PRESSURE SENSOR BT66i

USER'S GUIDE

CENTRE FOR MICROCOMPUTER APPLICATIONS

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Short description

The Pressure sensor BT66i is designed to measure **absolute** gas pressure. It has two measurement ranges, which can be selected using a switch located on the side of the sensor box, 0 .. 700 kPa range and 0 .. 130 kPa range.

The pressure is measured via a pressure port located next to the switch. The pressure port has a small threaded end called a *Luer-lock.* With a gentle half turn, you may attach a plastic tube or a valve with Luer-lock connectors. You can also attach the 20-ml plastic syringe included with the sensor directly to this port.

The Pressure sensor uses the Freescale MPX5700AP pressure transducer. This element measures the absolute gas pressure – the actual gas pressure at the port with respect to a built-in internal vacuum reference (zero pressure). The sensor produces an output voltage that varies in a linear way with the absolute pressure. Special circuitry minimizes the errors that might be caused by changes in temperature. The sensor is fairly durable but it is designed only for use with non-corrosive, non-ionic working gasses such as air, dry gases and the like. *Do not* allow water or any liquids come into the sensor.

The Pressure sensor is delivered with the following accessories:
- a plastic 20-ml syringe with Luer-lock,
- two plastic tubes with an inside diameter of 3.2 mm (5 cm and 45 cm long),
- a three-way valve with Luer-lock connectors, and
- two Luer-lock connectors.

The CMA Pressure sensor BT66i can be directly connected to the analog BT inputs of the CMA interfaces. The sensor cable BT - IEEE1394 needed to connect the sensor to an interface is **not supplied** with the sensor and has to be purchased separately (CMA Article BTsc_1).

Sensor recognition

The Pressure sensor BT66i has a memory chip (EEPROM) with information about the sensor: its name, measured quantity, unit and calibration. Through a simple protocol this information is read by the CMA interfaces and the sensor is automatically recognized when it is connected to these interfaces. Notice that for the Pressure sensor each of its measurement ranges has own EEPROM information. The switch position determines which information is used. To be able to detect to which of the ranges the sensor is set first disconnect the sensor from an interface, select the desired measurement range with the switch and then connect the sensor to the interface again. If your Pressure sensor is not automatically detected by an interface

you have to manually set up your sensor by selecting it from the Coach Sensor Library.

Calibration

The CMA Pressure sensor BT66i is supplied calibrated. The output of the Pressure sensor is linear with respect to the applied pressure.

The supplied calibration functions are:

$$0 .. 700 \text{ kPa range:} \quad p \text{ (kPa)} = 171.04 * V_{out} \text{ (V)} - 41.33$$
$$0 .. 130 \text{ kPa range:} \quad p \text{ (kPa)} = 31.76 * V_{out} \text{ (V)} - 31.24$$

The Coach software allows selecting the calibration supplied by the sensor memory (EEPROM) or the calibration stored in the Coach Sensor Library. For better accuracy the sensor can be calibrated. As the signal of the Pressure sensor is linear with the absolute pressure a two-point calibration suffices.

For the ***first calibration point*** perform the following operation:
- Keep the pressure port of the sensor open to the atmosphere so it equilibrates to atmospheric pressure. When the voltage reading stabilizes, enter the atmospheric pressure, as recorded with a barometer.

For the ***second calibration point***, do *one* of the following:
- Use the syringe provided with the Gas Pressure Sensor to produce a pressure very near zero. Before connecting the syringe, push its plunger all the way in to the 0-ml mark. Connect the syringe directly to the Gas Pressure Sensor stem. To produce near-zero pressure, pull the plunger out to the 20-ml position. If your syringe and valve have a tight seal, the pressure will be ~ 0 kPa, or
- Apply pressure with a pump, measuring it at the same time with a pressure gauge.

Suggested experiments

The Pressure sensor can be used in various experiments such as:
- Measurements of pressure changes in gas-law experiments, Boyle's and Gay-Lussac's laws,
- Measurements of vapor pressure of liquids,
- Measurements of reaction rates as a gas is produced in chemical reactions.

If the sensor pressure port is left open to the atmosphere, the Pressure Sensor will display the value for atmospheric (barometric) pressure. The measurement range 0 .. 130 kPa is suitable to measure such air pressure for weather studies or to perform measurements of the air pressure over a longer period of time or at different altitudes.

Note: The value for Barometric pressure reported by airports and weather stations is usually given for the pressure at sea level i.e. pressure after it has been adjusted to its equivalent at sea level. The value obtained by this sensor will be the pressure at its current location.

Pressure Units

Pressure can be measured in many different units, the standard SI unit is the pascal (Pa).

Conversion:
1 kPa = 1000 Pa = 10 hPa = 10 millibar = 0.01 bar = 7.5 mmHg = 0.00987 atm = 0.145 psi

Equivalent values for 1 atmosphere:
1 atm = 101.325 kPa = 760 mm Hg = 14.70 psi = 1013 millibar

Technical Specifications

Sensor kind	Analog, generates an output voltage between 0 .. 5 V
Measurement ranges	0 – 700 kPa (absolute) 0 – 130 kPa (absolute)
Calibration function	0 .. 700 kPa range: p (kPa) = 171.04* V_{out} (V) - 41.33 0 .. 130 kPa range: p (kPa) = 31.76 * V_{out} (V) - 31.24
Max. Pressure	1000 without permanent damage
Sensitivity	0 .. 700 kPa range: 6 mV/kPa 0 .. 130 kPa range: 30 mV/kPa
Usage	Only for non-corrosive gasses, non-ionic working gasses such as air, dry gases and the like. Keep the sensor dry!
Long term stability	± 0.1 % full scale reading
Response time	1 ms
Connection	IEEE1394 connector for BT-IEEE1394 sensor cable. Sensor cable **not delivered** with the sensor.

Warranty:

The Pressure sensor BT66i is warranted to be free from defects in materials and workmanship for a period of 24 months from the date of purchase provided that it has been used under normal laboratory conditions. This warranty does not apply if the sensor has been damaged by accident or misuse.

Note: This product is to be used for educational purposes only. It is not appropriate for industrial, medical, research, or commercial applications.

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