



So the problem with our current setup is that we have no way of determining the pressure inside the pipe, we need some way to vary the velocity other than the flow. The setup above goes from a circular pipe to a square pipe with a adjustable height gate. This way we can vary the velocity and know both of them from the mass conservation equation as:

$$\dot{m} = \dot{m}$$

$$\rho A_1 V_1 = \rho A_2 V_2$$

$$\Rightarrow V_1 = \frac{A_2}{A_1} V_2$$

Where we can get either V 's from the volume flow rate:

$$V = \frac{Q}{A}$$

To get the pressure, we need to apply Bernoulli's between the pressure gage and the atmosphere:

$$\frac{P_1}{\gamma} + Z_1 + \frac{v_1^2}{2g} = \frac{P_2}{\gamma} + Z_2 + \frac{v_2^2}{2g}$$

Since they are at the same height and $P_2 = 0$ this reduces to:

$$P_1 = \left[\frac{v_2^2 - v_1^2}{2g} \right] * \gamma$$

$$\Rightarrow P_1 = \left[\frac{v_2^2 - v_1^2}{2} \right] * \rho$$

So from here, we can get several different points of pressure without varying the flow rate, just need to vary the gate height. Now we just need to create an experiment for it.