

#### I. Objectives

On completion of this experiment you will:

- Understand the functionality of the reed switch.
- Appreciate how, and where, a reed switch is positioned within a system to measure proximity.
- Determine the resolution, repeatability and hysteresis of the reed switch system.
- Be aware of any limitations of the reed switch for measuring proximity.

#### II. Theory

The operation of the reed switch is based upon the principle of magnetic induction. When a magnet, whether permanent or electromagnetic, is in close proximity to a soft iron material the soft iron magnetises. The polarity will be such the soft iron always attracts the magnet - dissimilar poles attract -but only for as long as the magnet is present. This is shown graphically in Figure 1.

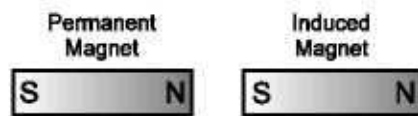


Figure 1

Once magnetised there is nothing to distinguish a permanent magnet from an induced magnet. Hence, any other soft iron material in close proximity will also be turned into an induced magnet and be attracted to the others. The ultimate limit of this process is the strength of the magnet and the overall reluctance of the magnetic circuit. This is shown in Figure 2 where all facing poles of the magnet/induced magnets are of opposite polarity and so attract.

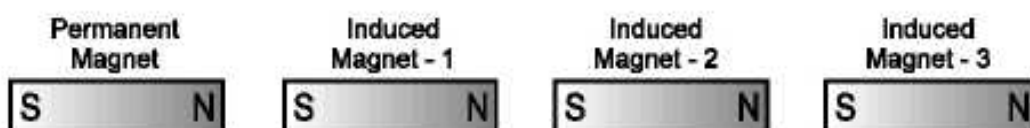


Figure 2

In the reed switch the contact material is selected because it has the properties of being a good conductor, flexible and ferromagnetic. The material used in the SIS reed switch is rhodium.

These contacts, termed leaves or reeds, mount in a sealed glass tube, to exclude air from the contacts, with access via leads at the ends. The contacts actually overlap but are normally biased to be open. That is, when there is no magnetic field the contacts will be apart and no circuit exists between the ends.

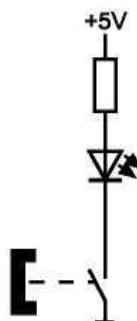
When a magnetic field of sufficient strength is adjacent to the reed switch, the contacts both become induced magnets and attract each other, causing them to close and provide a continuous electrical path through the switch. This contact closure, and opening once the magnetic field is removed, can be incorporated into a system's control processes.

The specification of the reed switch used in the SIS, would allow it to switch the power supply to substantial systems by being directly in the supply line. Where higher levels of current and power are required the reed switch can be used to control a solenoid relay of the required rating.

The object of this experiment is to investigate the operation of a reed switch in sensing the proximity of a magnet.

### III. Experimental Work

Make the connection shown in Figure 4 using one of the patching leads supplied. This circuit is shown schematically in Figure 3



**Figure 3:** Schematic representation of the reed switch

The LED indicates when the contacts are closed and the resistor limits the maximum amount of current that can flow through the switch. Set the meter to read volts (V).

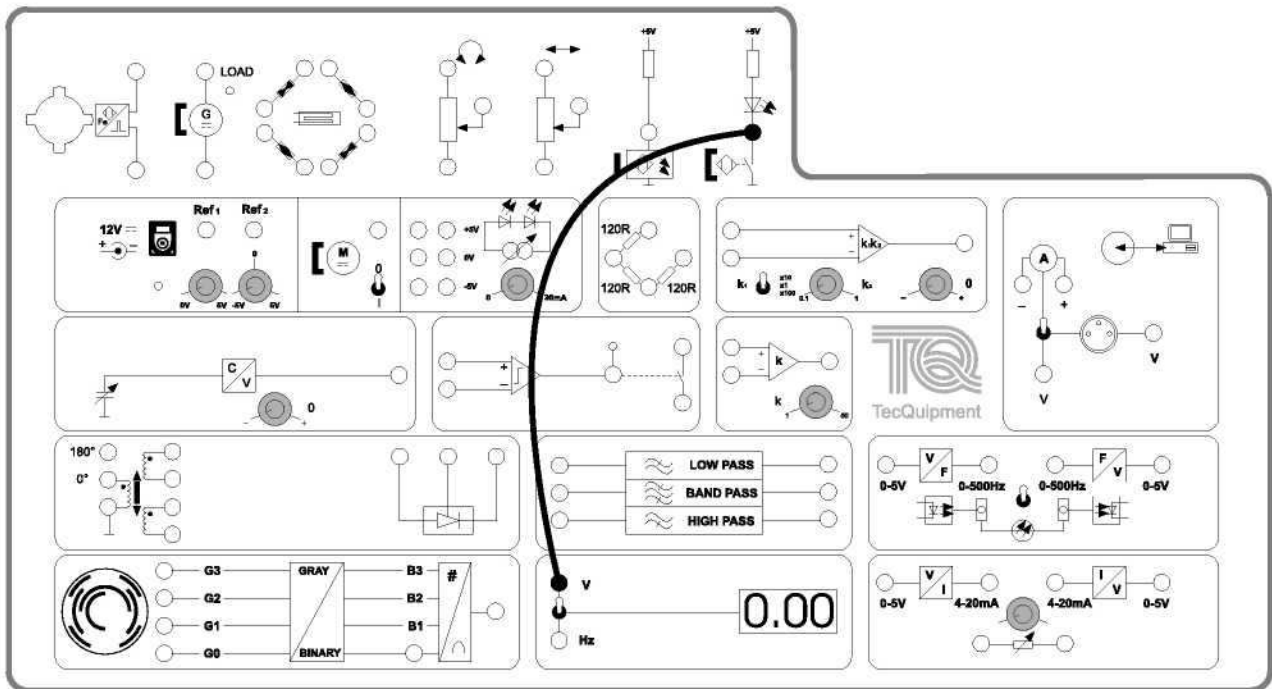
Move the Linear Assembly to the right by rotating the manual control clockwise until it reaches the end stop. Carefully adjust the dial until the zero aligns with the edge of the moulding.

In steps of 1 mm, one complete rotation of the rotary scale, move the Linear Assembly to the left over its full range of travel and record corresponding meter readings to complete Table 1. Be careful to adjust the control in one direction only throughout the procedure.

<b>Displacement (mm)</b>	<b>Output (V)</b>	<b>Contacts open/closed</b>
0		
1		
2		
3		
4		
5		
6		
7		
8		
9		

**Table 1: Results**

Where a contact closure occurs between readings return to that displacement range and, using smaller steps, determine the repeatability and the hysteresis of the measurement.



**Figure 6:** Reed switch connection diagram

#### IV. Comments and Conclusions

1. How many times was contact closure observed over the full range of movement of the Linear Assembly? Explain why this was so.
2. What would be the effect of either decreasing or increasing the strength of the magnet?
3. Suggest some applications for which the reed switch is suited.

#### Report:

Use the results obtained, observations made and the answers given to each of the questions in this experiment to write a report on the use the reed switch for measuring proximity. Include any theory you feel supports the comments and conclusions you give