PTB101B Barometric Pressure Sensor

User Guide

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Guarantee

This equipment is guaranteed against defects in materials and workmanship. This guarantee applies for twelve months from date of delivery. We will repair or replace products which prove to be defective during the guarantee period provided they are returned to us prepaid. The guarantee will not apply to:

- Equipment which has been modified or altered in any way without the written permission of Campbell Scientific
- Batteries
- Any product which has been subjected to misuse, neglect, acts of God or damage in transit.

Campbell Scientific will return guaranteed equipment by surface carrier prepaid. Campbell Scientific will not reimburse the claimant for costs incurred in removing and/or reinstalling equipment. This guarantee and the Company's obligation thereunder is in lieu of all other guarantees, expressed or implied, including those of suitability and fitness for a particular purpose. Campbell Scientific is not liable for consequential damage.

Please inform us before returning equipment and obtain a Repair Reference Number whether the repair is under guarantee or not. Please state the faults as clearly as possible, and if the product is out of the guarantee period it should be accompanied by a purchase order. Quotations for repairs can be given on request.

When returning equipment, the Repair Reference Number must be clearly marked on the outside of the package.

Note that goods sent air freight are subject to Customs clearance fees which Campbell Scientific will charge to customers. In many cases, these charges are greater than the cost of the repair.

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PTB101B Barometric Pressure Sensor

The PTB101B Barometric Pressure Sensor is housed in an aluminium case fitted with an intake valve for pressure equilibrium. It uses the unique Barocap® silicon capacitive pressure sensor developed by Vaisala.

1. Introduction

The sensor is fabricated from two pieces of silicon, with one piece acting as a pressure sensitive diaphragm and the other acting as a rigid support plate. Pressure variations deflect the sensitive diaphragm and change the sensor's capacitance. This capacitance is measured and linearised, and an analogue voltage output indicates the ambient pressure.

2. Specifications

2.1 Performance

Operating range:	600mB to 1060mB (hPa)
Temperature range:	-40°C to +60°C
Humidity range:	Non-condensing
Linearity*:	±0.45mB
Hysteresis*:	±0.05mB
Repeatability*:	±0.05mB
Calibration uncertainty**:	±0.15mB
Total accuracy at 20°C***:	±0.50mB
Total accuracy:	
+20°C	±0.50mB
0°C to +40°C	±1.5mB
-20°C to +60°C	±2.0mB
-40° to +60°C	±3.0mB
Drift:	<±0.1mB per year
Overpressure limit:	2000mB

2.2 Electrical

Supply voltage:	10V to 30V DC
Supply voltage sensitivity:	<0.1mB
Current consumption:	<4mA in operational mode, <1µA in shutdown mode
Output voltage:	0 to 2.5V DC
Load resistance:	10kΩ minimum
Load capacitance:	47nF maximum
Ext. Trig. ON/OFF voltage:	0V DC off, 5V DC on
Warm-up time:	1 second

2.3 Physical

Size:	60mm x 97mm x 22mm
Weight:	85g
Mounting hole centres:	76.2mm (3 inches)

* Defined as ±2 standard deviation limits of end-point non-linearity, hysteresis error or repeatability error.

** Defined as ±2 standard deviation limits of the inaccuracy of the working standard in comparison to international standards (NIST).

*** Defined as the root sum of squares of the above four errors.

3. Installation

The PTB101B will be supplied either as part of a complete Weather Station, in which case the unit will be wired as shown in Figure 1, or as a separate unit, when the following installation instructions should be followed.

3.1 Condensation

To prevent condensation install the sensor in an environmentally protected enclosure, complete with desiccant which is changed at regular intervals. As the sensor must detect the external ambient pressure the enclosure must *not* be 'hermetically sealed' unless a vent pipe (fitted with an in-line desiccant capsule) is used between the sensor pressure port and the outside of the enclosure.

CAUTION Failure to protect the sensor from condensation may result in permanent damage.

NOTE If it is necessary to make a vent hole in the outer wall of an enclosure, do not make the hole in one of the vertical side walls, as wind blowing around it can cause transient changes in pressure.

3.2 Mounting

The mounting hole spacing for the sensor is such that it will mount directly onto the grid of holes in Campbell Scientific ENC enclosures. Mount the sensor with the pressure port pointing vertically downwards so that water cannot enter the sensor.

A clip and screw are supplied with the sensor for mounting to 35mm wide DIN mounting rails. These are *not* required for mounting in ENC enclosures.

NOTE You will need to connect a wire between the case of the sensor and the system ground for screening purposes as a connection to ground is not guaranteed when screwing the sensor to the chassis plate.

3.3 Wiring Details for Short Cables (5 metres or less)

A general view and wiring details are shown in Figure 1. No cable is supplied with this sensor (unless it is supplied as part of a Campbell Scientific configured weather station, where the colours shown are used). The AGND terminal should *not* be used for short cables.

3.4 Wiring Details for Long Cables

When using cables of over 5 metres the voltage drop in the GND wire could induce an offset error. In this case make the measurement differentially with the AGND terminal connected to the input LO terminal and the VOUT terminal to the HI terminal. Connect the cable screen to the datalogger power ground terminals for electrical screening.

3.5 Jumper Settings

The PTB101B has two operating modes, 'continuous' and 'shutdown'. It is normally supplied in the 'shutdown' mode, in which the unit is turned on and off by a control signal from the EXT. TRIG. connection. In this mode, power consumption

is minimised but the sensor is subject to a 1-second 'warm-up' delay. To avoid the need for this delay the unit can be used in the 'continuous' mode, in which the sensor is powered on permanently. This can be achieved either by connecting the EXT. TRIG. terminal to a continuous 5V supply or by installing a jumper between the two pins on the circuit board. The jumper pins are accessed by removing the sticker positioned just below the large label which shows the serial number, etc. (see Figure 1).

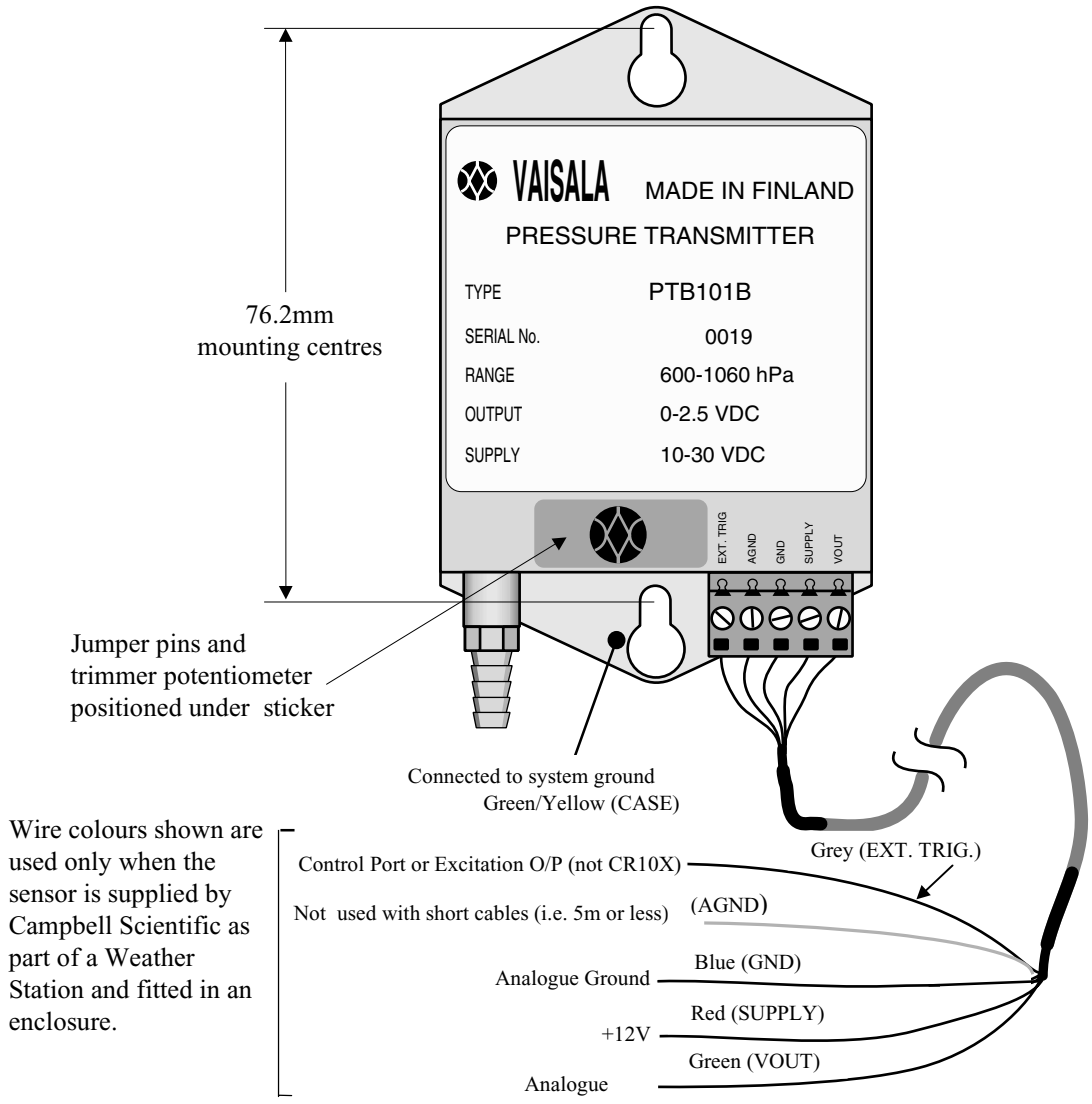

Figure 1 General View and Wiring Details for Short Cables

4. Programming

Two example programs are given, one using a CR10X digital output (i.e. a control port) and the other using a 21X excitation output. (It is not possible to run the PTB101B from a CR10X excitation output as 5000mV is required to guarantee turn-on of the sensor.)

Using a control port to turn on the sensor needs less power than using an excitation output.

4.1 Example Program using CR10X Digital Output

```
01:      P86     Do
    01:   41     Set Port 1 high        C1 is connected to Ext. Trigger
```

The following instruction simply provides a 1-second delay to allow the sensor to warm up.

```
02:      P22     Excitation with delay
    01:   1      Excitation channel
    02:   0      Delay with excitation
    03:   100    Delay after excitation (1 sec.)
    04:   0      Excitation in mV.
03:      P1      Voltage (SE)
    01:   1      Rep
    02:   5      2500mV Slow integration
    03:   2      In channel 2
    04:   3      Input location 3
    05:   0.184  Multiplier
    06:   600    Offset
04:      P86     Do
    01:   51     Set Port 1 low
```

4.2 Example Program using 21X Excitation Output

```
01:      P4          Excite, delay, sense
    01:   1          Rep
    02:   5          5000mV Slow integration
    03:   4          In channel 4
    04:   2          Excitation channel 2
    05:   100        1 second delay
    06:   5000       Excitation mV
    07:   4          Input store location
    08:   0.184      Multiplier
    09:   600        Offset
```

Both of the above examples give a result in millibars (hPa).

5. Measurement Interpretation

Most barometric measurements are referred to sea level, while the results given by the PTB101B are the local pressure at the weather station. The measurement can be corrected to sea level if the altitude is known (contact your local meteorological service for their recommended correction). The corrections involved can be significant: e.g. at 1000mB, at 20°C, barometric pressure will decrease by 1.1mB for every 10 metres increase in altitude.

6. Calibration

Recalibration is recommended once per year for best accuracy. An offset potentiometer is positioned under the small sticker, below the large label (see Figure 1). This potentiometer can be used to make small adjustments to the output (±2mB).

For a complete recalibration the sensor must be returned either to Campbell Scientific, your local Vaisala agent or directly to a reputable calibration laboratory, e.g. the UK Meteorological Office.