PRESSURE SENSOR

Description D034

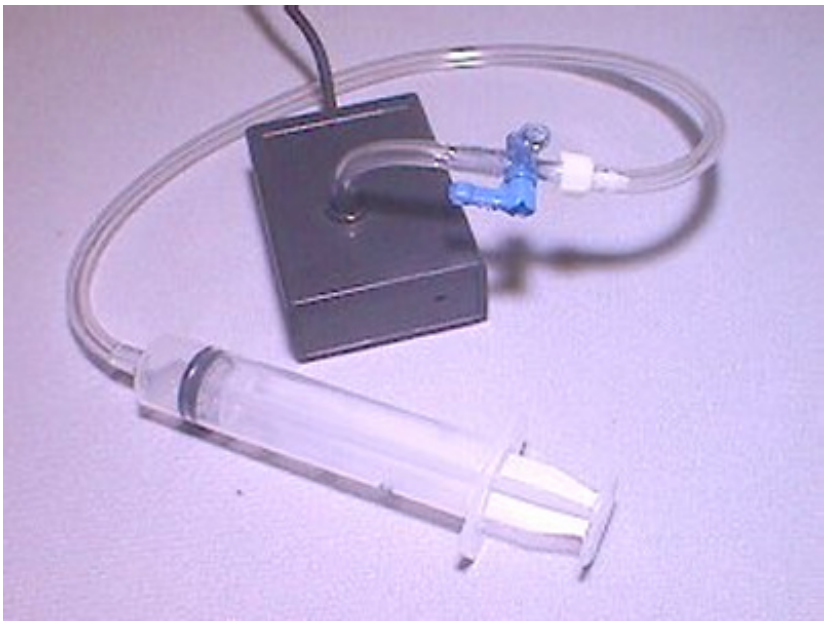
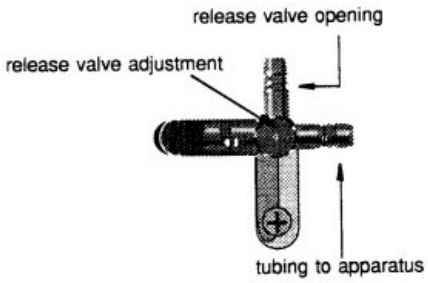


Figure 1. The Pressure Sensor

Short description

The Pressure sensor can be used to measure a gas pressure in the range from 0 up to 7 bar. The pressure is measured via a pressure valve, which is available on the top of the box. Via a release valve air can go in or out when the valve is left open, see figure 2.



As a standard, a plastic hypodermic syringe (20 cm^3), for use in simple Boyle experiments, and a plastic tube (approx. 45 cm) are supplied. The pressure sensor is delivered with a BT-plug and can be connected to the following interfaces:

- UIA/UIB through Measuring console (via 0520 adapter)
- CoachLab
- CoachLab II
- SMI (via 0520 adapter)
- Texas Instruments CBL™ data-logger.

There is an adapter (art. 0520) to connect sensors with BT-plugs to 4-mm inputs.

How the sensor works

The heart of this circuit is the SenSym SCX100ANC. It has membrane that flexes as pressure changes. This sensor is set up for absolute pressure measurement, so one side of the membrane is vacuum. The sensor produces an output voltage which varies in a linear way with absolute pressure. It includes special circuitry to minimize errors caused by changes in temperature. The amplifier inside the box conditions the signal from SCX100 sensor. The output voltage of the sensor varies between 0 and 3.4 V.
There is a plastic tube on the pressure sensor running from a port inside a box to a three-way valve on the outside of the box.
The SCX100ANC pressure sensor is fairly durable but it is designed only for use with non-corrosive gasses such as air, helium, nitrogen, etc. Do not get it wet.

Calibration

There are several ways to handle calibration with the pressure sensor. In some cases, the circuit can be used without calibration. Often only relative pressures are interesting then the raw voltage out put can be used.

The calibration shown in figure 3 has been performed with the supplied syringe. The volume of the sensor, including the connectors, is approximately 1.5 cm^3. This has been taken into account while determining the volume.

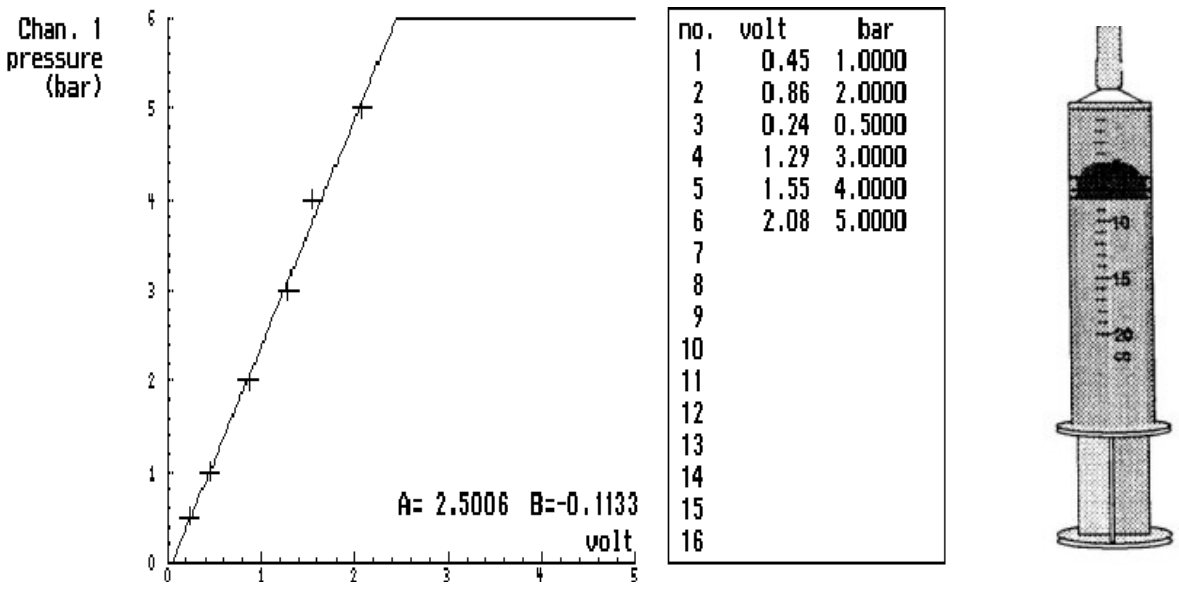


Figure 3. Calibration of the Pressure sensor: 0.40 V/bar.

The name of the pressure sensor in the sensor library of Coach 5 program is **Pressure sensor (034&bt) (CMA).**

Suggestion for experiments

- Measurements of pressure changes in gas-law experiments such as Boyle's law and Gay-Lussac's law.
- Measurements of reaction rates as a gas is produced in a chemical reaction.
- Measurements of vapor pressure of various liquids and solutions.

Boyle's law is easily be demonstrated by using the Pressure sensor. With the program Step Measurement the pressure has been determined as a function of the volume of a syringe. The tube between the sensor and the syringe has been kept as short as possible.

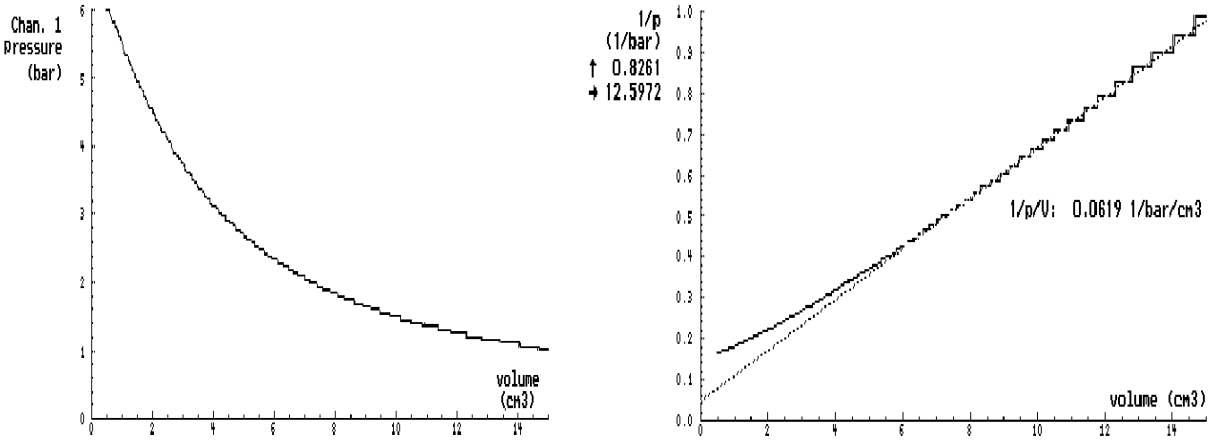


Figure 4. Experiment of Boyle, a measurement result and determination of the volume of the sensor.

Using Boyle's law, the own volume of the sensor can be determined.
A possible procedure is to calculate p^{-1} and then determine the slope of the graph. From the value of the slope and the point of intersection with the y-axis one can conclude, that the volume of the sensor is 0.8 cm^3. At high pressure the syringe will deform resulting in a measured volume which is smaller than the real volume.

Technical data

Sensitivity	0.40 V/bar
Output voltage	0 - 3.4 V
Pressure range	0 - 7.0 bar
Resolution using 12 bit 5V A/D converter	3 mbar
Connection	Tube, inner diameter 5.0 mm
Max. pressure	10 bar without permanent damage
Usage	Only for non-corrosive gasses like air, helium, nitrogen etc. Keep the sensor dry!
Stability	Approx. 0.1 % full scale
Speed	Reaction within 0.1 s
Dimensions	Internal volume sensor ± 1 cm^3 Length=8.2 cm; Width=5.2 cm; Height= 6.5 cm
Connection	 BT (British Telecom) plug
The Pressure sensor is supplied with a plastic syringe (20 cm^3) and a plastic tube (approx. 45 cm)	

In order to alter the settings you have to open the Pressure sensor and unscrew the circuit board. There are two potentiometers on the circuit board. The small round pot meter has been set in the fully counter-clockwise position (largest amplification). By turning the potentiometer clockwise, the sensitivity will decrease. To remain in the range of 0 - 3.6 V, you can adjust the offset using the larger rectangular potentiometer.

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