Speed Monitoring

The speed of DC and EC fans can be easily read by monitoring the Hall Effect signal from within the motors commutation. This gives an exact fan speed that can be used to determine if the fan is running slow or has stopped.

Hall Effect

A Hall Effect sensor detects the present of a magnetic field and produces a measurable output voltage. It works like a switch, when there is no magnetic field nearby it is off and when a magnetic field is close by it is on.

DC and EC motor commutation

To achieve motor rotation an alternating magnetic field is required. With a direct current supplied motor this is achieved by switching the direction of current flow. Thyristors are used in the electronic commutation circuit to switch the current flow direction. It is important to know the position of the permanent magnets within the rotor to ensure the current is changed at the correct moment. This is achieved by using Hall Effect sensor to detect when the magnet is in a defined position. A signal is sent to the microprocessor in the commutation logic that then switches on and off various thyristors to affect a change in current flow.
Figure 1 below shows the location of the Hall Effect sensor adjacent to the permanent magnet rotor and connected to the commutation logic. The commutation logic turns on and off thyristors T1 to T4 to alternate the direction of current flow i.

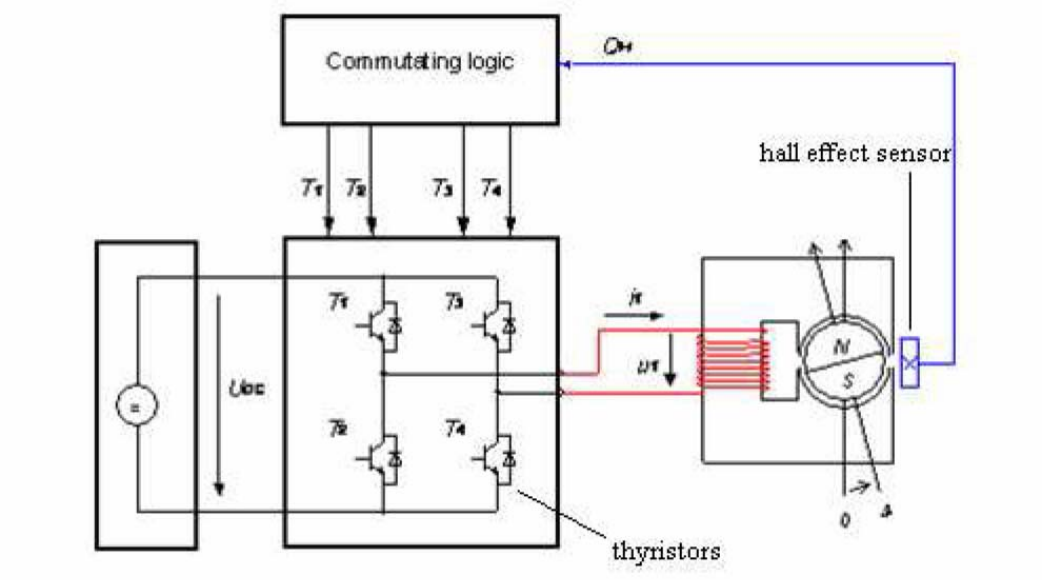

Figure 1 – schematic of 1 core DC motor

Hall Effect output signal

The rotating rotor will produce a pulsating output from the Hall Effect sensor. Figure 2 shows that a high signal is given when a north pole is adjacent to the sensor and a low signal with a south pole. The frequency of the pulse is a direct measurement of the rotational speed of the rotor. This pulse can be measured to determine the speed of the motor or whether to motor is working.

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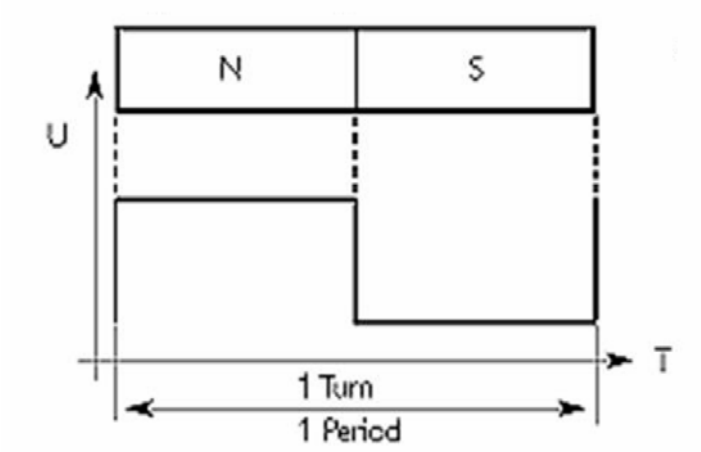

Speed Monitoring

The Hall Effects are a necessary feature of DC and EC motor commutation. Their presence provides a facility to output the signal from the motor so that the motor speed and operation can be monitored. A typical output of an open collector output amplifying the Hall Effect signal is shown in figure 3.

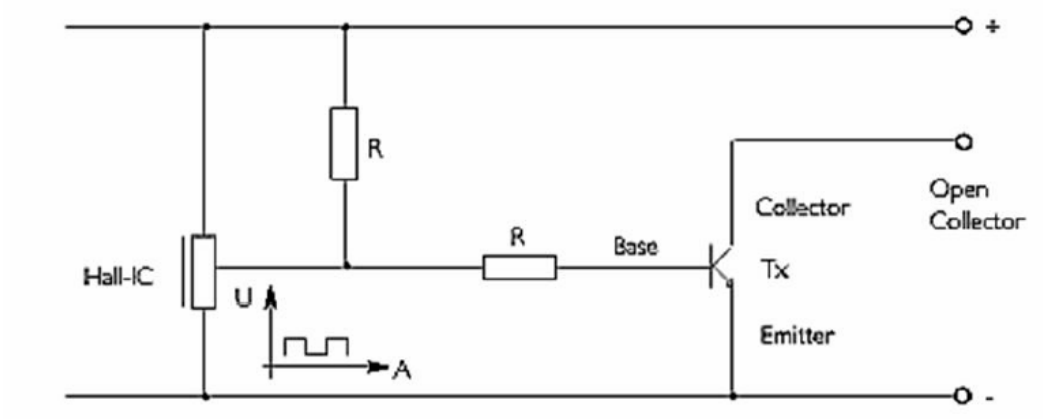

Figure 3 – circuit of an open collector output.

The output is referenced, in the case of figure 4, to the positive supply line through the pull up resistor. This sets the voltage level of the pulse. A suitable circuit, such as one with a PIC controller can be attached and used to measure the frequency of the signal to determine the rotational speed. It is important to identify the number of Hall Effect in a motor, 1 Hall Effect will give 1 pulse per revolution, 2 Hall Effects will give 2 pulses per revolution and so on.

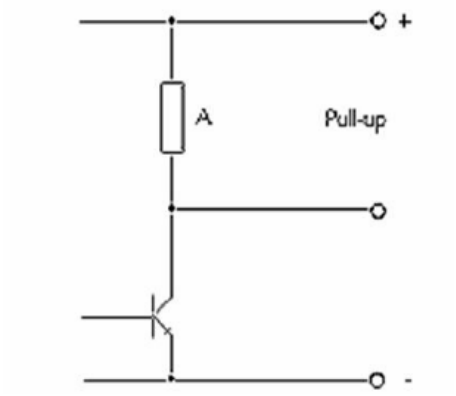

Figure 4 – circuit diagram of a pull up resistor

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