# Super Precision Gyroscope

**What's included:**

1 x gyroscope
1 x electric motor and battery pack
2 x screws to attach motor to the gyroscope
1 x 'Alan'/hex key for above screws
1 x string and pull handle
2 x extensions for demonstrations
2 x 'ball' ends
1 x slot end
1 x screw for the battery box

4 AA batteries are required for the battery pack

**IMPORTANT:**

The gyroscope rotates at high speed and hence care should be taken to ensure that you do not touch the spinning disk/shaft when it is spinning. Do not drop or knock the gyroscope as this may damage or break the gyroscope (shaft or bearings). Ensure clothing such as ties, along with hair is kept away from the gyroscope when it is spinning. Keep the gyroscope away from young children and make sure older children are supervised.

**About the gyroscope**

The Super Precision Gyroscope has been designed for practical demonstrations in the work place, schools, colleges and universities. Due to the fascinating behavior it may also be appealing as an executive toy. Its size makes it small enough to be carried around with ease.

Although the gyroscope can be started with a pull string it is strongly recommended and intended that the gyroscope is started with the included electric motor and battery pack. This is because the gyroscope rotates at much higher speeds using this method, providing longer running times and greater forces. It also means that less stress is placed on the bearings when the gyroscope is started. The electric motor can be permanently connected6 to the gyroscope using the two screws supplied or can be placed against the gyroscope while it is getting up to speed. The motor can then be taken away and turned off, leaving you to do experiments with the high speed spinning gyroscope.

## Three ways to get the gyroscope spinning

**1 Electric motor (temporary)**

- Firstly ensure that a good set of batteries are in the battery pack.
- Hold the gyroscope frame (silver coloured) in one hand.
- While the motor is OFF push the motor onto the axle of the gyroscope.
- Holding the motor and gyroscope firmly together turn the motor on (switch is on battery box)
- Wait until the gyroscope gets to the required speed and pull motor away from the gyroscope
- Turn off the motor (You are now free to conduct experiments with the gyroscope)

**2 Electric motor (permanently attached)**

- This option leaves the motor to the gyroscope (can be removed later)
- To attach the motor permanently push the motor onto the axle of the gyroscope.
- Insert the two screws using the provided 'Alan' key.
- Ensure that a good set of batteries are in the battery pack
- Turn on the electric motor (switch is on the battery box).
- Wait until the gyroscope is up to full speed
- You can either choose to leave the motor on or switch it off

(the gyroscope will slow down and come to a rest over a number of minutes).

**3 String and pull handle provided**

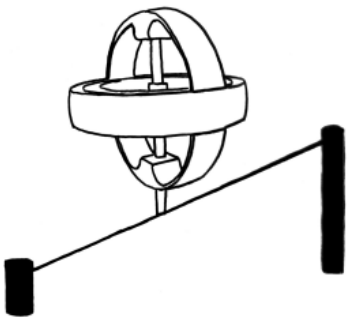
- Put one end of the string through the hole of the pull handle.
- Tie a knot around the pull handle. Ensure it is tight and secure.
- Pick up the gyroscope and hold the frame (silver coloured).
- Thread the other end of the string through the hole of the axle (do no tie it).
- Slowly rotate the shaft allowing the string to evenly wind onto it.
- (keep string away from the end of the shaft)
- Hold the pull handle in one hand and with the other hand firmly hold the gyroscope frame
- (Don't put your fingers too close to the brass disk).
- Pull the string away from the gyroscope. The gyroscope will start spinning.

**Demonstrating Gyroscopic Forces**

**Suspended by string**

Screw one of 'ball' ends into the opposite side of the gyroscope that you connect the electric drill . Start the gyroscope spinning. Hold both ends of the string and put the 'ball' end into the loop of string. Raise the gyroscope. The gyroscope will roughly maintain its angle to the horizon.

**Important:** Be ready to catch the gyroscope when it slows down.



**High Wire**

Screw the 'slot end' into the opposite side of the gyroscope that you connect the electric drill. Place the gyroscope onto taut string or wire (note the slot on the bottom). The gyroscope with remain on the wire until it slows down.

**Other demonstrations**

There are 7 places on the frame of gyroscope that the attachments can be screwed into. This allows you try out the attachments in different places and to explore the results.

## Gyroscope Specification

| | |
|---|---|
| **RPM** | 12,000rpm+ |
| **Weight** | |
| Total Weight : | 345g / 12.16oz |
| Gyroscope weight without motor : | 145.3g / 5.12oz |
| Brass disk (without shaft) : | 111.2g / 3.92oz |
| Aluminium casing, bearings and shaft weigh : | 34.1g / 1.2oz |
| Shaft (includes bearing washers) : | 4.7g / 0.16oz |
| Bearings : | 0.6g / 0.02oz |
| Aluminium casing : | 26.1g / 0.92oz |
| Screws (hold case together) : | 2.7g / 010oz |
| **Electrical** | |
| Motor Amps : | 2.5 amps / 14.5~ Watts (start up),<br>0.5 amps / 2.9~ Watts(at full RPM) |
| Motor Voltage with standard batteries : | 5.8 volts |
| Batteries : | Four 'AA' (LR6) batteries |
| **Sizes** | |
| Outer casing diameter : | 62.5mm / 2.46in |
| Brass disk diameter : | 53mm / 2.08in |
| Brass disk thickness : | 12mm / 0.47in |
| Brass disk cut-out depth : | 5.25mm / 0.21in |
| Brass disk cut-out diameter : | 40.9mm / 1.61in approx |
| Shaft Diameter (largest point) : | 3.98mm / 0.15 in |
| Motor length : | 58.2mm approx |
| Motor diameter (at largest point) : | 28.1mm approx |