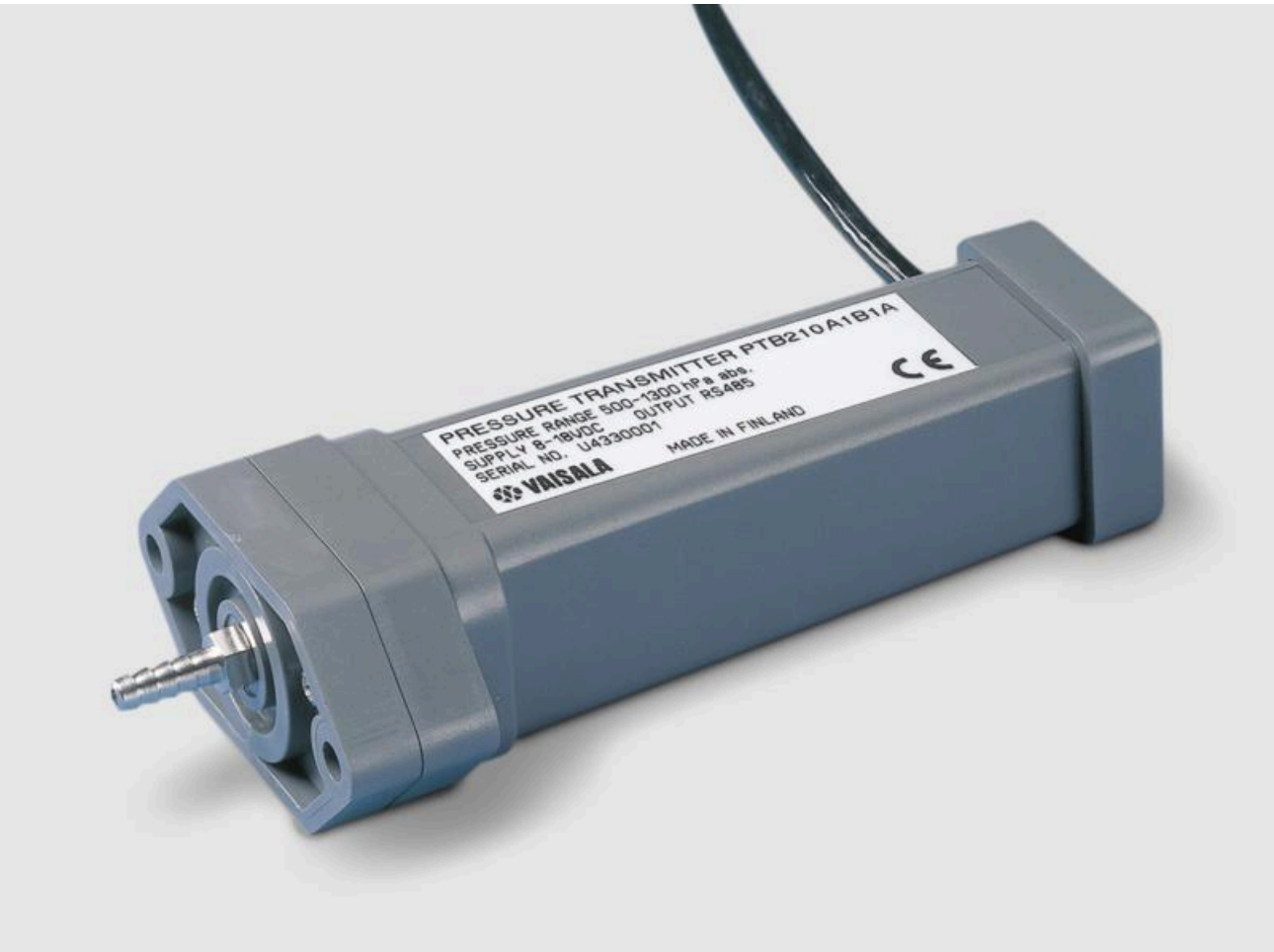
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USER GUIDE

PTB210

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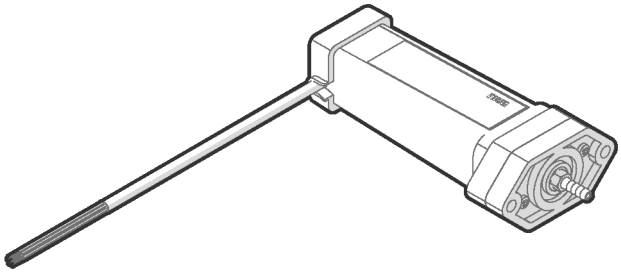


M210669EN-E

User Guide

Digital Barometers with Serial Output

PTB210 Series



VAISALA

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1. About this document

1.1 Version information

This document provides instructions for using Digital Barometer PTB210.

Table 1 Document versions (English)

Document code	Date	Description
M210669EN-E	June 2021	• Updated serial output information • Updated specifications
M210669EN-D	June 2009	Previous version

1.2 Documentation conventions

WARNING! Warning alerts you to a serious hazard. If you do not read and follow instructions carefully at this point, there is a risk of injury or even death.

CAUTION! Caution warns you of a potential hazard. If you do not read and follow instructions carefully at this point, the product could be damaged or important data could be lost.

Note highlights important information on using the product.

Tip gives information for using the product more efficiently.

Lists tools needed to perform the task.

Indicates that you need to take some notes during the task.

2. Product overview

2.1 PTB210 product overview

PTB210 is designed for various pressure ranges. It is available in 2 pressure ranges in 3 configurations:

- Serial output for 500 ... 1100 hPa
- Serial output for 50 ... 1100 hPa
- Analog output with different scalings between 500 ... 1100 hPa

PTB210 is ideal for outdoor installations and harsh environments. PTB210 is designed to operate in a wide temperature range, and the electronics housing provides IP65 (NEMA 4) standardized protection against sprayed water.

The rugged corrosion-resistant housing in combination with the small size facilitates easy installation and a long lifetime for the barometer.

PTB210 is ideal for use in applications such as weather stations, data buoys, ships, airports, and agrology. It is also an excellent solution for monitoring barometric pressure in industrial equipment such as laser interferometers and engine test benches.

In addition, PTB210 integrates directly with Vaisala Static Pressure Head Series SPH10/20. This pairing offers accurate measurement in all wind conditions.

PTB210 is digitally adjusted and calibrated by using electronic working standards. A higher accuracy barometer, which is fine-tuned and calibrated against a high-precision pressure calibrator, is available for the 500 ... 1100 hPa pressure range.

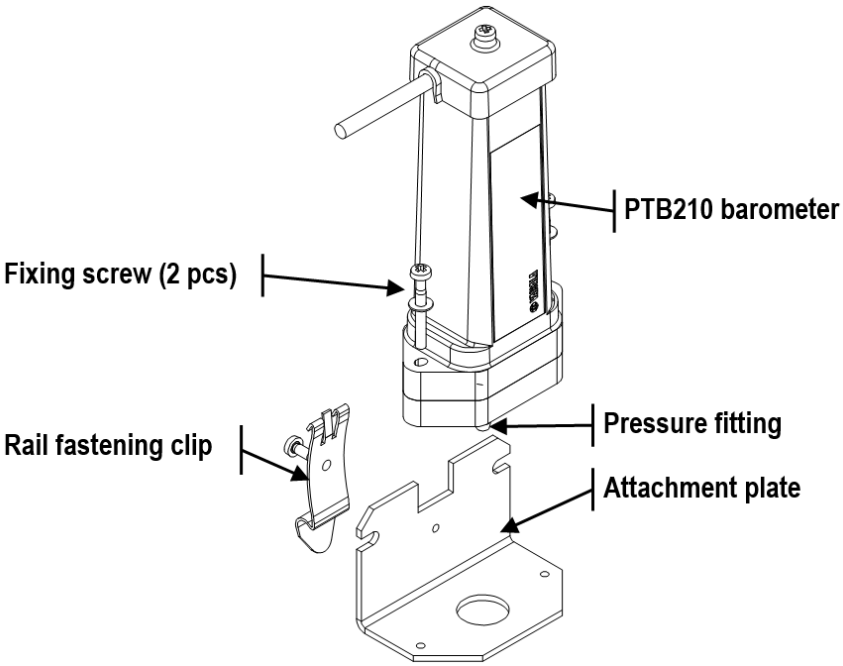


Figure 1 PTB210 with standard accessories

PTB210 uses the Vaisala BAROCAP sensor, a silicon capacitive absolute pressure sensor developed by Vaisala for barometric pressure applications. The Vaisala BAROCAP sensor provides excellent hysteresis and repeatability characteristics and outstanding temperature and long-term stability. PTB210 is delivered with a traceable factory calibration certificate.

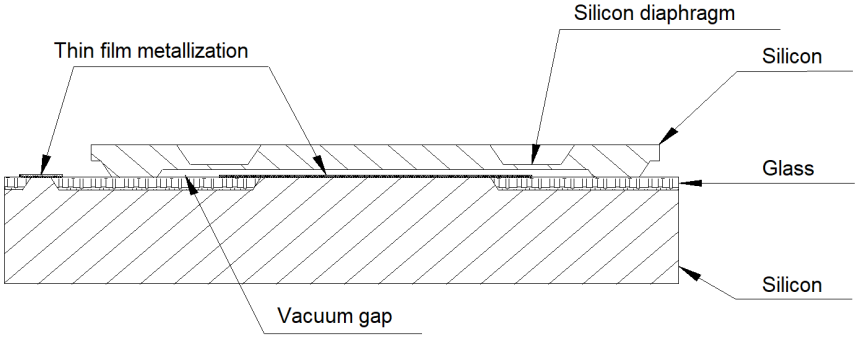


Figure 2 BAROCAP pressure sensor

The BAROCAP® pressure sensor consists of 2 layers of single crystal silicon having a layer of glass between them. The thinner silicon layer creates an integrated vacuum reference chamber, and forms a pressure-sensitive silicon diaphragm. The thicker silicon layer is the rigid base plate of the sensor, and it is clad with a glass dielectric. Thin film metallization has been deposited to form a capacitor electrode inside the vacuum reference chamber. The other electrode is the pressure-sensitive silicon diaphragm.

The coefficients of thermal expansion of silicon and glass materials used in the BAROCAP® pressure sensor are carefully matched together to minimize the temperature dependence, and to maximize the long-term stability. The BAROCAP® pressure sensor is designed to achieve zero temperature dependence at 1000 hPa, and its long-term stability has been maximized by thermal ageing at an elevated temperature.

2.2 Safety

WARNING! Only licensed experts may install electrical components. They must adhere to local and state legislation and regulations.

2.3 Trademarks

Vaisala® and BAROCAP® are registered trademarks of Vaisala Oyj.

Windows® is either a registered trademark or trademark of Microsoft Corporation in the United States and other countries.

All other product or company names that may be mentioned in this publication are trade names, trademarks, or registered trademarks of their respective owners.

3. Installation

3.1 Mounting PTB210

Due to the compact design of PTB210, you only need to mount the instrument and connect the wires. Choose one of the following 3 mounting options.

- Remove the pressure fitting and place the barometer on a desired structure. Attach it with slot-headed screws the O-ring sealing the attachment (A).
- Fix the supplied attachment plate to a desired place and attach the barometer on the plate with the supplied screws supplied (B).
- Attach PTB210 to a standard rail (DIN 35) with the attachment plate and clip (B). Fasten the clip and barometer to the plate with the screws supplied. Attach the clip to the rail.

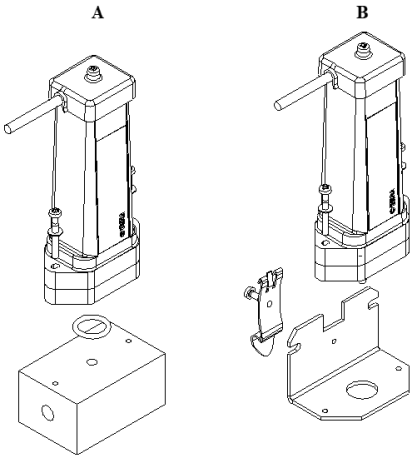
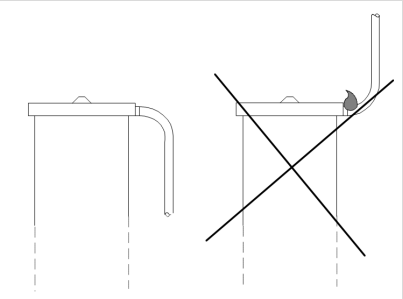


Figure 3 PTB210 mounting options

Always place the barometer so that the pressure fitting is downwards.

To prevent water from flowing along the cable and gathering near the feed-through, make sure that the cable is upwards from the barometer.

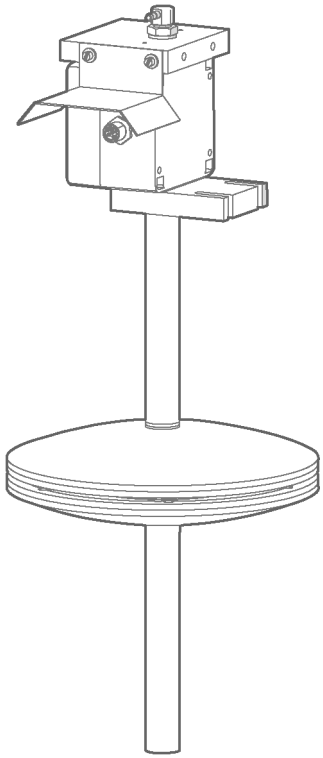


PTB210 has IP65 housing. You can mount it outdoors without any additional protection. Make sure that rainwater cannot block the open pressure fitting. Vaisala recommends connecting a piece of a tube with inner diameter of 4 mm or more to the fitting.

You can also use a static pressure head, SPH10/20 to protect the pressure channel from rain and minimize the effect of wind.

3.1.1 Static pressure head

The pressure fitting supplied with the transmitter is not a static pressure head. It is not suitable for turbulent or high-speed static wind conditions. In demanding wind conditions, Vaisala recommends using Vaisala static pressure head SPH10/20. PTB210 digital barometers can be directly integrated to SPH10/20. PTB210 with SPH10/20 provide accurate measurement in all wind conditions.



3.2 Connections

There are 3 different serial output interfaces available for PTB210 digital barometers:

- RS-232C
- RS-485/232C
- RS-232C/TTL

The connections depend on the output protocol in use.

Vaisala recommends isolating the free wire ends.

Table 2 PTB210 wiring with RS-232C

Wire color	Signal
Grey	RX
Green	TX
Blue	Ground
Pink	Supply voltage (5 ... 28 V DC)
Brown	Not connected
White	Not connected
Yellow	Power down mode (TTL level: 0 V = off, 5 V = on)

Table 3 PTB210 wiring with RS-485/RS-232C interface

Wire color	Signal
Grey	RX (with RS-232C)
Green	TX (with RS-232C)
Blue	Ground
Pink	Supply voltage (8 ... 18 V DC)
Brown	RS-485 -
White	RS-485 +
Yellow	Power down mode (TTL level: 0 V = off, 5 V = on)

The 2 output protocols cannot be used simultaneously. Connect either RX/TX or RS-485 wires.

Table 4 PTB210 with RS-232C/TTL interface

Wire color	Signal
Grey	RX (with RS-232C)
Green	TX (with RS-232C)
Blue	Ground
Pink	Supply voltage (5 ... 28 V DC)
Brown	RXD (TTL level)
White	TXD (TTL level)
Yellow	Power down mode (TTL level: 0 V = off, 5 V = on)



The 2 output protocols cannot be used simultaneously. Connect either RX/TX or RXD/TXD wires.

More information

- .RON/ .ROFF setting RS-485 terminating resistor on/off (page 18)

4. Operation

PTB210 can be operated through a serial line by using suitable terminal software like Windows® Hyper Terminal. The commands are described in the following pages.

The format of the commands is **.ZZZ.**xxx

zzz	Defines an event
xxx	Given parameter value

When there are several barometers on the same line, it is necessary to use an instrument-specific identification code in front of the command, such as **123.BAUD.**9600, where 123 is the ID-code. See .ID setting identification code (page 15). The code directs the command to that specific instrument. This prevents any inconsistency between the barometers and the host system. A barometer reacts only to a command with its ID, or the one without the code.

You can type common setting commands without the ID code. The settings apply to all barometers simultaneously.

The barometer does not echo the given commands nor confirm the new settings by echoing them. You can check the settings with the command **?**.

4.1 Settings

To activate the new setting, reset the barometer with the command **.reset<cr>**.

4.1.1 .BAUD setting baud rate

```
.BAUD.xxxx
```

xxxx	Baud rate (1200 ... 19200)

Example

.BAUD.9600 (commands invisible)

.RESET

4.1.2 Setting serial communication parameters

The following parameter combinations are available for PTB210. The factory setting for the parameters is E71.

```
.E71
```

or

```
.O71
```

or

```
.N81
```

The command sets the serial communication parameters of either a single barometer or all the barometers.

4.1.3 .ID setting identification code

```
.ID.xxx
```

xxx	Identification code (max. 15 characters)

The default ID code is 0. When several barometers are on the same line, use the ID code to direct the command to a specific instrument separately.
The barometer handles the ID code as characters, for example 0001, 01 and 1 are different codes

4.1.4 .PMIN / .PMAX setting pressure limits

You can define a lower and a higher pressure limit to the barometer. You can define, for example, the calibrated pressure range to a host system.

```
.PMIN.xxxx
```

xxxx	Lower pressure limit (0 ... 15000 hPa)

If current pressure is under the limit, the barometer outputs ****.** instead of the pressure reading.

```
.PMAX.xxxx
```

xxxx	Higher pressure limit

4.1.5 .MPM measurements per minute

```
.MPM.xxx
```

xxx	Number of measurements per minute (6 ... 4200)

The command sets the number of measurements performed in one minute. As default, the MPM is 60.

60 min^{-1} = 1 s^{-1} = 1 measurement per second

4.1.6 .AVRG defining averaging

```
.AVRG.xxx
```

xxx	Number of measurements of which the average is calculated (0 ... 255). The default **AVRG** is 0.

The command sets the number of measurement points that are used for the calculating an average pressure reading. This is not a moving average.

Example

If the number of measurements per minute is set to 30 and the averaging to 5, the pressure reading is updated every 10 seconds.

4.2 Operating commands

To activate a new setting, reset the barometer with the command **.reset**.

4.2.1 .P outputting single message

```
.P
```

The command outputs the latest multi-point corrected pressure reading with 2 decimals.

```
.P<cr>          (command invisible)
1012.99
```

4.2.2 .BP continuous output

```
.BP
```

The command outputs the multi-point corrected pressure reading continuously. The output interval depends on the measurement rate and the averaging. To stop the output, press **ENTER**.

```
.P<cr>        (command invisible)
 997.99
 998.01
 998.01
 ...
 998.02
 <cr>        (command invisible)
```

4.2.3 .UNIT selecting pressure unit

```
.UNIT.x
```

x	0 (hPa)
	1 (mbar)
	2 (inHg)
	3 (psia)
	4 (torr) 10 (bar)
	5 (mmHg)
	6 (kPa)
	7 (Pa)
	8 (mm H_2O)
	9 (in H_2O)
	10 (bar)

The default value is 0.

4.2.4 .FORM output with or without unit

```
.FORM.0
```

The command cancels the unit output after pressure reading. This is also the factory setting for the output format.

1017.61

```
1017.61
```

The command adds the unit to the output. The standard output field is for 6 characters. The first character is always a space.

1017.61 hPa

4.2.5 .RESET reset instrument

```
.RESET
```

The command resets the barometer and activates the setting changes.

4.2.6 .MPCON / MPCOFF set pressure correction on/off

You can set multi-point corrections on or off with **.MPCON** and **.MPCOFF**. See Calibration and adjustment (page 21).

```
.MPCON
```

The command activates the multi-point corrections.

```
.MPCOFF
```

The command deactivates the multi-point corrections.

4.2.7 .CALD setting calibration date

.CALD stores the last calibration date in the memory of the barometer.

```
.CALD.xxx
```

xxx	Calibration date, max. 15 characters

Example

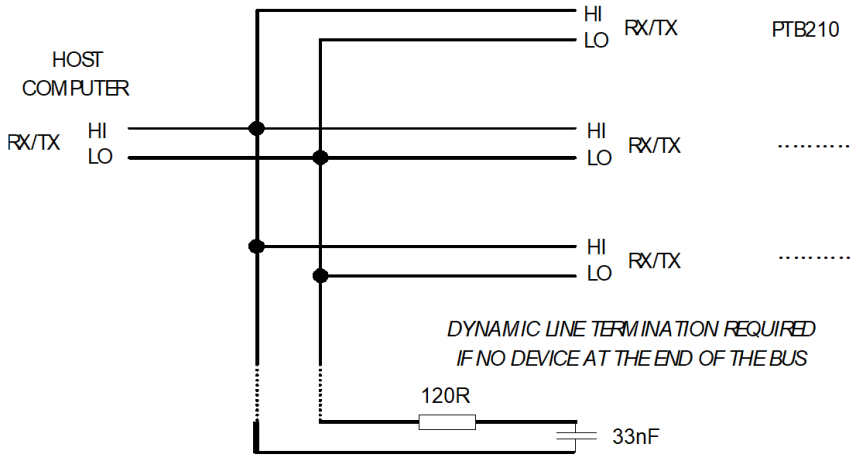
.CALD.991015

4.2.8 .RON/ .ROFF setting RS-485 terminating resistor on/off

PTB210 barometers have a built-in RS485 terminating resistor, which is off by default. You can set the resistor on or off with the **.RON**/**.ROFF** commands. If the barometer is in the end of the serial line, set the resistor on especially when long cables are used.

In case several barometers are connected to same line, set on only the resistor of the last one. The others must be off. This prevents formation of excessive load on the line. The maximum amount of barometers on same line is 32.

At the end of the serial bus there must be PTB210, a dynamic line adapter, or a line master.




```
.RON
```

The **.RON** command sets the terminating resistor on.

```
.ROFF
```

The **.ROFF** command sets the terminating resistor off.

4.3 Self-testing

4.3.1 .? basic information of barometer settings

```
.?
```

The command lists the basic information of the barometer settings. The following example shows also the factory settings for 50...1100 hPa model.

```
.?<cr>    (command not visible)
PTB210 Ver 1.0
CAL DATE :1999-06-10
ID CODE :10
SERIAL NUMBER :T00100004
MULTIPOINTCORR:ON
MEAS PER MINUTE: 60
AVERAGING : 0
PRESSURE UNIT : hPa
Pressure Min...Max: 500 1100     (50 1100 for model 50…1100)
LOW CURRENT MODE
RS485 RESISTOR OFF
```

5. Calibration and adjustment

5.1 Calibration and adjustment

You can adjust and calibrate PTB210 against pressure standards that have high accuracy and stability as well as known traceability to international standards.

- For the Class A barometers, use standards with uncertainty of 70 ppm (2 standard deviation value), or better.
- For the Class B barometers, Vaisala recommends electronic working standards with uncertainty of 150 ppm.

Calibration does not include any adjustments.

To perform pressure readjustment of PTB210, deactivate first the multi-point corrections using **`mpcoff`** command. It deactivates all fine adjustments. By comparing the output to a reference, you can define the corrections required for readjustment.

Write down the previous multi-point corrections.

To make the corrections, use the Wizard software. When you have made the new multi-point corrections to the barometer, you can activate the corrections with PTB210 Wizard or with the **`mpcon`** command. PTB210 is calibrated to verify its real accuracy.

More information

- .MPCON / MPCOFF set pressure correction on/off (page 18)
- Using Wizard software (page 21)

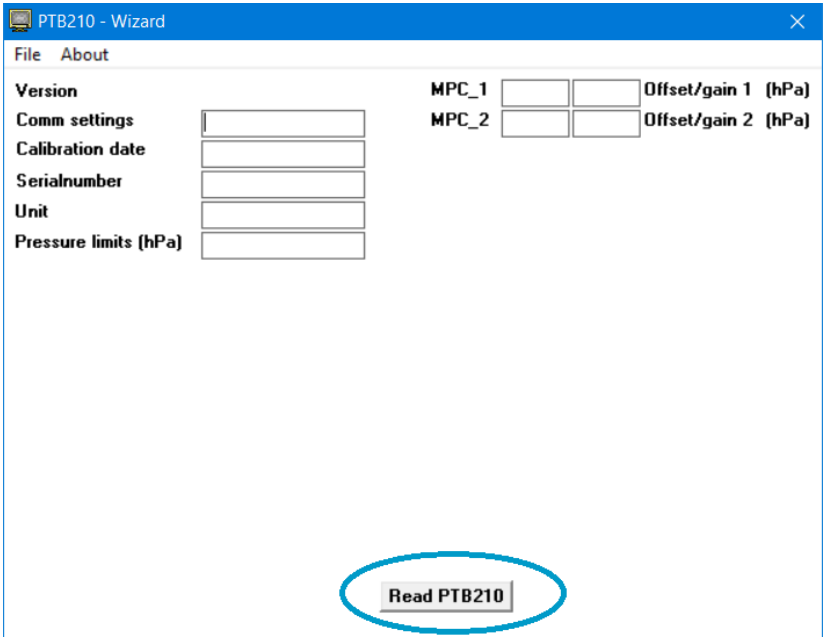
5.2 Using Wizard software

With the Wizard software, you can make multi-point pressure corrections for PTB210 through the serial line. You can also change some PTB210 settings with it.

Before operating the Wizard software, make sure that the terminal software is closed.

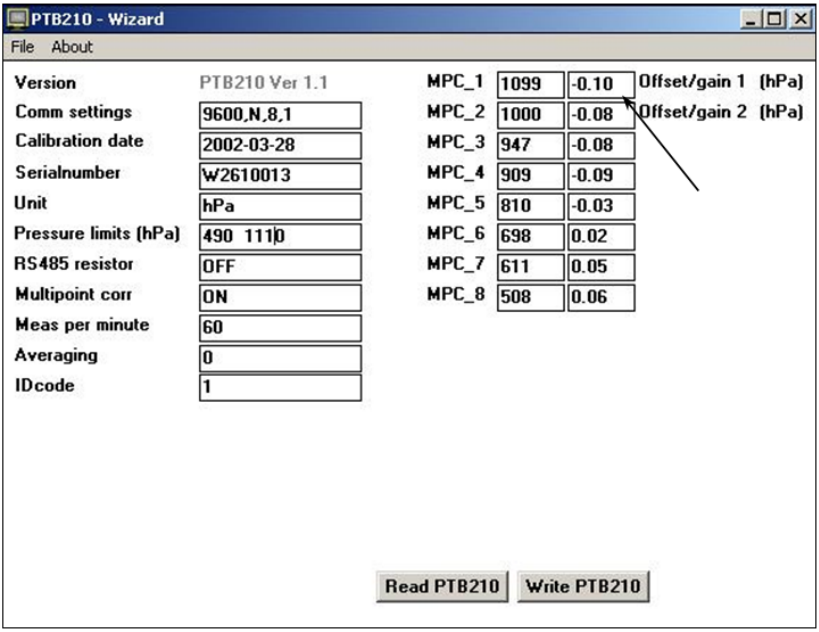
The Wizard software uses the RS-232 or RS-485 interface. If you use the TTL level, disconnect the RXD/TXD wires and connect the RX/TX wires. See Table 2 (page 12).

1. Go to http://www.vaisala.com/PTB210Wizard/. *PTB210_calibration_wizard.zip* downloads.
2. Extract the *zip* file and doubleclick the *exe* file.
3. Select **Run > Next > Next > Next > Install > Finish**
4. To choose the COM you use, select **File > ComPort**.
5. To open the connection, select **Read PTB210**.



6. Type the reference pressure values and the corresponding corrections.
   Calculate the corrections according to the following equation. You can also change the settings on the left.

$$corr = P_{reference} - P_{measured}$$

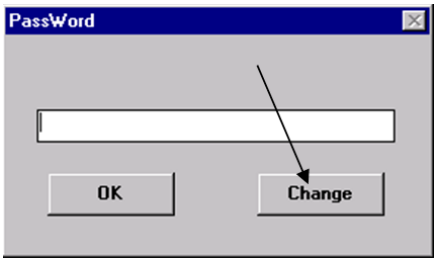




The values are in hPa. The reference value is as whole number and the correction with 2 decimals.

7. To save the corrections, select **Write PTB210**.

8. When prompted for a password, select **OK**. By default, there is no password. You can protect the new corrections with a password. To enter a password, select the **Change**.



9. Type a new password and type it again when prompted.
Make sure you set the multi-points corrections on.

6. Technical Data

6.1 PTB210 specifications

Table 5 PTB210 measurement performance

Property		Description/Value	
Pressure range			
Serial output		500 ... 1100 hPa 50 ... 1100 hPa	
Analog output		500 ... 1100 hPa 600 ... 1060 hPa 800 ... 1060 hPa 900 ... 1100 hPa	
Serial output, accuracy (hPa)			
Pressure range	500 ... 1100		50 ... 1100
	Class A	**Class B**	
Non-linearity [1]	± 0.10	± 0.15	± 0.20
Hysteresis [1]	± 0.05	± 0.05	± 0.10
Repeatability [1]	± 0.05	± 0.05	± 0.10
Calibration uncertainty [2]	± 0.07	± 0.15	± 0.20
Accuracy at +20 °C (+68 °F) [3]	± 0.15	± 0.20	± 0.35
Temperature dependency [4]	± 0.20	± 0.20	± 0.40
Total accuracy -40 ... +60 °C (-40 ... +140 °F) [3]	± 0.25	± 0.30	± 0.50
Long-term stability (hPa/year)	± 0.10	± 0.10	± 0.20
Analog output, accuracy			
Non-linearity [1]		± 0.20 hPa	
Hysteresis [1]		± 0.05 hPa	
Repeatability [1]		± 0.05 hPa	

Property	Description/Value
Calibration uncertainty [2]	± 0.15 hPa
Accuracy at +20 °C (+68 °F) [3]	± 0.30 hPa
Temperature dependency [4]	± 0.50 hPa
Total accuracy -40 ... +60 °C (-40 ... +140 °F) [3]	± 0.60 hPa
Long-term stability	± 0.10 hPa/year

1) *Defined as the ±2 standard deviation limits of end point non-linearity, hysteresis error, or repeatability error.*
2) *Defined as ±2 standard deviation limits of inaccuracy of the working standard including traceability to international standards.*
3) *Defined as the root sum of the squares (RSS) of end point non-linearity, hysteresis error, repeatability error, and calibration uncertainty at room temperature.*
4) *Defined as ±2 standard deviation limits of temperature dependence over the operating temperature range.*

Table 6 PTB210 operating environment

Property	Description/Value
Operating temperature	−40 ... +60 °C (−40 ... +140 °F)
Operating humidity	0 ... 100 %RH, non-condensing

Table 7 PTB210 inputs and outputs

Property	Description/Value
Serial output	
Shutdown	ON/OFF
Settling time at startup	2 s
Serial I/O	RS-232C RS-232C / TTL (optional) RS-485, non-isolated (optional)
Parity	None, even, odd
Data bits	7, 8
Stop bits	1, 2
Baud rate	1200, 2400, 4800, 9600, 19200
Response time	1 s

Property	Description/Value
Resolution	0.01 hPa (1 measurement/s) 0.03 hPa (10 measurements/s)
Current consumption, normal mode	< 15 mA (factory setting)
Current consumption, shutdown mode	0.2 mA
Analog output	
Outputs	0 ... 5 V DC, 0 ... 2.5 V DC (order specified)
Shutdown	ON/OFF
Response time	500 ms
Resolution	300 µV
Measurement rate	3 measurements/s
Current consumption, normal mode	< 8 mA
Current consumption, shutdown mode	0.2 mA
All models	
Max. pressure	5 000 hPa absolute
Pressure connector	M5 (10-32) internal thread
Pressure fitting	Barbed fitting for 1/8 in I.D. tubing
Supply voltage (reverse polarity protected), with RS-232/TTL output	5 ... 28 V DC
Supply voltage (reverse polarity protected), with RS-485 or analog output	8 ... 18 V DC

Table 8 PTB210 mechanical specifications

Property	Description/Value
Housing material	PC plastic
IP rating, electronics	IP65 (NEMA 4)
IP rating, sensor	IP53
Weight, sensor	110 g (3.9 oz)
Cable weight	28 g/m (1.0 oz)

Table 9 PTB210 compliance

Property	Description/Value
Directives	EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU)
EMC compatibility	EN / IEC 61326-1, Electrical equipment for measurement, control and laboratory use - EMC requirement; Basic environment CISPR 32 / EN 55032, Class B
Compliance	CE, FCC, UKCA

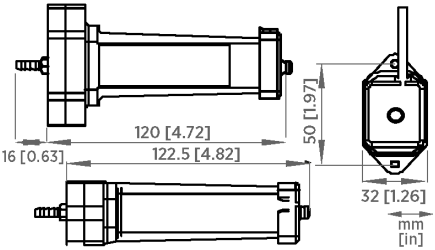


Figure 4 PTB210 dimensions

Appendix A. FCC Part 15 compliance statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that the interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.



CAUTION! Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.



This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Warranty

For standard warranty terms and conditions, see www.vaisala.com/warranty.
Please observe that any such warranty may not be valid in case of damage due to normal wear and tear, exceptional operating conditions, negligent handling or installation, or unauthorized modifications. Please see the applicable supply contract or Conditions of Sale for details of the warranty for each product.

Technical support



Contact Vaisala technical support at helpdesk@vaisala.com. Provide at least the following supporting information as applicable:

- Product name, model, and serial number
- Software/Firmware version
- Name and location of the installation site
- Name and contact information of a technical person who can provide further information on the problem

For more information, see www.vaisala.com/support.

Recycling



Recycle all applicable material.



Follow the statutory regulations for disposing of the product and packaging.

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