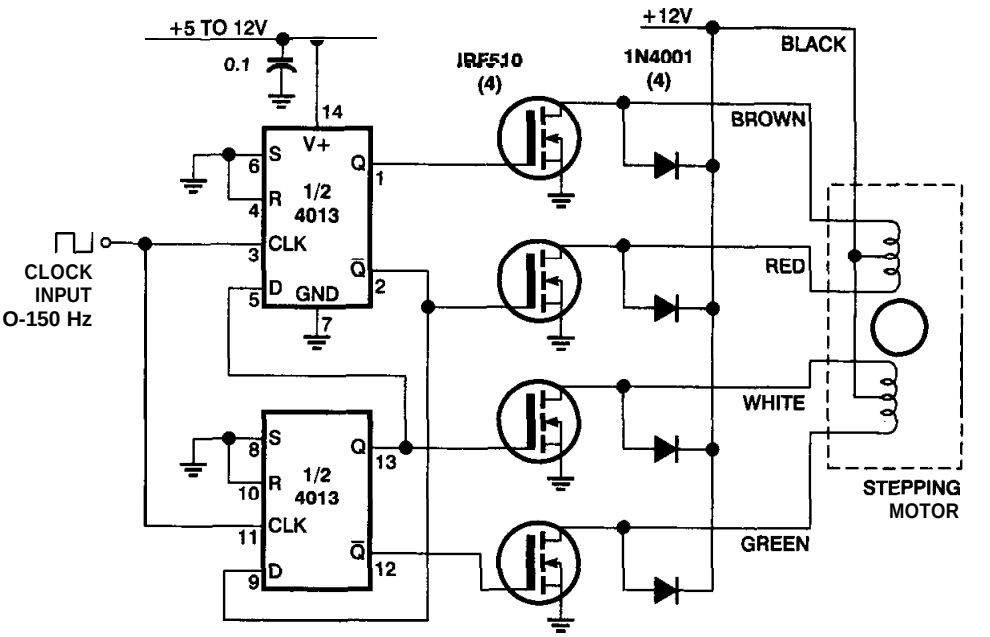

Fig. 2

Several popular ICs put this whole circuit, or something equivalent, on a single chip. Two chips of this type are the Allegro (formerly Sprague) UCN5804B and the Motorola SAA1 042A.

The SAA1042A is especially versatile because it can drive both bipolar (4-wire) and unipolar (S- and 6-wire) stepper motors. Figure 4 shows how to hook it up; your motor is the one in the middle. Other motors may use different color codes. The connections are easy to figure out with an ohmmeter plus some trial and error.

Pin 10 of the SAA1042A controls which way the motor turns; connect it either to ground or to V_{CC}. Similarly, pin 8 controls whether the motor moves in full or half steps. For logic-level compatibility, use a 5-volt supply for VCC while supplying the motor with a higher voltage (V_M). At higher voltages and currents the SAA1042A is likely to need a heat sink; with your 12-volt motor, it probably won't. Make sure the square-wave input doesn't swing below ground; if it does, the SAAl042A will skip steps and otherwise act erratic.

Now back to your STK6982 (ECG1736). That chip does the work of the power transistors in Fig. 2 but not the flip-flops that generate the waveform, so you'll have to generate the switching sequence externally. But a more serious problem is that the STK6982 contains a current limiter designed for 6-wire unipolar stepper motors — that is,

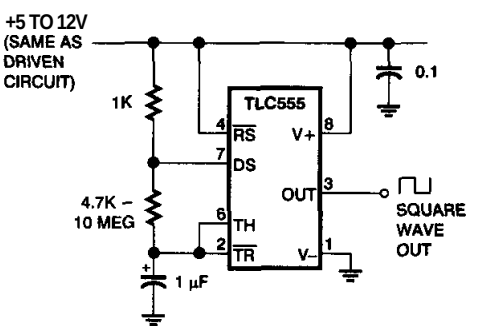

Fig. 3

motors in which the taps of the two windings are not connected together, as they are in yours. To use it, you'd have to open up the motor and separate the two connections that presently go to the black wire.

The SAA1042A costs about $17 from Motorola distributors. Data sheets are available from Motorola, PO. Box 20912, Phoenix, AZ 85036. If you decide to stick with the STK6982 (ECG1736), you can get an ECG1736 data sheet from Philips ECG, PO. Box 967, Greeneville, TN 37744.

Some useful World Wide Web

pages about stepping motors are maintained by Doug Jones at “http://www.cs.uiowa.edu/~djones/step/".

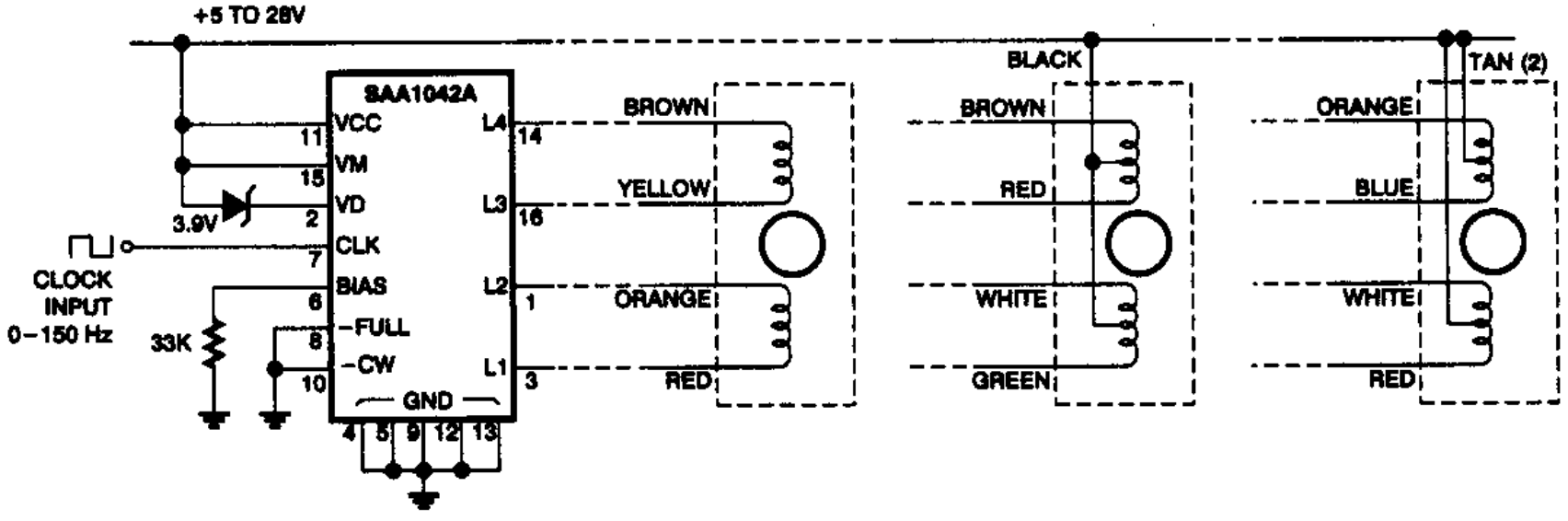
+5 TO 28V
SAA1042A
VCC
VM
VD
CLK
BIAS
FULL
CW
GND
L4
L3
L2
L1
11
15
2
7
6
8
10
14
16
1
3
4
5
9
12
13
3.9V
CLOCK INPUT 0–150 Hz
33K
BROWN
YELLOW
ORANGE
RED
BLACK
BROWN
RED
WHITE
GREEN
TAN (2)
ORANGE
BLUE
WHITE
RED

Fig. 4