Single-arm water manometer
2011-11-30

1) Allow both Port A and Port B to be open to the atmosphere. This ensures there is zero pressure difference across the water column.

2) Adjust the height of the resevoir (jam jar) to zero the water level in the main column on a convenient scale mark. This is a bit easier than sliding the entire scale up and down.

3) Connect the unknown pressure to Port A if negative, Port B if positive. Leave the other port open to the atmosphere.

4) Measure the water rise in the main column using the scale.

5) Calculate the pressure. So far, it's like a conventional manometer. However, because we're only measuring the rise in the main column, we need to account for the (very small) drop in the resevoir. The resevoir is intentionally chosen with a large diameter so the drop is very small.

If the rise in the main column is h, then the fall in the resevoir is $((d/D)^2)h$, where d and D are the inner diameters of the main column and resevoir, respectively. Therefore, the total difference in height between the water levels in the main column and resevoir is $h(1+((d/D)^2))$ and the actual pressure is given by the usual expression $P=\rho gh(1+((d/D)^2))$.

Because $(d/D)^2$ is very small (for example, 0.01 when d=5mm and D=50mm), errors or variations in the diameters of the main column or resevoir do not have any significant effect on the final pressure reading.