

PTB 200 DIGITAL BAROMETERS

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Appendix 1 Commands

SERIAL COMMANDS

Function	Command	Comment
serial bus settings	SERI	
echo on/off	ECHO	
output format	FORM	
pressure resolution	FORM	
units	UNIT	
integration time	MTIM, FILT	
settling time/response time	MTIM, FILT	
sending mode	SMODE	STOP, RUN and POLL modes
address	ADDR	for POLL mode only
defining single output command	SCOM	in STOP and RUN modes only
sleep mode	SLEEP	
list of software settings	?	
starting output	R	
stopping output	S	
output single reading	SEND	in POLL mode address required
setting output interval	INTV	
control of a single barometer in POLL mode	OPEN ,CLOSE	
resetting	RESET	
error messages	ERRS	
linear pressure adjustment	LP	
multipoint correction	MPC, MPC1	

1 PRODUCT DESCRIPTION

The PTB 200 A and PTB 201 A are fully compensated digital barometers designed to operate over a wide pressure and temperature range. The final factory adjustment and calibration of the PTB 200 A is done against a deadweight tester for best accuracy and pressure traceability. The PTB 201 A is adjusted and calibrated by using electronic working standards to meet the requirements of demanding weather station applications. The PTB 200 digital barometers can also be readjusted by the user with a local primary standard at up to eight selectable pressure levels.

There are three available outputs in the PTB 200 digital barometers. The RS 232C full duplex serial interface with software selectable serial bus settings and pressure units is the standard output for connection with computers. The user can also choose a TTL level bidirectional serial output. For simple data logger use the pulse output can be selected. The serial output of the PTB 200 barometers can be used in continuous, interval or on-demand modes. The pulse output is activated by an external trigger signal.

The PTB 200 digital barometers have two built-in features to reduce power consumption; the user can choose a software controlled sleep mode or use an external trigger signal to shut down the barometer.

The user can define various settings, such as integration time, settling time and pressure resolution according to his application (see chapters General and Configuration commands). The factory settings have been chosen so that both a fast settling time and high resolution are achieved. In applications where fast settling time is not required, we recommend longer integration times to suppress noise effects such as wind turbulence.

The PTB 200 digital barometers use Vaisala's BAROCAP® silicon capacitive absolute pressure sensor. The BAROCAP pressure sensor has excellent hysteresis and repeatability characteristics and very good temperature and long-term stability. The ruggedness of the BAROCAP sensor is outstanding.

From April 1993, the PTB 200 digital barometers are traceable to NIST in the USA. Until March 1993 the barometers have been traceable to L.N.E. in France.

2 INSTALLATION

2.1 Mounting

The dimensions and recommended mounting positions of the PTB 200 barometers are shown in Figure 1.

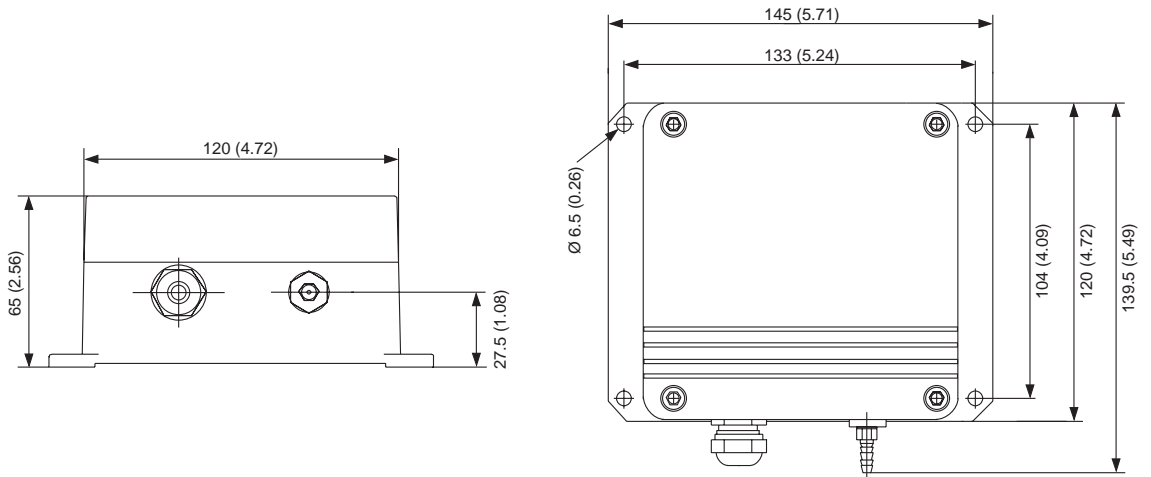


Fig. 1 Dimensions and mounting of PTB 200 barometers

See Chapter 2.2 Grounding and 2.6 Pressure connection for further information on electrical grounding and pressure connection alternatives.

2.2 Grounding

A single electrical cable with a screen and five or six wires is recommended for power and serial bus connections. The cable diameter should be 5 ... 10 mm.

The screen of the electrical cable must be grounded properly to achieve best possible EMC performance. First remove the bushing from the barometer housing and then push the cable through the bushing and its brass disks. Expose the screen braid, but be careful not to open the braid. Cut the braid and the wires to a suitable length. Pull back the braid and press it between the two brass disks of the cable bushing to make a full 360 degrees grounding (see Fig. 2). Then tighten the cable bushing to the barometer housing.

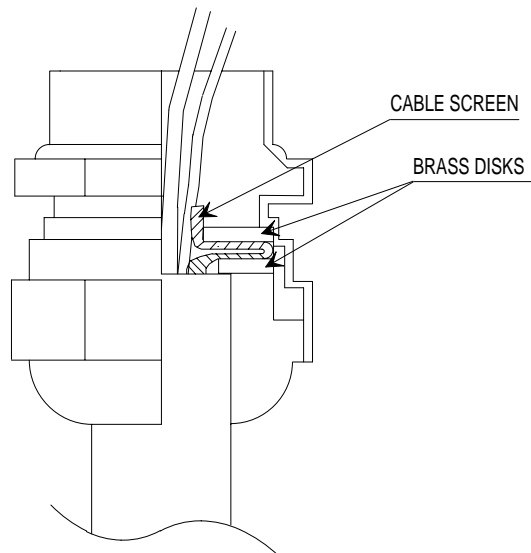


Fig. 2 Grounding the cable screening between the two brass disks of the cable bushing

In addition to grounding the cable screen in the cable bushing, either the barometer housing or the host end of the cable screen must be grounded. To ground the barometer housing use one serrated lock washer between a mounting screw and the housing; the lock washer breaks the painting of the housing. When the host end of the cable screen is grounded, the barometer housing must be mounted on an insulating support to avoid grounding at two points.

2.3 Power connections

Two wires, one for supply voltage and another for supply ground, are needed to connect power to the barometer (see Fig. 3).

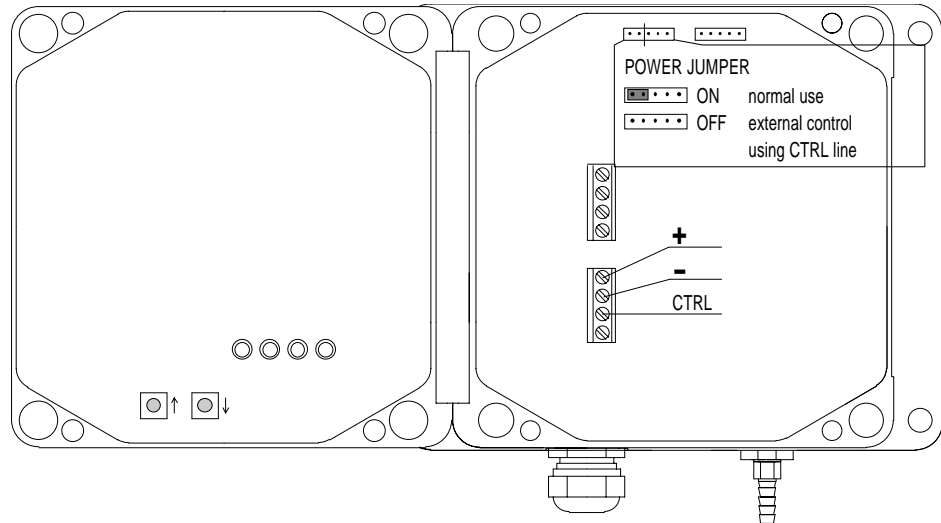


Fig. 3 Power connections and jumpers

However, when a logic output is available in the host system, a third wire can be connected to the power control terminal CTRL to enable external control of the barometer. The POWER jumper of the barometer must then be removed (see Fig. 3). The logic high TTL level (5 VDC) turns the barometer on and logic LOW (0 VDC) turns it off. The CTRL line can withstand higher logic voltage levels and is protected against electric discharges. To return to normal operation simply re-insert the POWER jumper.

2.4 Serial output mode connections

The serial communication can take place either using RS 232C or TTL level signals. In both cases the barometer is connected to the host system with three wires (TX, GND, RX) (see Figure 4). No handshaking lines are used.

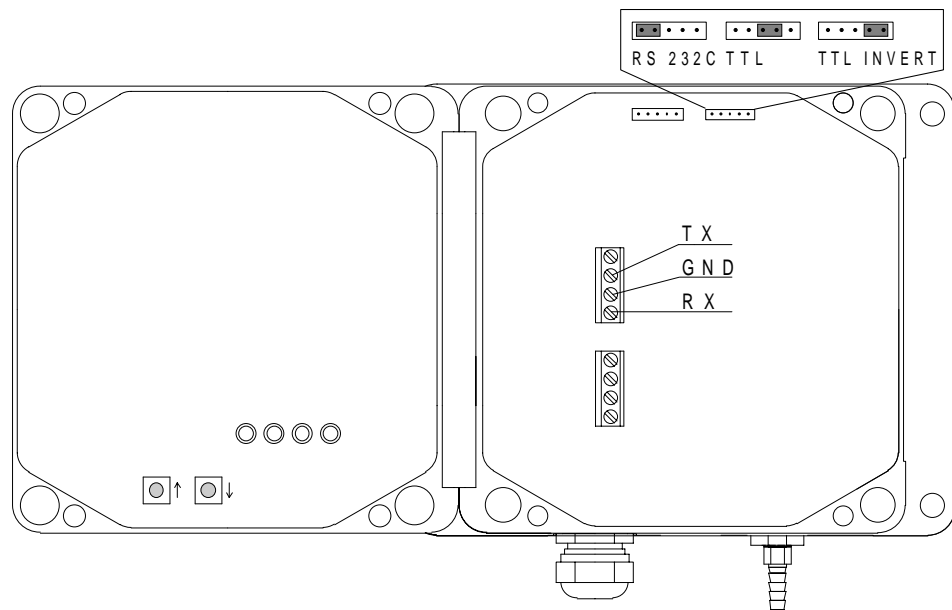


Fig. 4 Serial bus connections and jumpers

The selection between the RS 232C and TTL level output signals is made with a jumper (see Fig. 4). The TTL level output signal has two phase alternatives: TTL and TTL INVERT. The TTL output is in phase with the TXD line of the Intel 8051 microprocessor and the TTL INVERT output is in phase with the RS 232C output.

Although the PTB 200 barometers use a single polarity supply, both positive and negative voltage levels occur in the output in the RS 232C output mode. The higher the supply voltage, the higher are the output voltages in the transmission line of the barometer; for example, at 12 VDC supply voltage the output voltage levels are approximately ± 8 VDC. The TTL level output voltages are 0 and 5 VDC.

If the supply voltage is raised and the baud rate lowered, the RS 232C interface can be used over far longer distances than specified for the standard RS 232C interface.

The receiving RX line accepts both RS 232C and TTL level voltages as input; the TTL level phase selection does not affect the receiving line of the barometer.

2.5 Pulse output mode connections (software version 1.05 or higher)

The pulse output mode uses the same terminals as the serial output mode (see Figure 5). The transmitting terminal sends the pulse output (TX/PULSE) and the receiving terminal of the barometer receives the positive trigger signal (RX/PULSE TRIG).

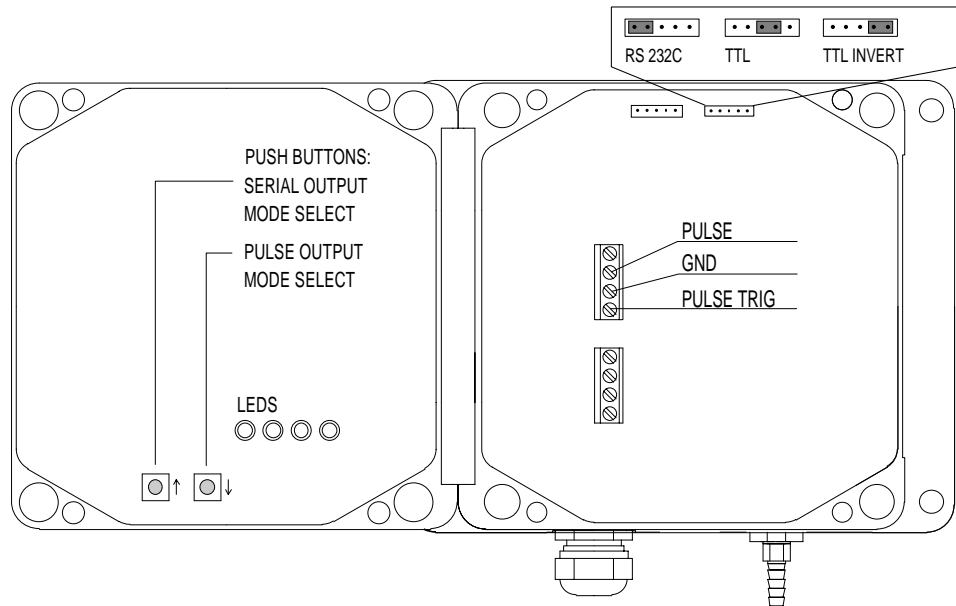


Fig. 5 Pulse output connections, jumpers and push buttons

The pulse output mode must be separately selected. Two push buttons (Fig. 5), arrow up and arrow down, are used to switch between the pulse output mode and the serial output mode.

To select the PULSE OUTPUT operation mode:

1. Set the baud rate to 9600 (see SERI command).
2. Switch power off.
3. Press and keep down the arrow down push button.
4. Switch power on; the four LEDs go on and go out.
5. Release the push button; the LEDs go on and go out again.

To select the SERIAL OUTPUT operation mode:

1. Switch power off.
2. Press and keep down the arrow up push button.
3. Switch power on; the four LEDs go on and go out.
4. Release the push button; the LEDs go on and go out again.
5. Check the serial bus settings (see SERI command).

The pulse frequency is about 4.5 kHz at baud rate 9600. The pulse output is triggered using a positive pulse (e.g. 100 ms/5 VDC). The pulse output voltage levels can be either RS 232C levels or TTL levels. The selection is made with a jumper (Fig. 5).

The pressure resolution is limited in the pulse output mode to 0.1 hPa. Each pulse represents 0.1 hPa, e.g. 10000 pulses equal 1000.0 hPa.

2.6 Pressure connections

The barometer is equipped with a standard Clippard barbed pressure fitting with 10-32 external thread installed in the barometer. This fitting is ideal for an 1/8" internal diameter tubing.

If some other pressure fitting needs to be used, it is possible to replace the barbed fitting. The pressure connection in the barometer housing has a metric M5 internal thread which is in practice compatible with non-metric 10-32 internal thread.

The barbed pressure fitting is not recommended for turbulent or high speed static wind conditions: the accuracy quoted for the PTB 200 digital barometers does not include any wind effects.

The PTB 200 barometers are designed to measure the pressure of clean, non-condensating, non-conducting and non-corrosive gases only.

2.7 Multiple transmitters on one RS 232C bus

It is possible to connect up to 99 PTB 200 barometers to one RS 232C bus by using a connector box with diodes for each barometer transmission line and one common barometer receiving line and ground line (see Figure 6). Each barometer must be initialized to POLL mode with a specific address (1...99) (see ADDR, SMODE POLL, OPEN and CLOSE commands). The host computer must have sufficient buffering to be able to handle several barometers.

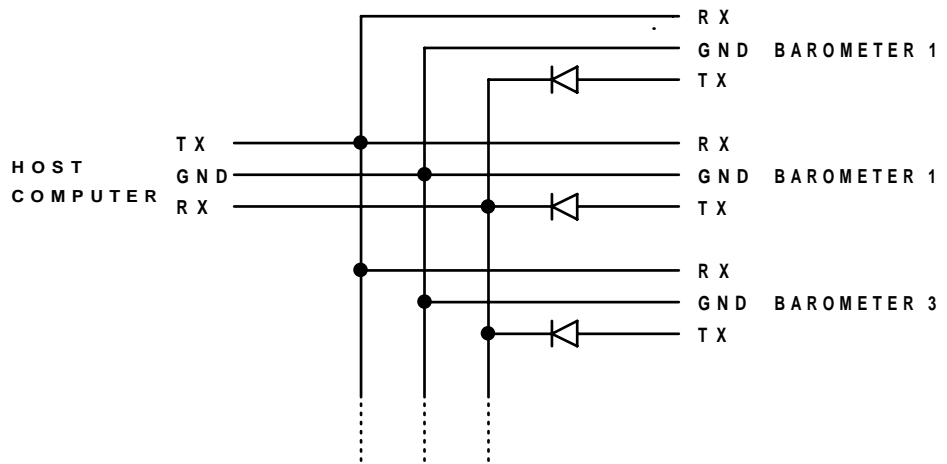


Fig. 6 Connector box for several barometers on one RS 232C bus

3 SERIAL COMMANDS

3.1 General

When delivered from factory the barometers are in serial full duplex RS 232C mode. No handshaking lines are in use. All commands are echoed. The factory settings of the serial bus are:

baud rate	1200
parity	even
data bits	7
stop bits	1
echo	ON
sending mode	STOP
address	0

The following table briefly shows the configuration commands used to change the settings of the PTB 200 barometers.

Function	Command	Comment
serial bus settings	SERI	
echo on/off	ECHO	
output format	FORM	
pressure resolution	FORM	
units	UNIT	
integration time	MTIM, FILT	
settling time, response time	MTIM, FILT	
sending mode	SMODE	STOP, RUN and POLL modes
address	ADDR	for POLL mode only
single output command	SCOM	in STOP and RUN modes only
sleep mode	SLEEP	
list of software settings	?	

The default output format, pressure resolution and pressure unit have been set to fit meteorological requirements. The internal time constants of the barometers have been chosen to prioritize short settling time (PTB 200 A: 2 s, PTB 201 A: 1 s) and high pressure resolution (PTB 200 A: 0.01 hPa, PTB 201 A: 0.1 hPa). If longer settling time can be accepted, use longer integration time to suppress noise effects.

The PTB 200 barometers have three sending modes: STOP, RUN and POLL modes. In STOP mode (factory setting) after power-up the barometer outputs its type code and software version number and then waits for further commands. In RUN mode pressure output starts automatically from power-up. POLL mode is meant mainly for adjustment and calibration where several barometers are connected to one RS 232C bus.

The following table briefly shows the commands used to control the operation of the PTB 200 barometers:

	Command	Comment
starting output	R	
stopping output	S	
output single reading	SEND	address required in POLL mode
setting output interval	INTV	
control of a single barometer in POLL mode	OPEN, CLOSE	in POLL mode only
resetting	RESET	
error messages	ERRS	

The commands are not case sensitive. However, the pressure unit must be given in the format given at the UNIT command (see UNIT command).

3.2 Configuration commands

SERI Serial bus settings

SERI b p d s<cr>

where

b baud rate (300, 600, 1200*, 2400, 4800, 9600)
p parity (E=even*,O=odd,N=none)
d data bits (7* or 8)
s stop bits (1* or 2) (* factory settings)
<cr> carriage return is generated by the ENTER or RETURN key of
 the host computer

The SERI command is used to set or inspect the serial bus settings.

Examples:

```
>SERI<cr>
1200 E 7 1

>SERI 9600 E 7 1<cr>
9600 E 7 1
>RESET<cr>

>SERI 1200<cr>
1200 E 7 1
>RESET<cr>
```

Always give the RESET command after the SERI command to invoke the new serial bus settings.

The following bus settings do not work with the barometer's Intel 8051 microprocessor and are modified by the barometer:

```
N 7 1 ⇒ N 7 2
E 8 2 ⇒ E 8 1
O 8 2 ⇒ O 8 1
```

Note: N 7 2 works on software version 1.06 or higher only.

The following settings can not be used at all:

```
E 8 1, O 8 1
```

ECHO **Setting the serial bus echo on/off**

```
ECHO ON<cr>
ECHO OFF<cr>
```

The ECHO command is used to control serial bus echo. In OFF mode the barometer does not output the '>' prompt character.

FORM **Defining the output format**

```
FORM<cr>
```

The FORM command is used to define the desired format and pressure resolution of the output. Do not use the FORM command to select a pressure unit (instead see UNIT command).

The basic definition consists of the current and new format:

```
>FORM<cr>
(current output format appears here)
? (type new format here)<cr>
```

The output format consists of the pressure reading area, pressure unit area, carriage return and line feed, e.g.:

```
"\PPPP.PP\ \uuuu\ \r\n"
```

where

```
\PPPP.PP\  pressure reading area
\uuuu\     pressure unit area
\r         carriage return
\n        line feed
```

An example of changing the output pressure resolution from two to one decimal (0.01 \Rightarrow 0.1):

```
>FORM<cr>
"\PPPP.PP\ \uuuu\ \r\n"
? \PPPP.P\ \uuuu\ \r\n<cr>
```

Example of adding leading spaces:

```
>FORM<cr>
"\PP.PPP\ \uuuu\ \r\n"
? \PPPP.PPP\ \uuuu\ \r\n<cr>
```

Example of adding text to the output:

```
>FORM<cr>
"\PPPP.PP\ \uuuu\ \r\n"
? Barometric pressure = \PPPP.PP\ \uuuu\ \r\n<cr>
```

Example of omitting the pressure unit from the output:

```
>FORM<cr>
"\PPPP.PP\ \uuuu\ \r\n"
? \PPPP.PP\ \r\n<cr>
```

UNIT Setting the pressure unit

```
UNIT x<cr>
```

where

x hPa*, kPa, mbar, inHg, mmHg, torr, psia (* factory setting).

Command UNIT is used to select the pressure unit. Type the selected pressure unit as given above.

Example of changing the pressure unit to mbar:

```
>UNIT mbar<cr>
```

MTIM Setting the measurement time parameters

```
MTIM<cr>
```

The MTIM command is used to set the number of measurement samples (MTIM value) integrated to get a pressure reading. The basic measurement sample time is about 25 milliseconds. The MTIM value can range from 4 to 255.

The MTIM factory setting of the PTB 200 A is 64; this ensures a stable resolution of 0.01 hPa. The integration time is then $64 \times 25 \text{ ms} = 1600 \text{ ms}$. The settling time including initialization and integration time is approximately 2 s.

The MTIM factory setting of the PTB 201 A is 16; this ensures a stable resolution of 0.1 hPa. The integration time is then $16 \times 25 \text{ ms} = 400 \text{ ms}$. The settling time including initialization and integration time is approximately 1 s.

The MTIM value affects the settling time of the barometer: the longer the integration time, the longer the settling time.

The FILT command also affects the integration and settling times (see FILT command).

Example of changing the MTIM value:

```
>MTIM<cr>  
Mtim        :    64 ? 150<cr>
```

FILT Setting the filter parameters

```
FILT xxx yyyy<cr>
```

where

xxx ON or OFF

yyyy FAST or SLOW

The FILT command is used to set additional numerical filtering modes.

FAST mode introduces a multiplication factor of 4 to the integration time set with the MTIM command. In addition a special algorithm that takes the derivative of the pressure change into account is used.

SLOW mode introduces a multiplication factor of 16 to the integration time set with the MTIM command. No derivative of the pressure change is taken into account.

The filter settings also affect the settling time of the barometer.

Example of setting the integration time to 5 seconds (MTIM 50, filter FAST):

```
>MTIM<cr>
Mtim        : 64 ? 50<cr>
>FILT ON FAST<cr>
Press. filter : ON
              FAST
```

Example of setting the integration time to 60 seconds (MTIM 150, filter SLOW):

```
>MTIM<cr>
Mtim        : 50 ? 150<cr>
>FILT ON SLOW<cr>
Press. filter : ON
              SLOW
```

```
>FILT OFF<cr>
```

turns the filter mode off. Then only the MTIM command affects the integration and settling times.

SMODE Setting the sending mode

SMODE xxxx<cr>	STOP and RUN modes only
SMODE aa STOP<cr>	POLL mode only

where

xxxx STOP, RUN or POLL

aa the address (1...99) of the barometer in the POLL mode

SMODE command sets or inspects the sending mode of the barometer.

The factory setting is the STOP mode. After power-up or reset the barometer outputs only its type code and software version number; pressure readings are output only by command.

In the RUN mode the barometer starts to output pressure readings automatically after power-up or reset. The S command can be used to stop the output.

The POLL mode is used mainly during adjustment and calibration when several barometers are connected to one RS 232C bus. In the POLL mode measurements can be output only with SEND aa command (see SEND aa command). Echo is off in the POLL mode. See also OPEN and CLOSE commands for further details on how to control a single barometer when several barometers are connected on one RS 232C bus.

Example of setting, using and resetting the POLL mode:

```
>SMODE<cr>
Serial mode      :   STOP
>ADDR<cr>
Address          :                0 ? 7<cr>
>SMODE POLL<cr>
Serial mode      :   POLL
SEND 7<cr>
(pressure reading appears here)
SMODE 7 STOP<cr>
Serial mode      :   STOP
>ADDR<cr>
Address          :                7 ? 0<cr>
```

ADDR **Setting the barometer address** (for POLL mode only)

```
ADDR<cr>
```

ADDR is used to set or inspect an address (1...99) of a barometer for the POLL mode.

Example of setting the address 7:

```
>ADDR<cr>  
Address                   :           0 ? 7<cr>
```

A new address replaces the previous address. Always set the address to 0 when no address is needed:

```
>ADDR  
Address                   :           7 ? 0<cr>
```

If the barometer is not in the POLL mode, it will respond to any SEND command regardless of if there is an address or not. See SMODE and SEND commands for further details.

SCOM **Setting a user defined command for single reading output** (STOP and RUN modes only)

```
SCOM<cr>
```

is used to define a new command for single reading output in the STOP and RUN modes. A command defined by SCOM command does not work in the POLL mode. The SEND command is always available.

Example of a command definition:

```
>SCOM P<cr>  
>P<cr>  
(a single pressure reading appears)
```

A new SCOM command replaces the previous definition.

SLEEP Setting and resetting the sleep mode

```
SLEEP ON<cr>
SLEEP OFF<cr>
```

The SLEEP command is used to set and reset the software controlled sleep mode which cuts down the power consumption by over 60 %. In the sleep mode the current consumption is below 10 mA when no output is required and about 25 mA during output. By activating the sleep mode the barometer automatically falls asleep when no output is required. Even then the barometer is ready to accept commands and execute them. However, because the barometer needs to wake up, the time from a command to output is a bit longer in SLEEP mode than in normal mode.

? List of basic software settings

```
?<cr>
```

Entering ? outputs a list of basic software settings, e.g.

Baud Parity Data Stop	1200 E 7 1	
Output format	\PPPP.PP\ \uuuu\ \r\n	
Pressure unit	hPa	
Temperature unit	'C	
Sending mode	STOP	
Address	0	
Sleep mode	OFF	
Measurement time	64 x 25 milliseconds	
Filter	OFF / FAST	
Output interval	0 s	
Calibration day code	92261	
Offset drift comp.	ON	
Offset drift correction	-0.056 hPa	
Multipoint correction	ON	
	Reading	Correction
	499.64	0.024
	599.79	0.013
	699.92	0.017
	800.04	0.021
	900.18	0 017
	1000.33	0.023
	1100.43	0.027

3.3 Operating commands

R Starting the measurement output

```
R<cr>
```

Command R starts the measurement output. The command is used to start output in the STOP and RUN modes (see SMODE command) and in interval output mode (see INTV command).

S Stopping the measurement output

```
S<cr>
```

Command S ends the RUN mode.

SEND Output a single reading

```
SEND<cr>          STOP and RUN modes only  
SEND aa<cr>       POLL mode only
```

where

aa the address of the barometer (0...99)

SEND command is used to output one pressure reading.

See also SCOM command to define your own command for single reading output in the STOP and RUN modes.

INTV Setting the output interval

```
INTV xxx yyy<cr>
```

where

xxx output interval (0...255)

yyy unit (s, min, h)

INTV command selects the interval output mode and sets the desired output interval. The R command is used to start the interval outputting.

Example of outputting the current settings:

```
>INTV<cr>  
Output intrv. :      0 s
```

Example of setting an output interval and starting outputting:

```
>INTV 1 min<cr>  
Output intrv. :      1 min  
>R<cr>
```

Example of cancelling the interval output mode:

```
>INTV 0 s<cr>  
Output intrv. :      0 s
```

OPEN **Setting a barometer to STOP mode** (POLL mode only,
CLOSE software version 1.04 or higher)

<pre>OPEN aa<cr> CLOSE aa<cr></pre>

where

aa the address (1 ... 99) of the barometer

OPEN and CLOSE commands are used to set a barometer momentarily to STOP mode and back to POLL mode again. This command is very useful when several barometers are connected to one RS 232C bus and only one individual barometer needs to be contacted.

Example of communication with a barometer with address 7:

```
>OPEN 7<cr>  
PTB 7 bus opened for operator commands  
(normal commands can now be used without disturbing other  
barometers on the RS 232C bus)  
>CLOSE 7<cr>  
bus closed  
(the barometer with address 7 is set back to the POLL mode and  
only SEND 7 and SMODE 7 STOP commands work)
```

Please note that when leaving the POLL mode, command CLOSE must always be followed by the address of the barometer.

RESET Resetting the barometer

```
RESET<cr>
```

resets the barometer. All software settings remain in the memory after reset or any power failure. After changing the serial bus settings RESET must always be given to invoke them.

ERRS Error message output

```
ERRS<cr>
```

ERRS command is used to print the error messages if any problems occur. The command outputs an error code and error description:

```
>ERRS<cr>  
E51 P y-value out of range
```

When an error occurs in the barometer, give the following seven commands and print the responses on paper. On the basis of the responses to these commands Vaisala can quickly determine which actions to take. The commands are:

```
>ERRS<cr>  
>?<cr>  
>C<cr>  
>F<cr>  
>T<cr>  
>Y<cr>  
>L<cr>
```

4 ADJUSTMENT AND CALIBRATION

The PTB 200 barometers can be adjusted and calibrated against local primary standards that have high accuracy and stability as well as known traceability to international standards.

The PTB 200 barometers are recommended to be adjusted or calibrated once a year when used in automatic weather station applications. In very demanding pressure standard applications shorter adjustment or calibration periods, e.g. two to four times a year, can be chosen.

The user can not erase the basic pressure and temperature adjustment coefficients made at factory from the barometer's memory. If anything goes wrong with adjustments or calibration, the user can always revert to the basic factory settings by changing the MEMORY jumper to EEPROM write enable position and then giving the following commands:

```
>LIP<cr>
P offset      0 * 0.001 ? 0<cr>
P gain        0 * 0.00001 ? 0<cr>
>MPC OFF<cr>
Multip. corr. : OFF
```

The factory settings can be changed only when the MEMORY jumper is in the EEPROM write enable position (see Fig. 7).

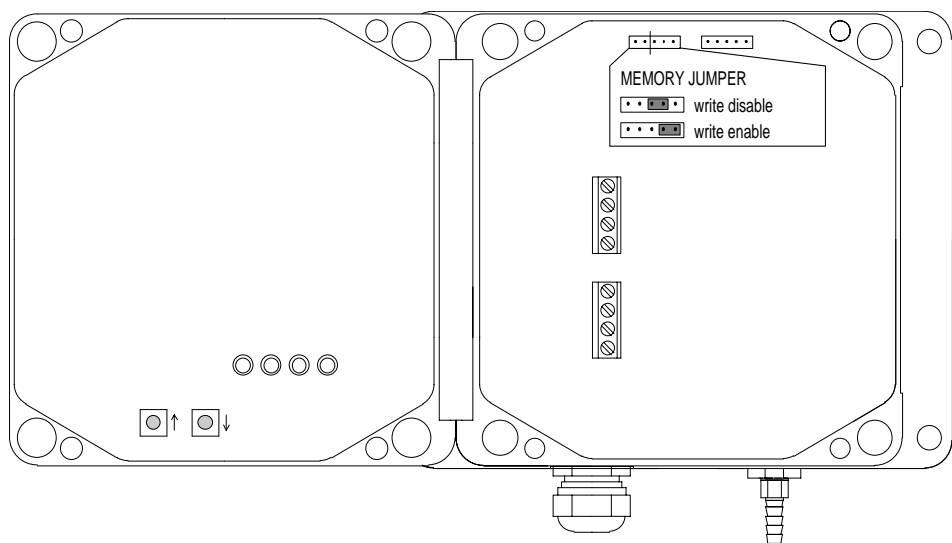


Fig. 7 MEMORY jumper positions

The following pressure adjustments are possible:

- offset adjustment
- offset/gain adjustment
- multipoint adjustment at up to eight pressure levels.

Offset and offset/gain adjustments are made with the barometer connected to a reference pressure (see LP command). With the LP command the pressure value of the primary standard is given to the barometer as a reference pressure and no separate corrections are needed.

Before multipoint adjustment, the barometer must first be precalibrated in order to find out the corrections needed to bring the barometer to the accuracy level of the primary standard. After precalibration the multipoint corrections are entered through the serial interface (see MPC and MPC1 commands).

Note that up to 99 PTB 200 barometers can be connected to one RS 232C bus which makes their adjustment and calibration more cost effective.

4.1 Offset and gain adjustment

LP Linear pressure adjustments

```
LP<cr>
```

The LP command is used in offset and offset/gain adjustment of the barometer.

The offset adjustment can be made at any pressure level. To guarantee the best possible pressure stability connect the pressure port of the barometer to the pressure standard even during offset adjustment. The two pressure levels used in offset/gain adjustment must be at least 400 hPa apart.

Change the MEMORY jumper to the EEPROM write enable position.

Example of an offset adjustment:

```
>LP<cr>
Ref1 ? (set pressure level and enter value
here)<cr>
P      : (the current non-corrected value
appears here)
Ref2 ? <cr>
```


Example of an offset and gain adjustment:

```
>LP<cr>
Ref1 ? (set first pressure level and enter value
here)<cr>
P      : (the current non-corrected value
appears here)
Ref2 ? (set second pressure level and enter
value here)<cr>
P      : (the current non-corrected value
appears here)
```

Use ESC to abort without executing a command.

Return the MEMORY jumper to the EEPROM write disable position.

4.2 Multipoint pressure adjustment

MPC OFF Multipoint correction off
MPCI Multipoint correction input
MPC ON Multipoint correction on

```
MPC OFF<cr>
MPCI<cr>
MPC ON<cr>
```

The MPC/MPCI commands are used in multipoint pressure adjustment at up to eight pressure levels.

If a new fine adjustment is needed, the previous multipoint corrections must first be omitted with the MPC OFF command. Writing down the previous multipoint corrections is recommended as they will be lost when MPCI command is used. Precalibrate the barometer to find out the new multipoint corrections; the corrections are then entered using the MPCI command. The MPC ON command is used to activate the new corrections.

Change the MEMORY jumper to the EEPROM write enable position.

Example of the multipoint pressure correction procedure:

```
>LIP<cr>
P offset          0 * 0.001 ? 0<cr>
P gain            0 * 0.00001 ? 0<cr>
>MPC OFF <cr>
Multip. corr.    : OFF
```

First precalibrate the barometer at up to eight pressure levels. Then calculate the corrections (reference value minus PTB 200 barometer indication) at each pressure level and enter the corrections using the MPCl commands.

```
>MPCl<cr>
1. PTB reading ?499.64<cr>
   correction   ?0.024<cr>
2. PTB reading ?599.79<cr>
   correction   ?0.013<cr>
...
7. PTB reading ?1100.33<cr>
   correction   ?0.027<cr>
8. PTB reading ?<cr>
```

```
>MPC ON <cr>
Multip. corr.      : ON
Reading           Corrections
 499.6400         0.0240
 599.7900         0.0130
.                 .
.                 .
.                 .
1100.3300         0.0270
```

Use ESC to abort without executing a command.

Return the MEMORY jumper to the EEPROM write disable position.
--

5 TECHNICAL DATA

OPERATING RANGE

Pressure range	600 ... 1100 hPa
Operating temperature range	-40 °C ... +60 °C
Storage temperature range	-60 °C ... +60 °C
Humidity range	non-condensing

Note: 1 hPa = 1 mbar (see note below).

ACCURACY	PTB 200 A	PTB 201 A
Linearity *	± 0.05 hPa ¹⁾ ± 0.10 hPa ²⁾	± 0.15 hPa
Hysteresis *	± 0.03 hPa	± 0.03 hPa
Repeatability *	± 0.03 hPa	± 0.03 hPa
Calibration uncertainty **	± 0.10 hPa	± 0.20 hPa
Accuracy at +20 °C ***	± 0.12 hPa ¹⁾ ± 0.15 hPa ²⁾	± 0.25 hPa
Temperature dependence	± 0.1 hPa	± 0.1 hPa
Total accuracy (RSS)	± 0.20 hPa	± 0.3 hPa
Long-term stability	± 0.1 hPa / a	+0.2 hPa / a

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

** Defined as ± 2 standard deviation limits of inaccuracy of the primary or working standard at 1000 hPa in comparison to international standards (NIST).

*** Defined as the root sum of the squares (RSS) of end-point non-linearity, hysteresis error, repeatability error and calibration uncertainty at room temperature.

- 1) 800 to 1100 hPa
2) 600 to 1100 hPa

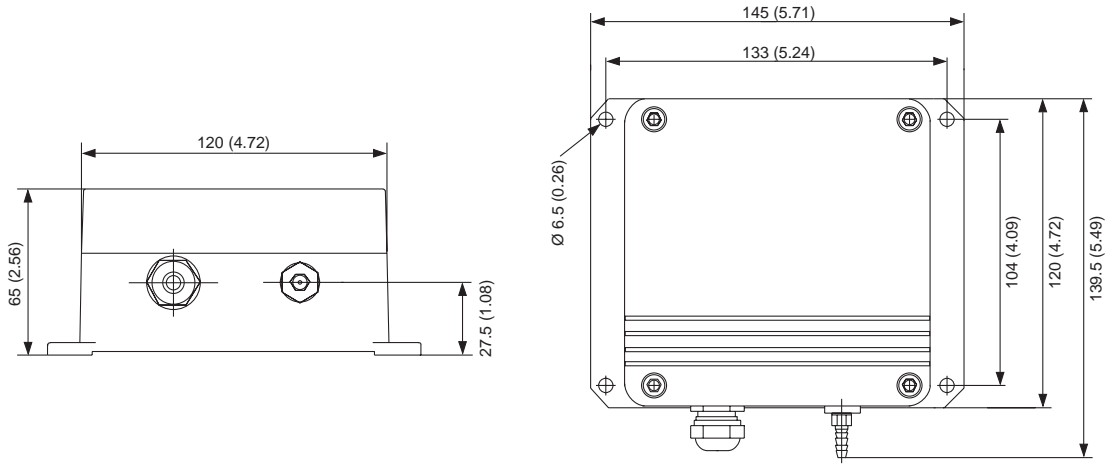
Note. The unit hectopascal (hPa) is recommended by WMO to be used in meteorological barometric pressure measurement (see WMO Guide to Meteorological Instruments and Methods of Observation, Fifth edition, 1983).

The official unit of pressure is pascal (Pa) and its multiples according to the International System of Units (SI) and according to ISO 1000.

GENERAL CHARACTERISTICS (factory settings*)

Supply voltage	10 ... 30 VDC, polarity protected
Supply voltage sensitivity	negligible
Current consumption	< 25 mA < 10 mA (sleep mode) < 0.1 mA (shutdown mode)
Serial I/O	RS 232C* full duplex serial I/O or bidirectional TTL level serial I/O
code	ASCII
parity	even*, odd, none
data bits	7* or 8
stop bits	1* or 2
Pulse output	pulse output at about 4.5 kHz; 10.000 pulses = 1000.0 hPa
Pressure units	hPa*, kPa, mbar, inHg, mmHg, torr, psia
Baud rates	300, 600, 1200*, 2400, 4800, 9600
Resolution	
PTB 200 A	0.01 hPa*
PTB 201 A	0.1 hPa*
Settling time after power-up	
PTB 200 A	2 seconds*
PTB 201 A	1 second*
Pressure step response time	
PTB 200 A	500 ms*
PTB 201 A	300 ms*
Acceleration sensitivity	negligible
Pressure connection	M5 (10-32) internal thread
Pressure fitting	barbed tube for 1/8" I.D. tubing
Maximum pressure limit	5000 hPa abs.
Minimum pressure limit	0 hPa abs.
Cable bushing	for 5 ... 10 mm diameter cables
Electrical connections	
excitation	supply, GND, CTRL (for shutdown)
serial communication	TX, RX, GND
pulse output	PULSE, PULSE TRIG, GND
Electrical connectors	screw terminals for AWG 22...16 wire
Housing	epoxy painted aluminium
Weight	950 g

Dimensions in mm (inches)



SERIAL COMMANDS

Function	Command	Comment
serial bus settings	SERI	
echo on/off	ECHO	
output format	FORM	
pressure resolution	FORM	
units	UNIT	
integration time	MTIM, FILT	
settling time/response time	MTIM, FILT	
sending mode	SMODE	STOP, RUN and POLL modes
address	ADDR	for POLL mode only
defining single output command	SCOM	in STOP and RUN modes only
sleep mode	SLEEP	
list of software settings	?	
starting output	R	
stopping output	S	
output single reading	SEND	in POLL mode address required
setting output interval	INTV	
control of a single barometer in POLL mode	OPEN ,CLOSE	
resetting	RESET	
error messages	ERRS	
linear pressure adjustment	LP	
multipoint correction	MPC, MPC1	