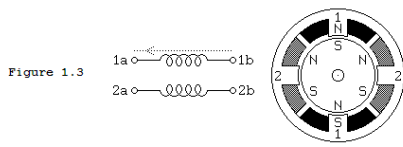


background info - see <http://homepage.cs.uiowa.edu/~jones/step/> for full story

Bipolar Motors



Bipolar permanent magnet and hybrid motors are constructed with exactly the same mechanism as is used on unipolar motors, but the two windings are wired more simply, with no center taps. Thus, the motor itself is simpler but the drive circuitry needed to reverse the polarity of each pair of motor poles is more complex. The schematic in Figure 1.3 shows how such a motor is wired, while the motor cross section shown here is exactly the same as the cross section shown in Figure 1.2.

The drive circuitry for such a motor requires an *H-bridge* control circuit for each winding; these are discussed in more detail in the section on **Control Circuits**. Briefly, an H-bridge allows the polarity of the power applied to each end of each winding to be controlled independently. The control sequences for single stepping such a motor are shown below, using + and - symbols to indicate the polarity of the power applied to each motor terminal:

```

Terminal 1a +-----+ +-----+
Terminal 1b -----+ +-----+
Terminal 2a +-----+ +-----+
Terminal 2b -----+ +-----+
time ---->
    
```

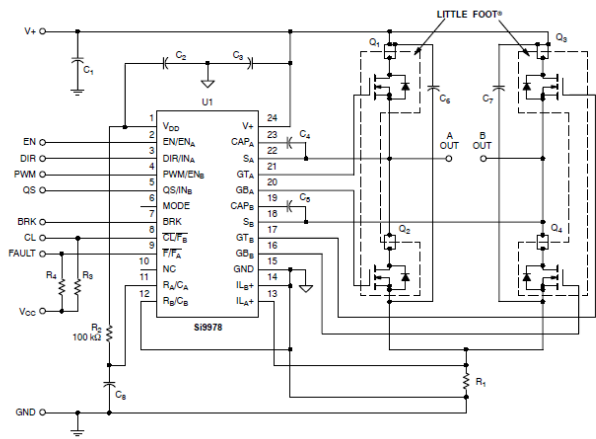
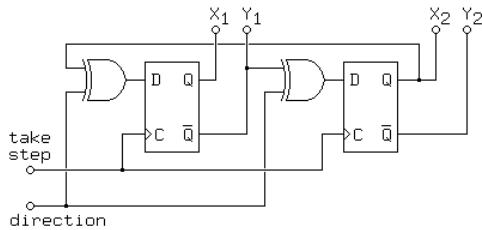
Note that these sequences are identical to those for a unipolar permanent magnet motor, at an abstract level, and that above the level of the H-bridge power switching electronics, the control systems for the two types of motor can be identical.

Note that many full H-bridge driver chips have one control input to enable the output and another to control the direction. Given two such bridge chips, one per winding, the following control sequences will spin the motor identically to the control sequences given above:

```

Enable 1 1010101010101010 1111111111111111
Direction 1 1x0x1x0x1x0x1x0x 1100110011001100
Enable 2 0101010101010101 1111111111111111
Direction 2 x1x0x1x0x1x0x1x0 0110011001100110
time ---->
    
```

Figure 6.3



ckt for step+direction signals to X1,Y1,X2,Y2 coil signals

si9978 hbridge ckt

this implements top right sequence wherein both coils are always on

(X1,Y1,X2,Y2 are the 'left' and 'right' ends of coils 1,2)

Since both coils are always on I only need to send the 'direction' signal to the si9978; the 'enable' is always on (since both coils are always on). The direction is just the X1 signal for coil1 and the X2 signal for coil 2.

So the following ckt should be ok:

Figure 6.3

