USER'S GUIDE

Vaisala BAROCAP$^\circledR$ Digital Barometer PTB330

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CHAPTER 1
GENERAL INFORMATION

This chapter provides general notes for the manual and the product.

About This Manual

This manual provides information for installing, operating, and maintaining Vaisala BAROCAP® Digital Barometer PTB330.

Contents of This Manual

This manual consists of the following chapters:

- Chapter 1, General Information: This chapter provides general notes for the manual and the product.

- Chapter 2, Product Overview: This chapter introduces the features, advantages, and the product nomenclature of PTB330.

- Chapter 3, Installation : This chapter provides you with information that is intended to help you install the product.

- Chapter 4, Operation: This chapter contains information that is needed to operate the product.

- Chapter 5, Maintenance: This chapter contains information that is needed in basic maintenance of the product.

- Chapter 6, Calibration and Adjustment: This chapter contains instructions for performing the calibration and adjustment of the product.
- Chapter 7, Technical Data: This chapter provides the technical data of the product.
- Appendix A, Calculation Formulas: This appendix contains the calculation formulas used by the product.
- Appendix B, Unit conversion tables: This appendix contains the unit conversion tables.
- Appendix C, PA11A Emulation Mode: This appendix describes the PA11A emulation mode of the PTB330 series.

General Safety Considerations

Throughout the manual, important safety considerations are highlighted as follows:

WARNING	Warning alerts you to a serious hazard. If you do not read and follow instructions very 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	Note highlights important information on using the product.

Feedback

Vaisala Customer Documentation Team welcomes your comments and suggestions on the quality and usefulness of this publication. If you find errors or have other suggestions for improvement, please indicate the chapter, section, and page number. You can send comments to us by e-mail: manuals@vaisala.com

Product Related Safety Precautions

The product delivered to you has been tested for safety and approved as shipped from the factory. Note the following precautions:

WARNING	Ground the product, and verify outdoor installation grounding periodically to minimize shock hazard.

CAUTION	Do not modify the unit. Improper modification can damage the product or lead to malfunction.

ESD Protection

Electrostatic Discharge (ESD) can cause immediate or latent damage to electronic circuits. Vaisala products are adequately protected against ESD for their intended use. However, it is possible to damage the product by delivering electrostatic discharges when touching, removing, or inserting any objects inside the equipment housing.

To make sure you are not delivering high static voltages yourself:

- Handle ESD sensitive components on a properly grounded and protected ESD workbench. When this is not possible, ground yourself to the equipment chassis before touching the boards. Ground yourself with a wrist strap and a resistive connection cord. When neither of the above is possible, touch a conductive part of the equipment chassis with your other hand before touching the boards.

- Always hold the boards by the edges and avoid touching the component contacts.

Recycling

♻	Recycle all applicable material.

🗑	Dispose of batteries and the unit according to statutory regulations. Do not dispose of with regular household refuse.

Trademarks

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License Agreement

All rights to any software are held by Vaisala or third parties. The customer is allowed to use the software only to the extent that is provided by the applicable supply contract or Software License Agreement.

Warranty

Vaisala hereby represents and warrants all Products manufactured by Vaisala and sold hereunder to be free from defects in workmanship or material during a period of twelve (12) months from the date of delivery save for products for which a special warranty is given. If any Product proves however to be defective in workmanship or material within the period herein provided Vaisala undertakes to the exclusion of any other remedy to repair or at its own option replace the defective Product or part thereof free of charge and otherwise on the same conditions as for the original Product or part without extension to original warranty time. Defective parts replaced in accordance with this clause shall be placed at the disposal of Vaisala.

Vaisala also warrants the quality of all repair and service works performed by its employees to products sold by it. In case the repair or service works should appear inadequate or faulty and should this cause malfunction or nonfunction of the product to which the service was performed Vaisala shall at its free option either repair or have repaired or replace the product in question. The working hours used by employees of Vaisala for such repair or replacement shall be free of charge to the client. This service warranty shall be valid for a period of six (6) months from the date the service measures were completed.

This warranty is however subject to following conditions:

a) A substantiated written claim as to any alleged defects shall have been received by Vaisala within thirty (30) days after the defect or fault became known or occurred, and

b) The allegedly defective Product or part shall, should Vaisala so require, be sent to the works of Vaisala or to such other place as Vaisala may indicate in writing, freight and insurance prepaid and properly packed and labelled, unless Vaisala agrees to inspect and repair the Product or replace it on site.

This warranty does not however apply when the defect has been caused through

a) normal wear and tear or accident;

b) misuse or other unsuitable or unauthorized use of the Product or negligence or error in storing, maintaining or in handling the Product or any equipment thereof;

c) wrong installation or assembly or failure to service the Product or otherwise follow Vaisala's service instructions including any repairs or installation or assembly or service made by unauthorized personnel not approved by Vaisala or replacements with parts not manufactured or supplied by Vaisala;

d) modifications or changes of the Product as well as any adding to it without Vaisala's prior authorization;

e) other factors depending on the Customer or a third party.

Notwithstanding the aforesaid Vaisala's liability under this clause shall not apply to any defects arising out of materials, designs or instructions provided by the Customer.

This warranty is expressly in lieu of and excludes all other conditions, warranties and liabilities, express or implied, whether under law, statute or otherwise, including without limitation any implied warranties of merchantability or fitness for a particular purpose and all other obligations and liabilities of Vaisala or its representatives with respect to any defect or deficiency applicable to or resulting directly or indirectly from the Products supplied hereunder, which obligations and liabilities are hereby expressly cancelled and waived. Vaisala's liability shall under no circumstances exceed the invoice price of any Product for which a warranty claim is made, nor shall Vaisala in any circumstances be liable for lost profits or other consequential loss whether direct or indirect or for special damages.

CHAPTER 2
PRODUCT OVERVIEW

This chapter introduces the features, advantages, and the product nomenclature of PTB330.

Introduction to PTB330

Vaisala BAROCAP® Digital Barometer PTB330 provides reliable pressure measurement in a wide range of applications. Digital outputs RS-232 (standard) or RS-422/485 (optional) can be selected. Alternatively, analog outputs can be chosen between current and optional voltage signals. A local graphical display is available as well. The quantities measured and calculated by PTB330 are presented in

The PTB330 barometer is available with one, two or three barometer modules. The barometer can be used successfully both in accurate pressure measurement applications at room temperature and in demanding automatic weather station applications.

Basic Features and Options

- for applications in industrial and meteorological areas

- 1...3 barometer modules (sensors)

- graphical display showing the measurement trends of the quantities chosen by the user

- user friendly, multilingual display

- calculated output quantities, QFE and QNH, available

- barometer mounting accessories for multiple installation purposes

- service port for MI70 Link Interface Software or PC

- four module slots

- optional modules: power supply module, RS-485 module, analog output module and relay module

- optional USB cable

- IP 65 housing

- screw terminal, optional M12 connector or D-9 connector

Pressure Measurement

The PTB330 series barometers use a BAROCAP$^{®}$ silicon capacitive absolute pressure sensor developed by Vaisala for barometric pressure measurement applications. The BAROCAP$^{®}$ sensor has excellent hysteresis and repeatability characteristics, low temperature dependence and a very good long-term stability. The ruggedness of the BAROCAP$^{®}$ sensor is outstanding and the sensor is resistant to mechanical and thermal shocks.

The measurement principle of the PTB330 series digital barometers is based on an advanced RC oscillator and reference capacitors against which the capacitive pressure sensor is continuously measured. The microprocessor of the barometer performs compensation for pressure linearity and temperature dependence.

Table 1   Quantities Measured by PTB330

Quantity	Abbreviation
Pressure (measures average pressure from P_1, P_2, and P_3)	P
Pressure from barometer module 1 or 2 or 3	P_1, P_2, and P_3
Pressure trend and tendency	P_{3h}
Pressure difference (P_1 -P_2)	$deltaP_{12}$
Pressure difference (P_1 -P_3)	$deltaP_{13}$
Pressure difference (P_2-P_3)	$deltaP_{23}$ (available on serial port only)
QNH pressure	QNH

Table 1   Quantities Measured by PTB330 (Continued)

Quantity	Abbreviation
QFE pressure	QFE
Height Corrected Pressure	HCP
Pressure tendency	A_{3h}

Outer Structure of the Barometer
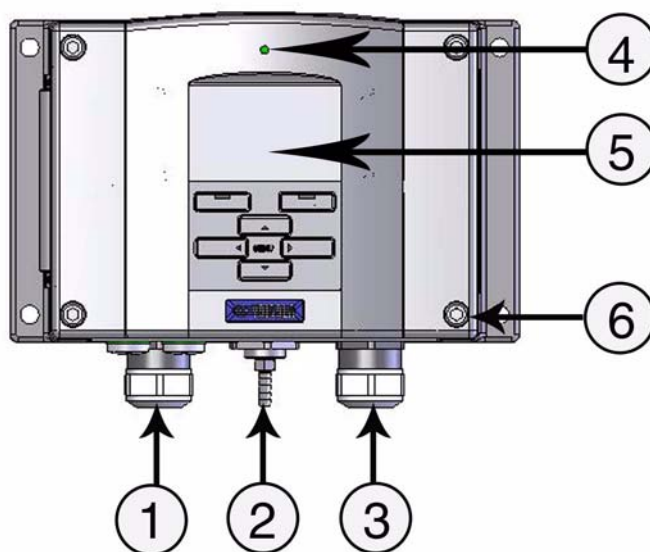
Figure 1   Barometer Body

Numbers refer to Figure 1 on page 19:

1 = Signal + powering cable gland

2 = Pressure port

3 = Cable gland for optional module

4 = Cover LED

5 = Display with keypad (optional)

6 = Cover screw (4 pcs)

Inner Structure of the Barometer
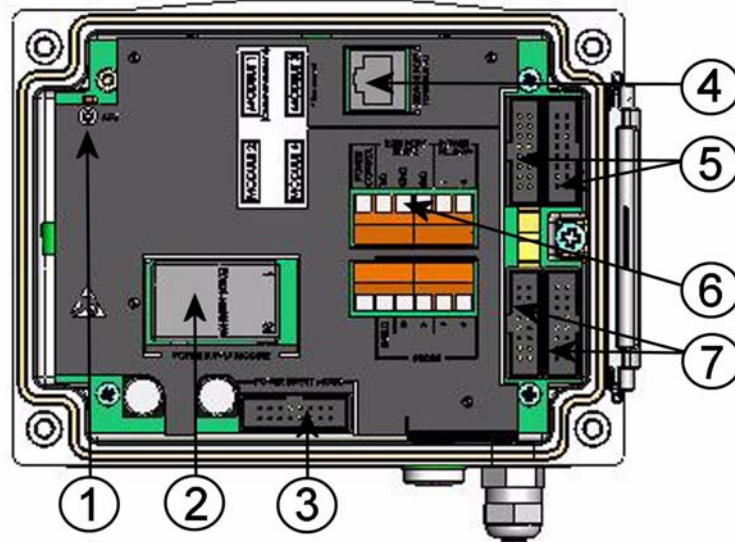
Figure 2   Inside of Open Barometer

Numbers refer to Figure 2 on page 20:

1   =   Adjustment button with indicator LED
2   =   Power supply module (optional)
3   =   Power supply mode selections
4   =   Service port (RS-232)
5   =   Module 1/Module 3 connectors
6   =   User port
7   =   Module 2/Module 4 connectors

CHAPTER 3
INSTALLATION

This chapter provides you with information that is intended to help you install the product.

Mounting the Housing

The housing can be mounted either without the mounting plate or with optional mounting plates.

Standard Mounting without Mounting Plate

Mount the housing by fastening the barometer to the wall with 4 screws, for example M6 (not provided).
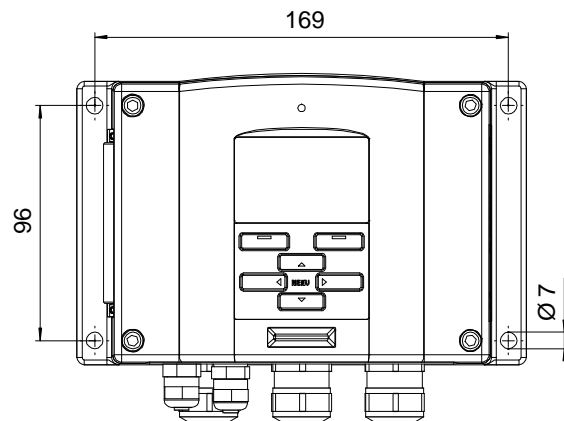
Figure 3   Standard Mounting

Wall Mounting with Wall Mounting Kit

When mounting with wall mounting kit the mounting plate (Vaisala order code 214829) can be installed directly on wall or onto a standard wall box (also US junction box). When wiring through back wall, remove the plastic plug from the wiring hole in the barometer before mounting.
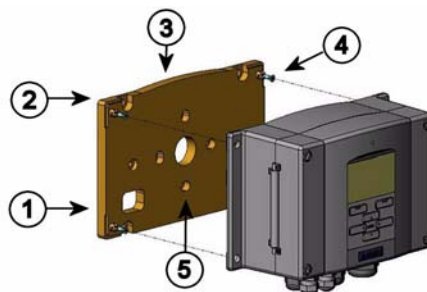
Figure 4   Mounting with Wall Mounting Kit

Numbers refer to :

1   =   Plastic mounting plate

2   =   Mount the plate to wall with 4 screws M6 (not provided)

3   =   The arched side up

4   =   Fasten barometer to the mounting plate with 4 fixing screws M3 (provided)

5   =   Holes for wall/junction box mounting
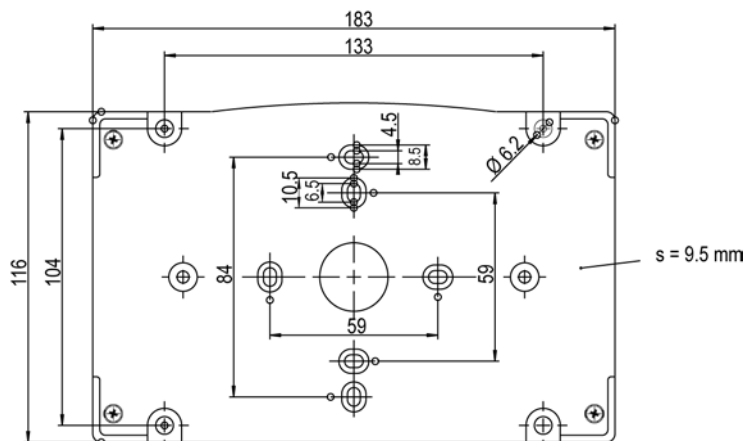
Figure 5   Dimensions of Plastic Mounting Plate

Mounting with DIN Rail Installation Kit

DIN rail installation kit includes a wall mounting kit, 2 clip-fasteners and 2 screws M4 x 10 DIN 7985 (Vaisala order code 215094).

1.   Attach two spring holders to the plastic mounting plate by using the screws provided in the installation kit.

2.   Fasten the barometer to the plastic mounting plate with 4 screws provided for that purpose.

3.   Press the barometer onto the DIN rail so that the clip-fasteners snap into the rail.
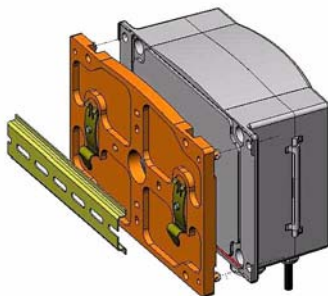
Figure 6   Mounting with DIN Rail Installation Kit

Pole Installation with Installation Kit for Pole or Pipeline

Installation kit for pole or pipeline (Vaisala order code: 215108) includes the metal mounting plate and 4 mounting nuts for pole mounting. When mounting, the arrow in the metal mounting plate must point upwards, see Figure 10, Mounting with Metal Wall Mounting Plate, on page 25.

Figure 7   Vertical Pole (side)
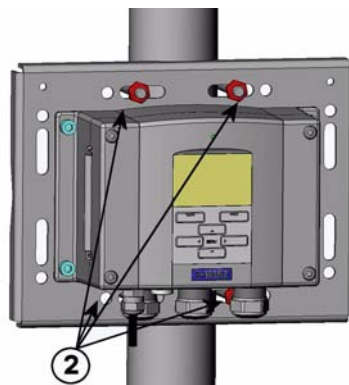
Figure 8   Vertical Pole (front)

Numbers refer to Figure 8 on page 24:

1   =   Fixing brackets (2 pcs) M8 (provided) for 30 ... 102 mm poles.

2   =   Mounting nuts M8 (4 pcs)
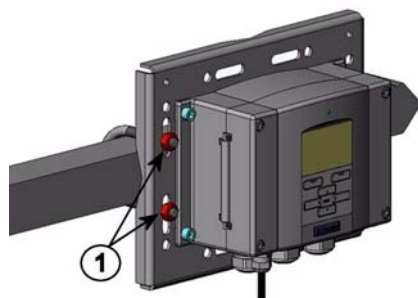
Figure 9   Horizontal Pole

Number refers to Figure 9 on page 25:

1   =   Mounting nuts M8 (4 pcs)

Metal mounting plate is included in rain shield with installation kit and installation kit for pole or pipeline.
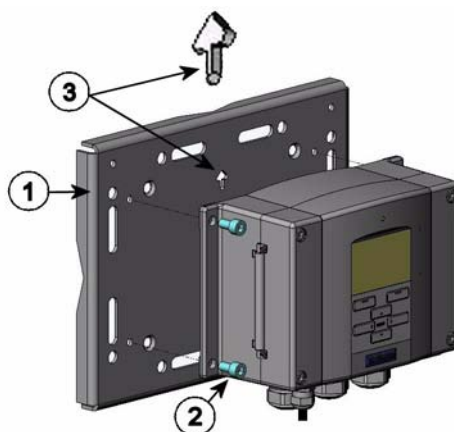
Figure 10   Mounting with Metal Wall Mounting Plate

Numbers refer to Figure 10 on page 25:

1   =   Mount the plate to wall with 4 screws M8 (not provided)

2   =   Fasten the barometer to the mounting plate with 4 fixing screws M6 (provided)

3   =   Note the position of the arrow when mounting. This side must be up when mounting.
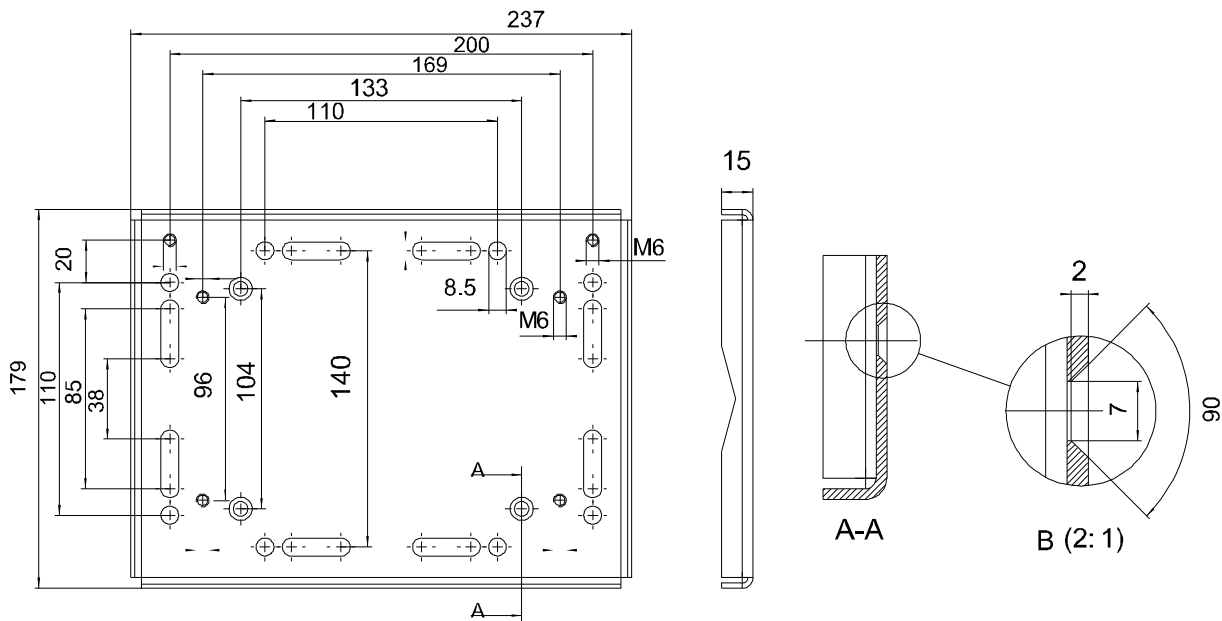
Figure 11   Dimensions of Metal Mounting Plate (mm)

Mounting Rain Shield with Installation Kit

Figure 12   Mounting Rain Shield with Installation Kit

Numbers refer to Figure 12 on page 26:

1 = Fasten the rain shield with installation kit (Vaisala order code: 215109) to the metal mounting plate with 2 (M6) mounting screws (provided).

2 = Fasten the mounting plate with rain shield with installation kit to the wall or to the pole (see pole installation).

3 = Fasten the barometer to the mounting plate with 4 fixing screws (provided).

Panel Mounting Frame

To enable a neat and dirt free embedded installation of the transmitter, a panel mounting frame is available as an option (Vaisala order code: 216038). The frame is a thin, flexible plastic frame for the transmitter, with adhesive tape on one side.The frame is used to hide any rough edges of the installation hole, and provide a more finished look. Note that the panel mounting frame is not intended to bear the weight of the transmitter, and does not include any mounting supports.

Use the panel mounting frame as follows:

1. Use the frame as a template to mark the required size for the installation hole in the panel.
2. Cut the hole in the panel.
3. Mount the transmitter through the panel with suitable supports.
4. Remove the paper protecting the adhesive tape on the frame, and attach the frame around the transmitter. Refer to below.
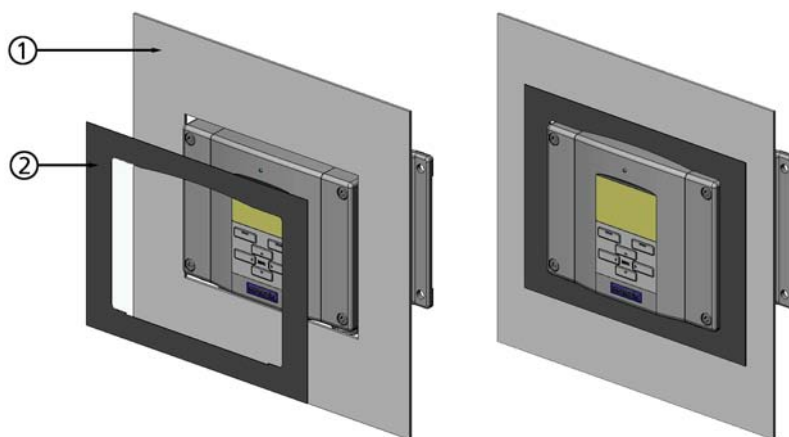
Figure 13   Panel Mounting Frame

Numbers refer to :

1 = Panel (not included)
2 = Panel mounting frame
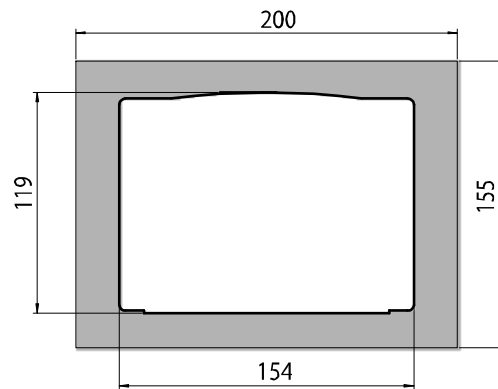
Figure 14   Panel Mounting Dimensions

General about Wiring and Grounding

Cable Bushings

A single electrical cable with a screen and three to ten wires is recommended for power and signal connections. The cable diameter should be 8...11 mm. The number of cable bushings depends on the barometer options. See the following recommendations for the cable bushings:
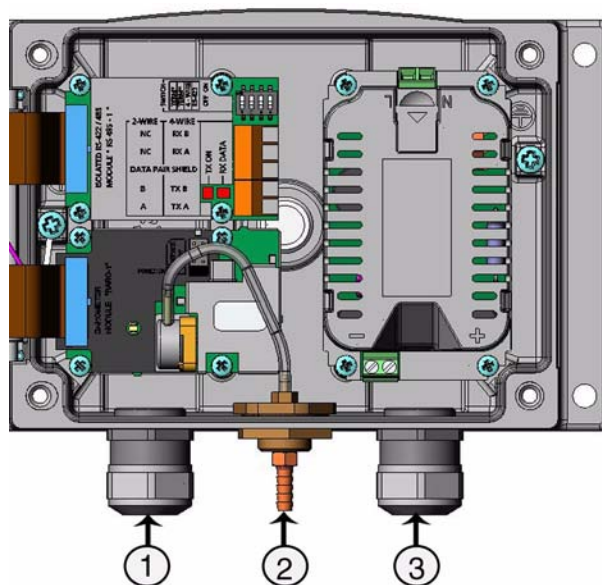
Figure 15   Cable Bushings

Numbers refer to Figure 15 on page 29:

1   =   Cable for signal/powering Ø 8 ... 11 mm

2   =   Pressure port

3   =   Cable for optional power supply/relay module Ø 8 ... 11 mm

NOTE	When there is high electric noise level (for example, near powerful electric motor) in the operating environment it is recommended to use shielded cable or take care that the signal cables are separated from other cables.

Grounding the Cables

Ground the screen of the electrical cable properly to achieve the best possible EMC performance.

Fig. 1
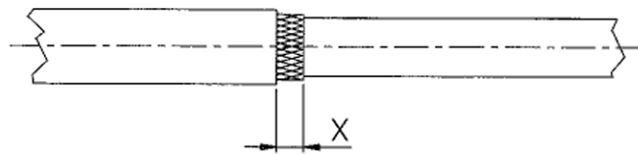
Fig. 2
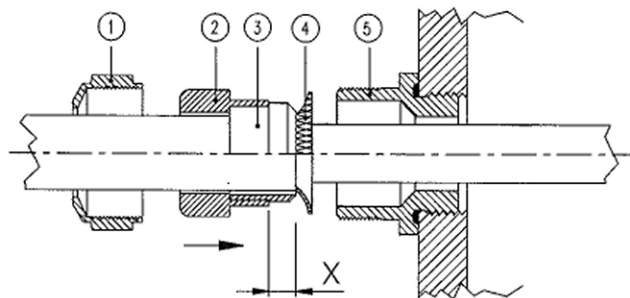
Fig. 3
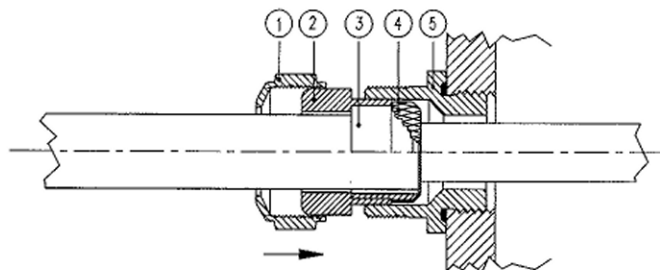
Figure 16   Grounding the Screen of Electrical Cable

1. Cut back outer sheath to desired length.

2. Cut back screen braiding or screen foil to dimension X (see Figure 16 on page 30).

3. Push the domed cap nut (item 1) and the seal insert with contact socket of the gland (item 2+3) onto the cable as shown in the diagram.

4. Bend over the screen braiding or screen foil by about 90° (item 4).

5. Push the seal insert with the contact socket of the gland (item 2+3) up to the screen braiding or screen foil.

6. Mount lower part (item 5) on the housing.

7. Push the seal with the contact socket of the gland and (item 2+3) flush into the lower part (item 5).

8. Screw the domed cap nut (item 1) onto the lower part (item 5).

Grounding the Barometer Housing

In case you need to ground the barometer housing, the grounding connector is found inside the housing. Make sure that different groundings are made to the same potential. Otherwise harmful ground currents may be generated.

If a galvanic isolation of the power supply line from the output signals is needed, the barometer can be ordered with an optional output isolation module. This module prevents harmful grounding loops.

Alternate Wiring Systems

There are optional ways to connect the barometer: using basic wiring, the D-9 connector, or the M-12 connector.

The wiring system is selected when ordering the device. If a connector is needed for wiring, it is set at the factory.

-   When using basic wiring, see section Signal and Power Supply Wiring on page 32.

-   When using 8-pin connector, see section M-12 (8-Pin) Connector on page 34.

-   When using D-9 connector, see section D-9 Connector on page 35.

Signal and Power Supply Wiring

When wiring the power supply module, see section AC Power Supply Module on page 36.
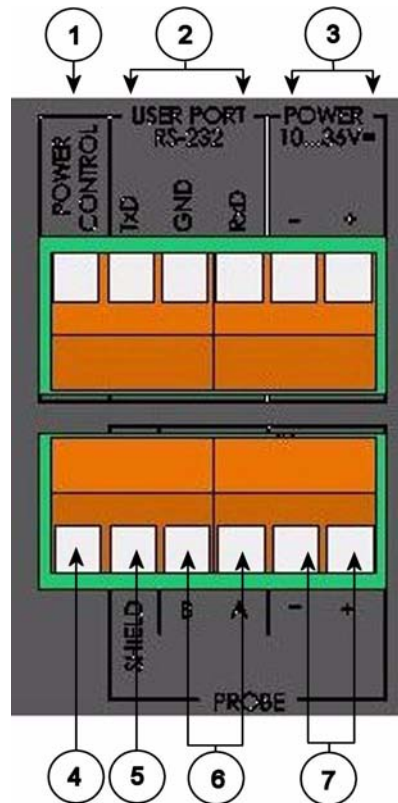
Figure 17   Screw Terminal Block on Motherboard

Numbers refer to Figure 17 on page 32:

1   =   Power control (0VDC = OFF, 5VDC = ON, if feature enabled)

2   =   User port (RS-232 terminals)

3   =   Power supply terminals 10 ... 36 V DC

4   =   Test terminal (not connected, not used in PTB330)

5   =   Probe cable shield (not used in PTB330)

6   =   Probe bus (not used in PTB330)

7   =   Probe power (not used in PTB330)

WARNING	Make sure that you connect only de-energized wires.

1. Open the barometer cover by taking out the four cover screws.

2. Insert the power supply wires and signal wires through the cable bushing in the bottom of the barometer; see the grounding instructions in the previous sections.

3. Connect the RS-232 user port cables to terminals RxD, GND and TxD. For more information about the RS-232 connection, see section, Serial Line Communication, on page 68.

4. When wiring RS-485 module, relay module or additional analog output module, see sections RS-422/485-1 Interface Module on page 46, Relay Module (RELAY-1) on page 43, and Analog Output Module on page 42.

5. Connect the power supply wires to the connectors: POWER 10 ... 35V (+) and (-) terminals.

6. Turn on the power. The indicator led on the cover is lit continuously during normal operation.

7. Close the cover and replace the cover screws. The barometer is ready for use.

NOTE	If you have chosen the external power control option you have to remove the wire between "Power control" and "Power +" -terminals prior to using the power control feature.

M-12 (8-Pin) Connector
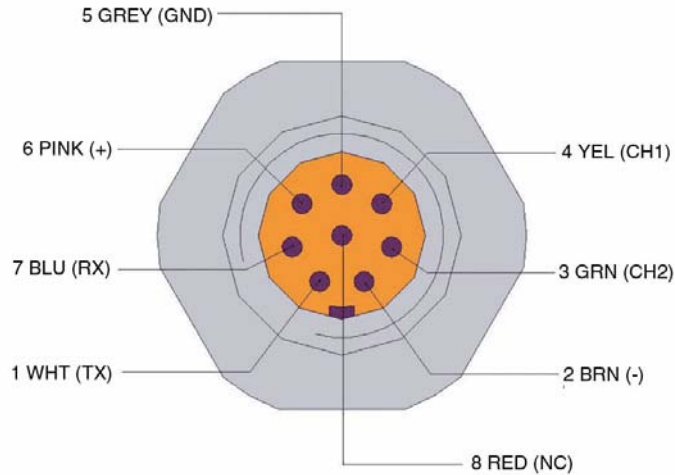
Figure 18   Wiring of Optional M-12 (8-Pin) Connector

Table 2   Pin Assignments to RS-232-/485 Serial Output

Pin/Terminal	Wire	Serial Signal		Analog Signal
		RS-232 (EIA-232)	RS-485 (EIA-485)	
1	White	Data out TX	A -	-
2	Brown	(serial GND)	(serial GND)	Signal GND (for both channels)
3 (optional)	Green	External power control	(serial GND)	Signal GND (for both channels)
4	Yellow	-	-	Analog output
5	Grey	Supply -	Supply -	Supply -
6	Pink	Supply +	Supply +	Supply +
7	Blue	Data in RX	B -	-
8	Shield/Red	Cable shield	Cable shield	Cable shield

NOTE	The 8-pin connector cannot be used with relay modules or power supply module that have AC (mains) power connection.

D-9 Connector
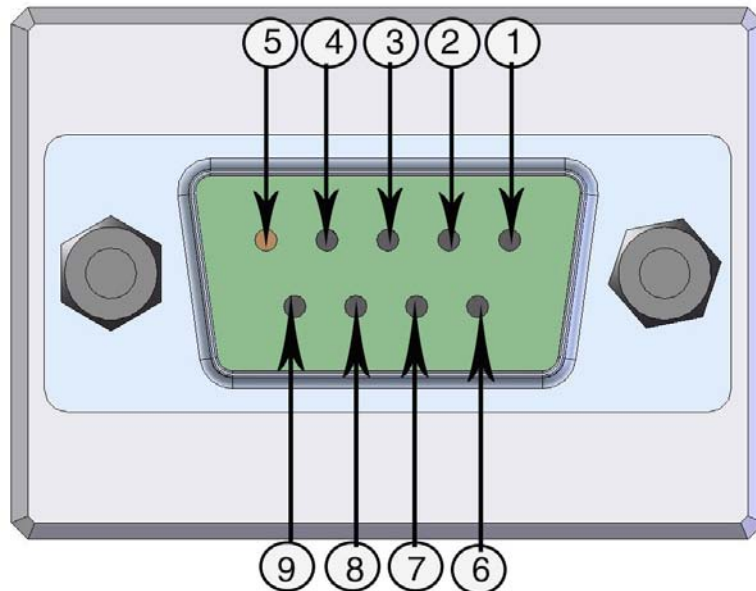
Figure 19   Wiring of Optional D-9 Connector

Table 3   Pin Assignments to RS-232/485 Serial Output

Pin	Wire Color	Serial Signal		Analog Signal +RS232
		RS-232 (EIA-232)	**RS-485 (EIA-485)**	
1	Red			
2	White	TX		TX
3	Black	RX		RX
4 (optional)	Yellow	External power control	External power control	External power control
5	Brown	Ground		Ground
6	Green		LO	Aout
7	Blue	Ground for supply voltage	Ground for supply voltage	GND supply
8	Grey		HI	AGND
9	Orange	Supply voltage (10...30 VDC)	Supply voltage (10...30 VDC)	Supply

NOTE   The D-9 connector cannot be used with relay modules or power supply module that have AC (mains) power connection.

NOTE   The D-9 connector is not IP65 protection classified.

Optional Modules

AC Power Supply Module

The AC (mains) power connection may be connected to the power supply module only by an authorized electrician. A readily accessible disconnect device shall be incorporated in the fixed wiring.
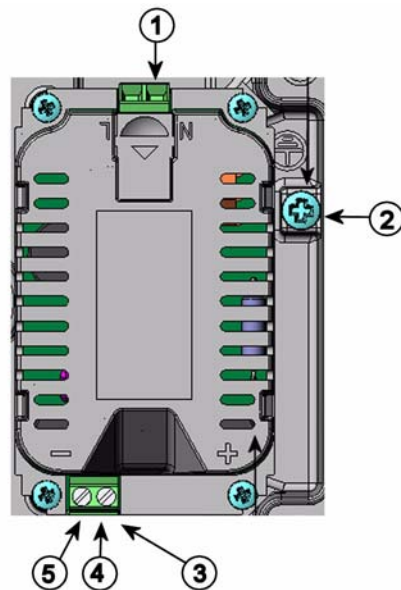
Figure 20   AC Power Supply Module

Numbers refer to Figure 20 on page 36:

1   =   Connect AC (mains) voltage wires to these terminals

2   =   Grounding terminal

3   =   In case the module is not installed in the factory: Connect wires from these terminals to the POWER 10...36V terminals of the motherboard.

4   =   +

5   =   -

Installation

1. Disconnect the power and open the barometer cover.

2. Remove the protective plug from the cable gland and thread the wires. In case the power supply module is installed in the factory, continue with the step 5.

3. To attach the module fasten the power module to the bottom of the housing with four screws. See the position of the power supply module in .

4. Connect the wires from the terminals of the power supply module marked with + and - to the terminals POWER 10 ... 35 V on the motherboard of the barometer.

5. Connect the AC mains voltage wires to the power supply module terminals marked with N and L.

6. Attach the grounding wire to the grounding terminal on the right-hand side of the barometer.

7. Connect the power. The LED on the cover of the barometer is lit continuously during normal operation.

WARNING	Do not detach the power supply module from the barometer when the power is on.

WARNING	Do not connect the mains power to power supply module when it is not installed in the barometer.

WARNING	Always connect protective ground terminal.

Warnings

Dieses Produkt entspricht der Niederspannungsrichtlinie (73/23 EWG).

- Das Netzmodul darf nur von einem dazu befugten Elektriker angeschlossen werden.
- Trennen Sie das Netzmodul nicht vom Messwertgeber, wenn der Strom eingeschaltet ist.
- Verbinden Sie das Netzmodul nur mit der Spannungsquelle, wenn es im Messwertgeber PTB330 montiert ist.
- Das Erdungskabel muss zum Schutz immer angeschlossen sein.

Ce produit est conforme à la Directive relative à la Basse Tension (73/23 EEC).

- Seul un électricien compétent est habilité à raccorder le module d'alimentation au secteur.
- Ne pas détacher le module d'alimentation du transmetteur lorsqu'il est en service.
- Ne pas raccorder le secteur au module d'alimentation lorsque celui-ci n'est pas installé dans le transmetteur PTB330.
- Toujours raccorder un bornier de protection à la terre.

Tämä tuote on pienjännitedirektiivin (73/23 EEC) mukainen.

- Vaihtovirtaliitännän saa kytkeä tehonsyöttömoduuliin ainoastaan valtuutettu sähköasentaja
- Älä irrota tehonsyöttömoduulia lähettimestä, kun virta on kytkettynä.
- Älä kytke verkkovirtaa tehonsyöttömoduuliin, jos kyseistä moduulia ei ole asennettu PTB330 lähettimeen.
- Kytke aina maadoitusliittimet.

Denna produkt uppfyller kraven i direktivet om lågspänning (73/23 EEC).

- Nätanslutningen (växelströmsanslutningen) får bara anslutas till strömförsörjningsmodulen av en behörig elektriker.
- Ta inte loss strömförsörjningsmodulen från mätaren när strömmen är på.
- Anslut inte strömförsörjningsmodulen till nätet när den inte är installerad i PTB330-mätaren
- Anslut alltid en skyddande jordningsplint.

Questo prodotto é conforme alla Direttiva sul basso voltaggio (73/23 CEE).

- La conduttura elettrica puó essere collegata al modulo di alimentazione elettrica soltanto da un elettricista autorizzato.
- Non staccare l´alimentazione elettrica dal trasmettitore quando é acceso.
- Non collegare la corrente elettrica al modulo di alimentazione elettrica se non é installato nel trasmettitore PTB330.
- Collegare sempre il morsetto protettivo a terra!

Dette produkt er i overensstemmelse med direktivet om lavspænding (73/23 EØS).

- Netstrømskoblingen til må kun tilsluttes strømforsyningsmodulet af en autoriseret elinstallatør
- Strømforsyningsmodulet må ikke løsgøres fra senderen, mens spændingen er sluttet til.
- Slut ikke netspændingen til strømforsyningsmodulet, når det ikke er installeret i PTB330- senderen
- Forbind altid den beskyttende jordklemme!

Dit product voldoet aan de eisen van de richtlijn 73/23 EEG (Laagspanningsrichtlijn).

- De stroom kan aan de stroomtoevoer module aangesloten worden alleen door een bevoegde monteur.
- Het is niet toegestaan de stroomtoevoer module van de transmitter los te koppelen wanneer de stroom aan is.
- Het is niet toegestaan de stroom aan de stroomtoevoer module aan te sluiten als deze niet in een PTB330-transmitter is gemonteerd.
- Altijd beschermend aardcontact aansluiten!

Este producto cumple con la directiva de bajo voltaje (73/23 EEC).

- La conexión de la alimentación principal al módulo de alimentación sólo puede realizarla un electricista autorizado.
- No desenchufe el módulo de alimentación del transmisor cuando esté encendido.
- No conecte la alimentación principal al módulo de alimentación cuando no esté instalado en el transmisor PTB330.
- Conecte siempre el terminal de protección de conexión a tierra.

See toode vastab madalpinge direktiivile (73/23 EEC).

- Voolukaabli võib vooluallika mooduli külge ühendada ainult volitatud elektrik.
- Ärge ühendage vooluallika moodulit saatja küljest lahti, kui vool on sisse lülitatud.
- Ärge ühendage voolukaablit vooluallika mooduli külge, kui seda pole PTB330-tüüpi saatjasse paigaldatud.
- Ühendage alati kaitsev maandusklemm!

Ez a termék megfelel a Kisfeszültségű villamos termékek irányelvnek (73/23/EGK).

- A hálózati feszültséget csak feljogosított elektrotechnikus csatlakoztathatja a tápegységmodulra.

- A bekapcsolt távadóról ne csatolja le a tápegységmodult.

- Ne csatlakoztassa a hálózati feszültséget a tápegységmodulhoz, ha az nincs beépítve a PTB330 távadóba.

- Feltétlenül csatlakoztasson földelő védőkapcsot!

Šis produktas atitinka direktyvą dėl žemos įtampos prietaisų (73/23/EB).

- Elektros tinklą su energijos tiekimo moduliu sujungti gali tik įgaliotas elektrikas.

- Niekada neišimkite energijos tiekimo modulio iš siųstuvo, kai maitinimas yra įjungtas.

- Jei energijos tiekimo modulis nėra įmontuotas PTB330 siųstuve, nejunkite jo į elektros tinklą.

- Visada prijunkite prie apsauginės įžeminimo jungties!

Šis produkts atbilst Zemsprieguma direktīvai (73/23 EEC).

- Strāvas pieslēgumu var pieslēgt pie barošanas avota moduļa tikai autorizēts elektriķis.

- Neatvienot barošanas avota moduli no raidītāja, kad pieslēgta strāva.

- Nepievienot strāvu barošanas avota modulim, ja tas nav uzstādēts PTB330 raidītājā

- Vienmēr pievienot aizsargājošu iezemētu terminālu !

Ten produkt spełnia wymogi Dyrektywy niskonapięciowej (73/23 EEC).

- Napięcie zasilające powinno zostać podłączone do modułu zasilacza tylko przez wykwalifikowanego elektryka.

- Nie wolno odłączać modułu zasilacza od nadajnika, kiedy zasilanie jest włączone.

- Nie wolno podłączać napięcia zasilającego do modułu zasilacza, kiedy nie jest on zamontowany w nadajniku PTB330.

- Zawsze należy podłączać zabezpieczający zacisk uziemiający!

Tento výrobek vyhovuje Směrnici pro nízké napětí (73/23 EEC).

- Připojení síťového napájení k napájecímu modulu smí provádět pouze oprávněný elektrikář.

- Neodpojujte napájecí modul od snímače při zapnutém napájení.

- Nepřipojujte síťové napájení k napájecímu modulu, pokud není instalován ve snímači PTB330.

- Vždy zapojte ochrannou zemnící svorku!

Galvanic Isolation for Output

If galvanic isolation of the power supply line from the output signals is needed, the barometer can be ordered with optional output isolation module. This module prevents harmful grounding loops.

NOTE	Output isolation module is not needed when using the AC power supply module.
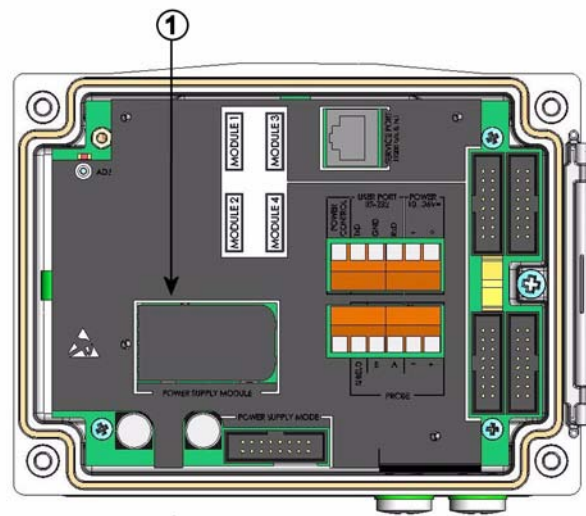
Figure 21   Galvanic Output Isolation

Number refers to Figure 21 on page 41:

1   =   Power Supply module

Analog Output Module
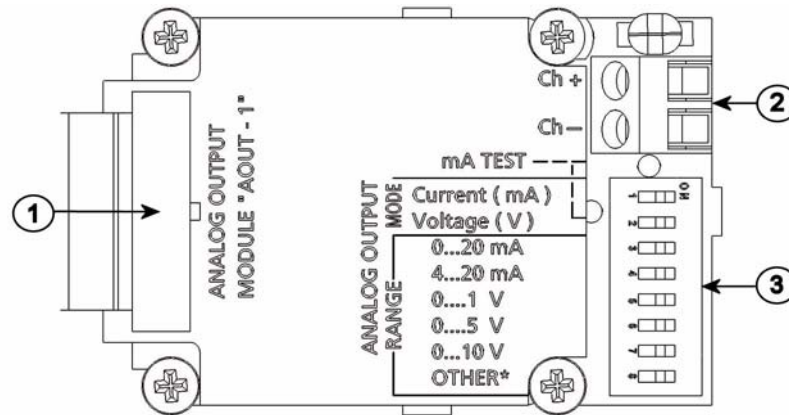
Figure 22   Analog Output 1 module

Numbers refer to Figure 22 on page 42:

1   =   Flat cable pins

2   =   Screw terminals for signal line

3   =   DIP switches to select the output mode and range

Installation and Wiring

1.   Disconnect the power. In case the analog output module is installed in the factory, continue with the step 4.

2.   To attach the module, open the barometer cover and fasten the analog output module to the bottom of the housing on the module slot 1 with four screws.

3.   Connect the flat cable between the analog output module and the motherboard's pins MODULE 1.

4.   Take out the protective plug from the cable gland and thread the wires.

5.   Connect the wires to the screw terminals marked with **Ch+** and **Ch-** .

6.   Select the current/voltage output by setting ON either of the switches 1 or 2.

7.   Select the range by setting ON one of the switches 3...7.

8.   Connect the power.

9.   Select the quantity and scale the channel through the serial line or display/keypad.

	OFF	ON	Selection
1			Current output selection, ON=Current output selected
2			Voltage output selection, ON=Voltage output selected
3			0...20 mA selection, ON= 0...20 mA selected
4			4... 20 mA selection, ON= 4... 20 mA selected
5			0...1 V selection, ON=0...1 V selected
6			0...5 V selection, ON=0...5 V selected
7			0...10 V selection, ON= 0...10 V selected.
8			For service use only, keep always in OFF position.

Figure 23   Analog Output

NOTE	For instructions on how to operate the analog output, see section Operation of Analog Output on page 99.

NOTE	Only one of the switches 1 and 2 can be ON at a time. Only one of the switches 3...7 can be ON at a time.

Relay Module (RELAY-1)

The barometer can be equipped with one configurable relay module. The module contains two configurable relays.

NOTE	The relay module is only intended for DC use.

Installation and Wiring

1. Disconnect the power and open the barometer cover. In case the relay-module is installed in the factory, continue with step 5.

2. To attach the module, first place a protective plate to the bottom of the housing, then fasten the relay module to the top of the plate with four screws. See the position in Figure 2, Inside of Open Barometer, on page 20 .

3. When the mains power is in use attach the grounding wire to the grounding terminal.

4. Connect the flat cable between the relay module and the MODULE 3 pins of the motherboard.

5. Take out the protective plug from the cable gland and thread the relay wires.

6. Connect the wires to the screw terminals: NO, C, NC. See section Selecting the Activation State of the Relay on page 44.

7. Connect the power and close the cover.

Selecting the Activation State of the Relay

The middlemost C terminal and either one of the terminals NO/NC must be connected. The polarity can be freely selected.

NO	**Normally open**
C	Common relay
NC	Normally closed

Relay NOT activated:	**C and NC outputs are closed, NO is open**
Relay IS activated:	C and NO outputs are closed, C and NC are open.

NOTE	For instructions on how to operate the relay (for example, select quantity for the relay output and set the relay setpoints) see section Operation of Relays on page 89.
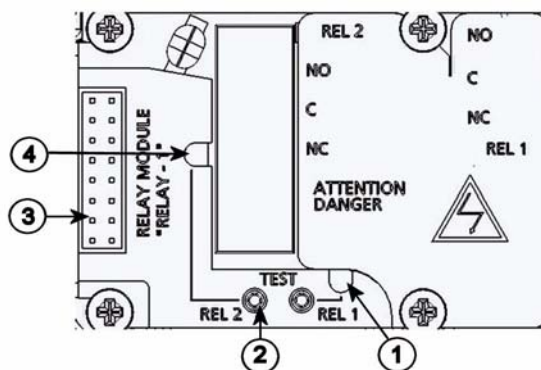
Figure 24   Relay Module

Numbers refer to Figure 24 on page 45:

1   =   Indication led for the relay 1, 3, 5 or 7

2   =   Relay test buttons

3   =   Flat cable pins

4   =   Indication led for relay 2, 4, 6 or 8

WARNING	The relay module may contain dangerous voltages even if the barometer power has been disconnected. Before opening the barometer you must switch off **both** the barometer **and** the voltage connected to the relay terminals.

WARNING	Do not connect the mains power to the relay unit.

RS-422/485-1 Interface Module
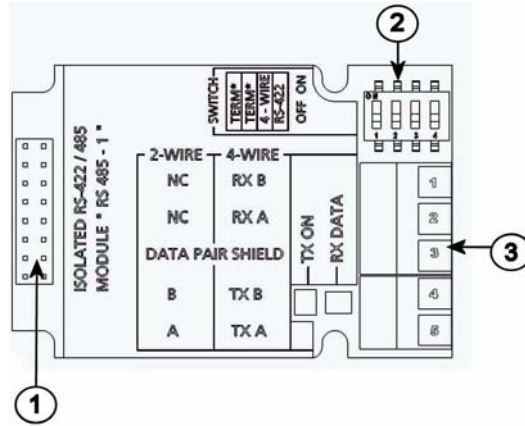
Figure 25   RS-485-1 Module

Numbers refer to Figure 25 on page 46:

1   =   Flat cable pins

2   =   Selection switches

3   =   Screw terminals for wiring

Installation and Wiring

1. Disconnect the power. In case the RS-485-module is installed in the factory, continue with the item 4.

2. To attach the module, open the barometer cover and fasten the RS-485 module to the bottom of the housing with four screws.

3. Connect the flat cable between the RS-485 module and the motherboard's pins MODULE1 (Communications).

4. Pull the network wirings through the cable gland.

5. Connect the twisted pair wires (1 or 2 pairs) to the screw terminals as presented in Table 4, Connecting the Twisted Pair Wires to the Screw Terminals, on page 47.

6. If you use RS-485 (or RS-422) to connect just one barometer to a master computer, enable the internal termination of the barometer by switching switches 1 and 2 ON. Make sure that the master's end of the line is also terminated (by using master's internal termination or with a separate terminator).

7. If you are connecting several barometers to the same RS-485 bus, make sure that switches 1 and 2 are OFF and terminate the bus with separate terminators at both ends. This allows removing any barometer without blocking the bus operation.

8. Use the bus type (4-wire/2-wire) to select the selection switch 3.

9. In 4-wire mode RS-485 master sends data to the PTB330 barometer through terminals RxA and RxB and receives data from PTB330 barometer through terminals TxA and TxB.

10. When operating in communication mode RS-422, set both switches 3 and 4 to ON position (4-wire wiring is required for RS-422 mode).

11. Connect the power and close the cover.

NOTE	If you use the internal termination of the barometer at the end of the RS-485 bus (instead of using separate terminators) removing that barometer will block the bus operation.

Table 4   **Connecting the Twisted Pair Wires to the Screw Terminals**

Screw terminal	Data line (2-wire RS-485)	Data line (4-wire RS-485/422)
1	(not connected)	RxB
2	(not connected)	RxA
3	Data pair shield	Data pair shield
4	B	TxB
5	A	TxA
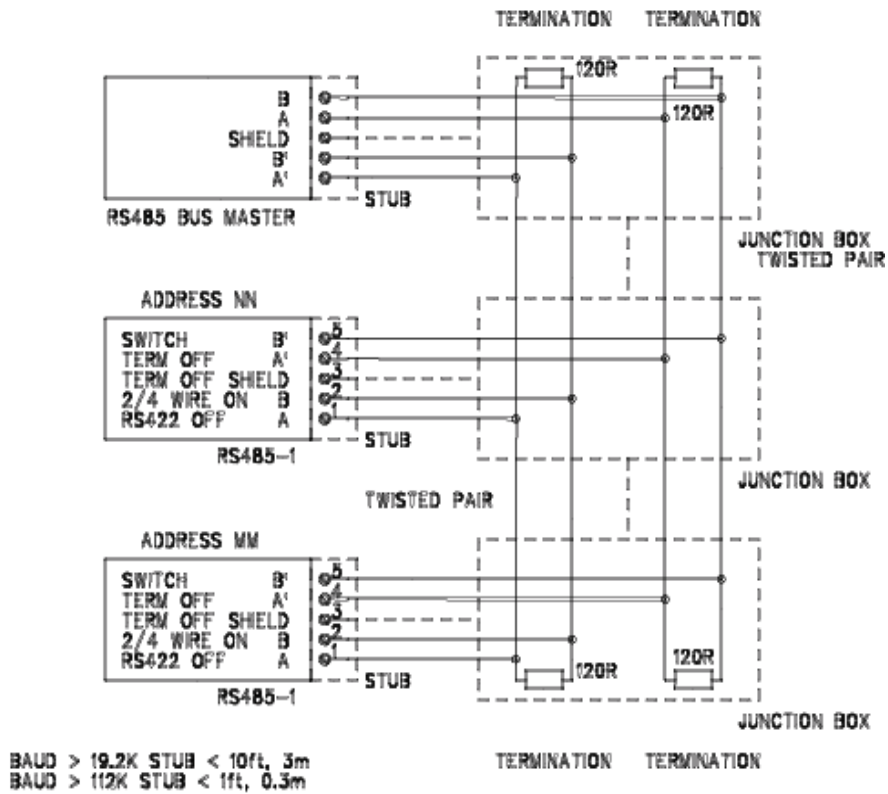
Figure 26   4-Wire RS-485 Bus

Table 5   4-Wire (Switch 3:On)

RS-485 master	Data	PTB330
TxA	->	RxA
TxB	->	RxB
RxA	< -	TxA
RxB	< -	TxB
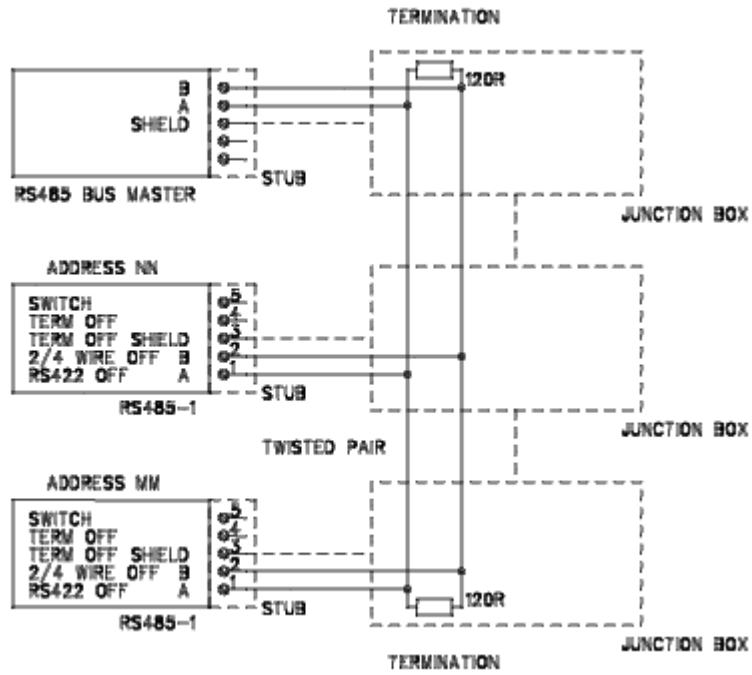
Figure 27   2-Wire RS-485 Bus

Table 6   2-Wire (Switch 3:Off)

RS-485 master	Data	PTB330
A	<->	A
B	<->	B

CHAPTER 4
OPERATION

This chapter contains information that is needed to operate the product.

Getting Started

Within a few seconds after power-up the led on the cover of the barometer is lit continuously indicating normal operation. When using the optional display and turning on the barometer for the first time, the language selection menu opens. Select the language with the up/down arrow buttons and press the left function button **SELECT**.

Display/Keypad (Optional)

Basic Display

Display shows you the measurement values of the selected quantities in the selected units. You can select 1... 4 quantities for the basic display. The basic display shows two quantities (P and P_1) by default.
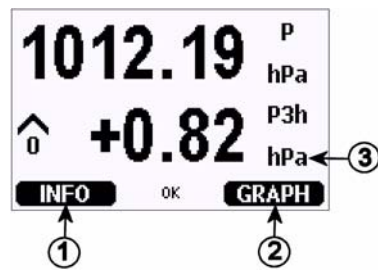
Figure 28   Basic Display

Numbers refer to Figure 28 on page 52:

1   =   The Info shortcut key/left function button with guiding text

2   =   The Graph shortcut button/right function button with guiding text

3   =   Quantities selected for display. Note that units displayed (for example P) depend on the type of measurements.

NOTE	To return directly to the basic display from any view, press and hold down the right function button **EXIT** for two seconds.

Menus and Navigation

You can change settings and select functions in the menus.

1.   Open the **MAIN MENU** by pressing any of the arrow buttons in the basic display.

2.   Move in the menus vertically with the up/down arrow buttons and enter/exit submenus with the left/right arrow buttons.

3.   Select an option from a list this way: move to the desired option by pressing the down arrow button as many times as needed. The option is selected once it is highlighted.

4.   Submenu is indicated with an arrow pointing right. Open a submenu by pressing the right arrow button.

5.   Set value by pressing the left function button.

6.   Press the left arrow button to return to the previous menu level.

7.   Press the **EXIT** button to return directly to the basic display.

Figure 29 **Main Menu (main level)**

Pressure 3h Trend and Tendency Reading

Using Basic Display

Figure 30 **P_{3H} Tendency**

Numbers refer to Figure 30 on page 53:

1 = Tendency: Increasing/decreasing graph symbol with the code number (for more information, see Figure 31, Pressure Tendency Description, on page 54).

2 = P3h symbol

3 = Trend (middlemost numeric value in the example), that is, pressure change during last 3 hours

Pressure tendency graphics and codes

The characteristic symbols of pressure tendency during the 3 hours preceding the time of observation are described as follows:

Pressure tendency	Code
	1
	2
	3
	0
	4
	5
	6
	7
	8

Figure 31   Pressure Tendency Description

where:

1   =   Increasing, then steady; or increasing, then increasing more slowly; atmospheric pressure now higher than three hours ago

2   =   Increasing (steadily or unsteadily); atmospheric pressure now higher than three hours ago

3   =   Decreasing or steady, then increasing; or increasing then increasing more rapidly; atmospheric pressure now higher than three hours ago

4   =   Steady; atmospheric pressure the same as three hours ago

6   =   Decreasing, then steady; or decreasing, then decreasing more slowly; atmospheric pressure now lower than three hours ago

7   =   Decreasing (steadily or unsteadily); atmospheric pressure now lower than three hours ago

8 = Steady or increasing, then decreasing; or decreasing then decreasing more rapidly; atmospheric pressure now lower than three hours ago

Source: The World Meteorological Organization (WMO) publication Manual on Codes Vol. 1.1, International Codes, Part A - Alphanumerical Codes, 1995 Edition, WMO - No. C, Code Table 0200:a.

Using Serial Line

Pressure 3h trend and tendency reading is also available through serial line. Key in the lines below:

```
>form "trend=" P3H " " "tend" A3H #RN
>
```

For more information on the Form command, see section .

Missing Trend

When the pressure tendency has not yet been calculated, that is, the device has been powered-up less than three hours ago, the PTB330 barometer outputs a code "*" . The absence of the pressure trend is indicated in a similar manner, too.

Graphic History

The graphical display shows the data trend of the selected quantities, one at a time. The graph is updated automatically while measuring. Use the following functions in the graphical display:

- Press the **NEXT** button to have the trend graph and max/min graph in turns and browse through the quantities selected for display.
- Press the **EXIT** button to return to the basic display.
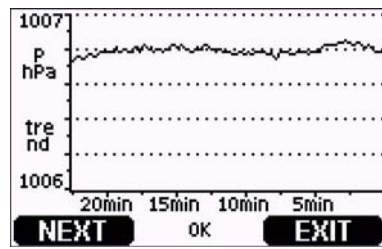
Figure 32   Graphical Display

Trend graph: Displays a curve of average values. Each value is a calculated average over a period.

Max/min graph: Displays the minimum and maximum values in a form of curve. Each value is max/min over a time period. See Table 7 below.

Table 7   Periods for Trend and Max/Min Calculations

Observation Period	Period for Trend/Max/Min Calculations (Resolution)
20 minutes	10 seconds
3 hours	90 seconds
1 day	12 minutes
10 days	2 hours
2 months	12 hours
1 year	3 days

- Press the up/down arrow buttons to zoom in and out the time in the graph window.

- Press the left/right arrow buttons to monitor the cursor mode where you can observe individual measuring points. Press an arrow button to move the cursor (vertical bar) along the time axis. The numerical value at the cursor position is shown at the left upper corner. Time from the present to the chosen moment is shown at the upper right corner.

Table 8   Graph Information Messages in Cursor Mode

Message	Interpretation
Power outage	Power failure (marked also with dashed vertical line)
No data	No data was recorded at pointed time.
Main unit failure	Generic failure detected at pointed time.
Meas. failure	Measurement failure detected at pointed time.
Adj. mode active	The device was in the adjustment mode at pointed time.

A question mark after time tells you that at least one power failure (dashed vertical line) has occurred after the chosen moment. In this case, the exact time difference between the present and the cursor position is not exactly known.

NOTE	The 3h trend (P3h) is not shown on the graphical display. Instead, the history readings of P (pressure) are displayed.

Information Display

The information display contains the current settings and status of the device. Access the display by pressing the left **INFO** function button in the basic display. The following information will be shown:

- present or past unacknowledged errors, if any

- device identification; product name, version and serial number

- information on barometer modules

- adjustment information

- measuring settings

- diagnostic settings

- serial interface information

- analog output information (when applicable)

- relay output information (when applicable).

Figure 33   Device Information on Display

Proceed in the information views by pressing the **MORE** button as many times as you get the desired information. You can browse through the information displays also with the arrow buttons. Press the **OK** button to return to the basic display.

Display Settings

Changing Quantities

1. Open the **MAIN MENU** by pressing any of the arrow buttons.

2. Select **Display** and press the right arrow button.

3. Select **Quantities** and press the right arrow button.

4. Select a quantity by using the up/down arrow buttons. Confirm your choice by pressing the **SELECT** button. You can select 1 ... 4 display quantities at a time. Undo selection by selecting it and pressing the **HIDE** button.

5. Press **EXIT** to return to the basic display.

See Table 1 on page 18 for available quantities.

NOTE	Only the quantities selected for the display are stored in the graphical history. If a quantity is hidden, it will not be stored in the memory of the barometer for the time being.

Changing Units

1. Open the **MAIN MENU** by pressing any of the arrow buttons.

2. Select **Display** and press the right arrow button.

3. Use the up/down arrow buttons to select **Units**. Press the right arrow button.

4. Use the up/down arrow buttons to select display units. Confirm the selection by pressing **CHANGE**.

5. Press **EXIT** to return to the basic display.

NOTE	Changing the display quantities/units (by using the display/keypad) has no effect on the serial output data.

NOTE	In order to output P_{3h} or A_{3h} readings through the serial line, the display unit chosen must be either P or P_{3h}.

Rounding

Round off one decimal by using the rounding function. The default setting is rounding off. Rounding has no effect on quantities without decimals.

1. Open the **MAIN MENU** by pressing any of the arrow buttons.
2. Select **Display**, then press the right arrow button.
3. Select **Rounding** and press the **ON/OFF** button.
4. Press the **EXIT** button to return to the basic display.

Backlight

As a default the display backlight is always on. In the automatic mode the backlight stays on for 30 seconds from the last press of any button. When pressing any button, the light turns on again.

1. Open the **MAIN MENU** by pressing any of the arrow buttons.
2. Select **Display**, then press the right arrow button.
3. Select **Backlight**, press the **CHANGE** button.
4. Select **On/Off/Automatic**, then press the **SELECT** button.
5. Press **EXIT** to return to the basic display.

Contrast

1. Open the **MAIN MENU** by pressing any of the arrow buttons.
2. Select **Display**, press the right arrow button.
3. Select **Contrast**, press the **ADJUST** button.
4. Adjust the contrast by pressing the left/right arrow buttons.
5. Press **OK** and **EXIT** to return to the basic display.

Keypad Lock

This function locks the keypad and prevents unintentional button strokes.

1. To lock the keypad, press and hold down the left function button for 4 seconds (at any display).
2. To unlock the keypad, press and hold down the **OPEN** button for 4 seconds.

Measuring Settings

See the calculation formulas for pressure values in Appendix A, Calculation Formulas, on page 127.

1. Open the **MAIN MENU** by pressing any of the arrow buttons.

2. Select **Measuring** and press the right arrow button.

3. Select **Measuring settings**. Press the right arrow button.

4. Select an option with up/down arrow buttons. Press the **SET** button.

5. First press the left/right arrow buttons to move from a digit to another. Then press the up/down arrow buttons to enter desired numeric value for the digit. Repeat the procedure until all the desired digits are set. Press the **OK** button.

6. Press **EXIT** to return to the basic display.

Diagnostic Settings

Use the display/keypad to set the pressure stability limits

1. Press any of the arrow buttons to open the **MAIN MENU**.

2. Select **System** and press the right arrow button to confirm your selection.

3. Select **Diagnostics** and press the right arrow button to confirm your selection.

4. Select **Diagnostic Settings.**

5. Use the up/down arrow buttons to select **Stability.** Press **SET** to input the value. Use the left/right arrow buttons to move between the value and the unit. Set the value and the unit using the up/down arrow buttons. Press **OK** to confirm your choice.

6. Proceed as instructed in point 5 to set **Max. diff.**

7. Press **SET** to confirm your selection.

8. Press **EXIT t**o return to the basic display.

Use the display/keypad to check the stability of the pressure measurement. If concurrent pressure measurements differ less than the set value, the display will output a small "OK" text.

Figure 34   Checking Stability of the Measurement

Serial Interface Settings

The communication settings for the user port can be changed through the serial line or by using the optional display/keypad. The communication settings for the service port are fixed and not changeable.

1. Press any of the arrow buttons to open the **MAIN MENU**.

2. Select **Interfaces** and press the right arrow button to confirm your selection.

3. Select **Serial interface** and press the right arrow button to confirm your selection.

4. Select **Bit rate**/**Serial format**/**Comm. mode** by pressing the **CHANGE** button. Use the up/down arrow buttons to select and press **SELECT** to confirm your selection.

5. If you selected RUN for communication mode, select **RUN** interval and press **SET** to confirm your selection.

6. Use the arrow buttons to set the measuring interval and the unit. Press **OK** to confirm your settings.

7. If you selected POLL for communication mode, select **POLL address** and press **SET** to confirm your selection.

8. Use the arrow buttons to set the barometer address. Press **OK** to confirm the setting.

9. Use the arrow buttons to select **ECHO**. Press **ON** to turn to it on. Press **OFF** to turn it off.

10. Press **EXIT** to return to the basic display.

The new user port settings set using the display/keypad are effective immediately.

System Settings

Language

1. Open the **MAIN MENU** by pressing any of the arrow buttons.

2. Select **System** (the lowest row), press the right arrow button.

3. Select **Language** (marked with a flag symbol), press the **SELECT** button.

4. Select the menu language with up/down arrow buttons and press the **SELECT** button.

5. Press the **EXIT** button to return to the basic display.

Menu PIN Lock

You can prevent unauthorized changes of the device settings by activating the menu PIN lock. When this function is activated, the basic display and graphical view are available but access to the menus is locked. The key symbol indicates the activation of this feature.

1. Open the **MAIN MENU** by pressing any of the arrow buttons.

2. Select **System**, press the right arrow button.

3. Select **Menu PIN**, press the **ON** button.

4. Enter a PIN code by using the up/down arrow buttons. Press **OK** to confirm the setting. Now the PIN lock is on and a key symbol is shown in a display.

5. Press **EXIT** to return to the basic display. Returning to the menu is possible only by entering the correct PIN code.

When you want to turn off the PIN lock, go to the menu by entering the PIN code and select **System**, **Menu PIN**, press **OFF** button.

In case you have forgotten the PIN code, open the barometer cover and press the **ADJ** button once. Wait for a few seconds until the adjustment menu opens. Select **Clear menu PIN**, press **CLEAR**.

NOTE	You can also disable the keypad completely with the serial command **LOCK**. For more information, see section LOCK on page 85.

Factory Settings

Use the display/keypad to restore the factory settings. This operation does not affect the adjustments. Only settings available in the menus are restored.

1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Select **System** by pressing the right arrow button.
3. Select **Factory settings** and press the **REVERT** button to confirm your selection. Press the **YES** button to reset all settings to the factory defaults.

In case you change your mind and want to exit the menu without making any changes, press the **NO** button.

Clearing Graph Displays

Use the keypad/display to delete the recorded files. Note that the barometer automatically overwrites the old data when the memory gets full, so manual deletion of the recorded files is not necessary.

1. Press any of the arrow buttons to open the **MAIN MENU**
2. Select **System** by pressing the right arrow button.
3. Select **Clear graph memories** by pressing the **CLEAR** button. Press the **YES** button to confirm the selection.

CAUTION	This function clears all the data history from the memory, all graphs included.

Relay Settings

Relay Outputs
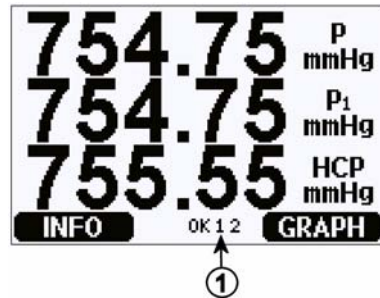
Figure 35   Relay Indicators on Display

The number refers to Figure 35 on page 64:

1   =   List enabled relays. Activation state is shown in black.
                Disabled relays are not shown.

Use the display/keypad to set the relay outputs.

1.   Press any of the arrow buttons to open the **MAIN MENU**.

2.   Select **Interfaces** and press the right arrow button to confirm your
        selection.

3.   Select **Relay Outputs** and press the right arrow button to confirm
        your selection.

4.   Select **Relay 1/Relay 2** by pressing the right arrow button. Use the
        up/down arrow buttons to select the quantity and press **SELECT**
        to confirm your selection.

5.   Select **Quantity**, press the **CHANGE** button. Select quantity by
        using the up/down arrow buttons. Confirm your selection by
        pressing the **SELECT** button.

6.   Select **Act. above/Act. below**. Press the **SET** button. You may be
        asked, whether you want to modify the value or remove the
        setpoint. In this case, select **MODIFY** to adjust the value or
        REMOVE to clear the setpoint. Adjust numeric values by pressing
        the up/down/left/right arrow buttons. Confirm your selection by
        pressing the **OK** key.

7. Select **Hysteresis**. Press the **SET** button and adjust the value. Finally press the **OK** button.

8. Select **Relay enable**. Press the **ON/OFF** button to enable/disable the relay.

9. Press **EXIT** to return to the basic display.

See section for more information on the relay setpoints.

NOTE	When only one relay module is installed, its relays are called "relay 1" and "relay 2".

Testing the Operation of Relays

Testing activates relays even if they are disabled.

Use the module push buttons to activate the relays. Press the REL 1 or REL 2 button to activate the corresponding relay.

Relay is activated: **led is lit**

Relay is not activated: led is not lit

Use the display/keypad to test the operation of relays.

1. Open the **MAIN MENU** by pressing any of the arrow buttons.

2. Select **System**, press the right arrow button.

3. Select **Diagnostics**, press the right arrow button.

4. Select **Relay tests**, press the right arrow button.

5. Select **Relay Output Status**, press **SHOW** to see the active relay or relays. Press **OK** to return to the previous level.

6. Select **Test relay 1** to test the output of relay 1. Press **ON/OFF** to activate/deactive the output. Press **OK** to go back to normal operation.

7. Select **Test relay 2** to test the output of relay 2. Press **ON/OFF** to activate/deactive the output. Press **OK** to go back to normal operation.

8. Press **EXIT** to return to the basic display.

Analog Output Settings

Analog Output Quantities

Use the display/keypad to change and scale the analog output quantities.

1. Press any of the arrow buttons to open the **MAIN MENU**.

2. Select **Interfaces** and press the right arrow button.

3. Select **Analog outputs** and press the right arrow button.

4. Select **Output 1(P)** and press the right arrow button.

5. Select **Quantity** and press the **CHANGE** button.

6. Select the quantity by using the up/down arrow buttons. Press the **SELECT** button to confirm your selection.

7. Select **Scale**, lower limit, by pressing the up/down arrow buttons. Press the **SET** button. Adjust the lower limit value by pressing the arrow buttons up/down/left/right. Press the **OK** button to confirm your setting.

8. Select **Scale**, upper limit by pressing the up/down arrow buttons. Press the **SET** button. Adjust the upper limit value by pressing the arrow buttons up/down/left/right. Press the **OK** button to confirm your setting. Press the **EXIT** button to return to the basic display.

9. Select **Fault Indication** and press the **SET** button. Adjust the lower limit value by pressing the arrow buttons up/down/left/right. Press the **OK** button to confirm your setting. Adjust the upper limit value by pressing the arrow buttons up/down/left/right. Press the **OK** button to confirm your setting. Press the **EXIT** button to return to the basic display.

10. Press the **EXIT** button to return to the basic display.

Testing the Operation of Analog Outputs

Use the display/keypad for testing the operation of the analog outputs by forcing the outputs to known values. Measure then the outputs with a current/voltage meter.

1. Press any of the arrow buttons to open the **MAIN MENU**.

2. Select **System** and press the right arrow button.

3. Select **Diagnostic**s and press the right arrow button.

4. Select **Analog output tests** and press the right arrow button.

5. Select **Analog output status**. Press the **SHOW** button to check the status and **OK** to finish.

6. Select **Test analog output 1**, press **TEST**. Select one of the testing options by pressing the **0%/50% or 100%** button.

7. Press the **OK** button to stop testing and go back to the the **Analog output tests** menu. Then press the **EXIT** button to return to the basic display.

Analog Output Fault Indication

The factory default state for the analog outputs during error condition is 0 V/ 0 mA. Please be careful when selecting the new error value. The user must not input an error value that will cause unexpected problems in process monitoring.

Use the display/keypad to set the analog output fault indication.

1. Press any of the arrow buttons to open the **MAIN MENU**.

2. Select **Interfaces** and press the right arrow button.

3. Select **Analog Outputs** and press the right arrow button.

4. Select **Output 1** and press the right arrow button.

5. Choose **Quantity**, press **CHANGE**. Select output quantity by moving up/down with the arrow buttons. Press **SELECT**.

6. Choose **Scale 0mA**, press **SET**. Set the value by moving up/down with the arrow buttons. Press **OK**.

7. Choose **Scale 20mA**, press **SET**. Set the value by moving up/down with the arrow buttons. Press **OK**.

8. Select **Fault indication**. Press the **SET** button. Enter the fault indication value by using the arrow buttons. Press the **OK** button to confirm your setting. This value is outputted if a barometer error occurs.

9. Then press the **EXIT** button to return to the basic display.

MI70 Link Interface Software for Data Handling

Recorded data can be transferred to a PC by using MI70 Link Interface Software. You can examine the recorded data easily in Windows environment and transfer it further to a spreadsheet program (such as Microsoft Excel) or virtually to any Windows program in numeric or graphical format. the MI70 link program also allows you to monitor barometer readings directly with a PC (real-time window function).

The MI70 Link Interface Software is available from Vaisala.

1. Connect the connection cable between the serial port of your PC and the Service Port of the barometer.

2. Check that the barometer is powered up and start using the MI70 Link program.

Use a MI70 Link version 1.10, or a newer one, to be able to utilize all the functions of the barometer.

Serial Line Communication

Connect the serial interface by using either the user port or the service port.

For permanent interfacing to host system, use the user port. You can change the serial settings and operate in RUN, STOP and POLL modes.

For temporary RS-232 connections use the service port. Service port is always available with fixed serial settings and it starts in the STOP mode after power-up always.
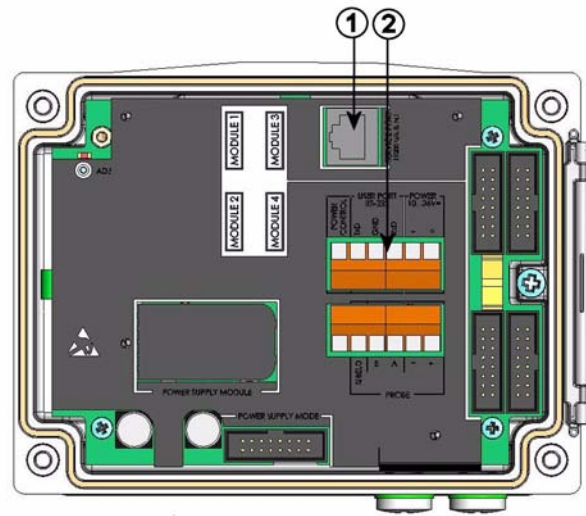
Figure 36   Service Port Connector and User Port Terminal on Motherboard

Numbers refer to Figure 36 on page 69:

1   =   Service port connector

2   =   User port terminals

User Port Connection

Use suitable serial cable between the user port RxD, GND and TxD screw terminals and the PC serial port.

Table 9   Default Serial Communication Settings for the User Port

Parameter	Value
Bit rate	4800
Parity	Even
Data bits	7
Stop bits	1
Flow control	None
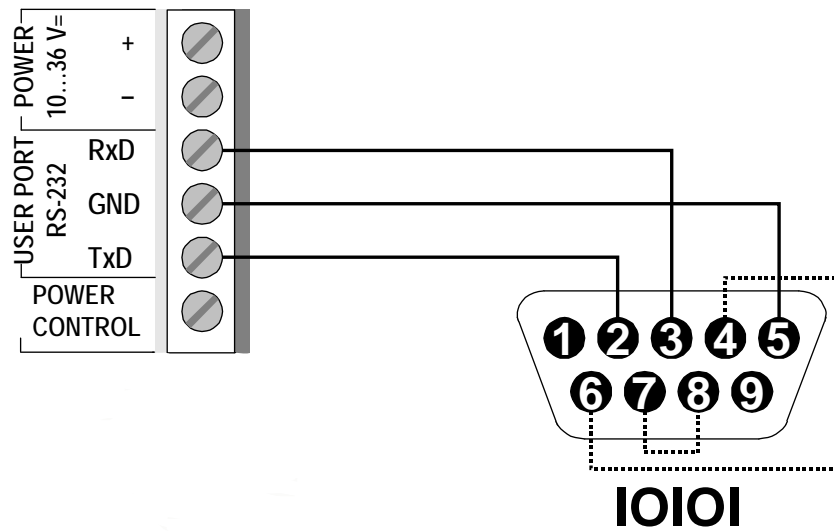
Figure 37   Connection Example Between PC Serial Port and User Port

Connections to pins 4,6,7 and 8 on PC serial port are required only if you are using software requiring hardware handshaking.

NOTE	User port cannot be used when RS-485 module is connected.

After power-up the barometer (in STOP mode) outputs the software version and the command prompt.

In RUN mode a measurement output starts immediately after power-up.

Service Port Connection

Table 10   Fixed Communication Settings for Service Port

Parameter	Value
Bit rate	19200
Parity	No
Data bits	8
Stop bits	1
Flow control	None

1.   Connect the serial interface cable (optional accessory, order code: 19446ZZ) between the serial port of your PC and the service port connector on the motherboard.

2.   Open a terminal program and set the communication settings (see the following section for detailed instructions).

3.   Power-up the barometer.

Terminal Program Settings

The following instructions show a connection example with HyperTerminal program (included in the Microsoft Windows).

Follow the instructions below to open a HyperTerminal program:

1.   Start HyperTerminal. To get help for starting HyperTerminal, click "Start", select "Help" to open Windows help, and search for "HyperTerminal".

2.   In the "New Connection"window of the HyperTerminal, define a name for the barometer serial connection, for example "PTB330". Click OK.

3.   In "Connect using" box, select the PC communications port where the serial cable is connected. (If your computer has only one COM port, it is called "COM1"). Click OK.

4.   Set the port settings in the "Properties" window to match the settings of your barometer *user port/service port*. For the barometer, "Flow control" must always be set to "None". Finally click OK to start using the serial connection.

5.   Select "File", and then "Save" in the HyperTerminal main window to save the serial port settings. To use the saved settings later, start HyperTerminal, click cancel in the "New Connection" window, and select "File". Then select "Open".

Figure 38   Starting Hyper Terminal Connection

Figure 39   Connecting to Hyper Terminal
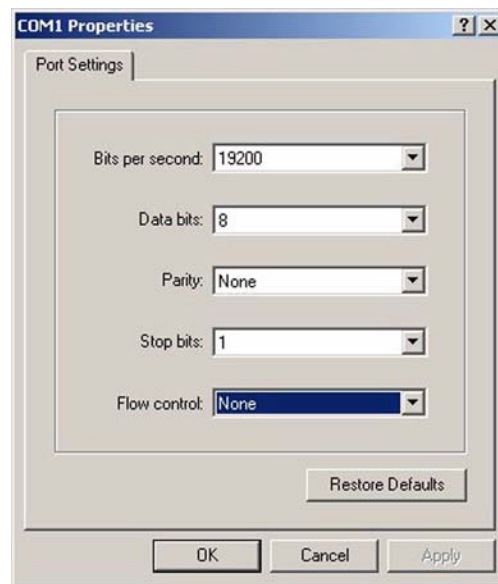
Figure 40   Hyper Terminal Serial Port Settings

List of Serial Commands

The bold text in the brackets is the default setting. Enter commands by inputting them on your computer and pressing the Enter key <cr>.

General commands

BNUM	Shows the device and module batch numbers.
SERI	Shows or sets the serial port settings for the user port.
SNUM	Shows the device and module serial numbers.
ERRS	Shows all unacknowledged errors (and clears them).
HELP	Shows the available commands.
LOCK	Shows or sets the keyboard lock.
?	Outputs information on the device.
ECHO [**ON**/OFF]	Shows or sets the serial interface echoing.
RESET	Resets the device.

VERS		Displays the product name and software version number.
SNUM		Shows the device and module serial numbers.

Measurement commands

R		Changes the serial mode to RUN and starts outputting measurement results according to the FORM string (with interval defined by INTV).
INTV	[**0**...255 **s**/min/h/d]	Shows or sets the continuous output interval (for RUN mode).
SEND	[0...99]	Shows the measurement results according to the configured form.
SMODE	[**STOP**/POLL/ RUN]	Shows or sets the start mode.
SDELAY	[0...254] (0... 2540 ms)	Shows or sets the answer delay for the serial line in tens of milliseconds.
ADDR	[**0**...255]	Sets the barometer address.
OPEN	[0...99]	Opens communications after having entered the CLOSE command.
CLOSE		Closes communications until the OPEN command is entered.
SCOM		Shows or sets an alias (a user-specific form) for the SEND command. The given alias cannot be a command already in use.
SEND		Shows the measurement results according to the configured form.

Measurement setting commands

TQFE	[-40...+60°C]	Shows or sets the temperature for QFE corrected pressure.
DPMAX		Shows or sets the maximum difference pressure between barometer modules.
HHCP	[-30...+30 m]	Shows or sets the altitude for height corrected pressure.

HQFE	[-30...+30 m]	Shows or sets the altitude for the QFE corrected pressure.
HQNH	[-30...3000 m]	Shows or sets the altitude for the QNH corrected pressure.
PSTAB		Shows or sets the pressure stability limits.
AVRG		Sets the barometer measurement averaging time (in seconds).

Formatting commands

FORM	Sets the custom output for the SEND command and for RUN mode.
TIME	Shows or changes the current time.
DATE	Shows or changes the current date set.
UNIT	Shows or sets unit for a quantity. If several quantities offer the same unit, these will also be changed to the given unit.

Data recording commands

DSEL	Selects the quantities that will be displayed on the graphical user interface. The quantities on the display will also be logged.
DELETE	Erases the log memory.
UNDELETE	Restores the erased log memory.
DIR	Lists the available logs in the logging memory.
PLAY	Shows the trend, min and max values of the given log.

Calibration and adjustment commands

| **CDATE** | Shows or sets the calibration date. |
| **LCP1/** **LCP2/** **LCP3** | Performs a linear correction for the barometer module/module. |

MPCP1/ **MPCP2/** **MPCP3**	Performs a multipoint correction for the barometer module/module.
CTEXT	Shows or sets the calibration info text.

NOTE	The calibration and adjustment commands are available in adjustment mode only. Press the adjustment button before inputting these commands.

Setting and testing the analog outputs

AMODE	Displays the analog output mode (if an AOUT-1 module/s is/are connected).
ASEL	Sets the analog output quantity and scaling (low/high).
ACAL	Adjusts the analog output.
AERR	Sets the analog output error value.
ATEST	Sets the analog output test value

Setting and testing the relays

RSEL	Sets the relay scaling (if a RELAY-1 module/s is/are connected).
RTEST	Sets a test value for a relay output.

General Settings

Changing Quantities and Units

To change quantities and units use serial commands or the optional display/keypad. See for available quantities.

NOTE	Only the quantities selected when ordering the device can be selected as a display output quantity.

Using Serial Line

Use the serial line command **FORM** to change the format or select a
certain quantities for the output command **SEND** and for RUN mode.

FORM [x]

where

x   =   Formatter string

Formatter string consists of quantities and modifiers. When selecting
the quantity, use the abbreviations of the quantities presented in Table
1 on page 18. The modifiers are presented in Table 11 on page 77.

Table 11   The modifiers

Modifier	Description
x.y	Length modifier (number of digits and decimal places)
#t	Tabulator
#r	Carriage-return
#rn	CR+LF
#n	Line feed
""	String constant
#xxx	Special character, code "xxx" (decimal), for example #027 for ESC
U5	Unit field and length (optional)

Example:

```
>form "pressure = " P " " U #r #n
"pressure = " P " " U #r #n
>
```

Command '**FORM** /' will return the default output format. The default
output format depends on the device configuration.

```
>form /
Output format  : P " " P1 " " QNH #RN
>send
1004.95 1004.96 1004.95
>
```

UNIT

Use the **UNIT** command to display or set the output quantities and their units.

Table 12   Output Quantities and Units

Quantity	Output Quantity	Available Output Units
Pressure (measures average pressure from P_1, P_2, and P_3)	P	hPa, psi, inHg, torr, bar, mbar, mmHg, kPa, Pa, mmH_2O, inH_2O
Pressure from barometer module 1 or 2 or 3	P_1, P_2, and P_3	
Pressure trend	P_{3h}	
Pressure difference (P_1 -P_2)	$deltaP_{12}$	
Pressure difference (P_1 -P_3)	$deltaP_{13}$	
Pressure difference (P_2 -P_3)	$deltaP_{23}$	
QNH pressure	QNH	
QFE pressure	QFE	
Height Corrected Pressure	HCP	

UNIT [x] [y]

where

x   =   Output quantity

y   =   Output unit

Use the **UNIT** command to set the measurement unit for the quantities. The output of all the quantities measured will be shown in the unit fed by the user.

Example:

```
>unit Pa
P               : Pa
P3h             : Pa
P1              : Pa
P2              : Pa
DP12            : Pa
HCP             : Pa
QFE             : Pa
QNH             : Pa
>
```

Use the **UNIT** command to change the measurement unit for a quantity. Specify the quantity and the desired unit for it.

Example:

```
>unit P mmhg
P               : mmHg
P3h             : Pa
P1              : Pa
P2              : Pa
DP12            : Pa
HCP             : Pa
QFE             : Pa
QNH             : Pa
>
```

NOTE	This command changes both the serial output and display units.

Use the **UNIT ??** command to list the available measurement units for the quantities.

Measurement Related Commands

TQFE

Use the **TQFE** command to show or set the temperature for QFE corrected pressure. The valid range of QFE temperature is -80...+200 °C.

Example:

```
>tqfe
QFE temp.       : 20.00 'C ? 21
>
```

DPMAX

The serial line command **DPMAX** shows or sets the maximum difference pressure allowed between barometer modules. The command is only available, if more than one barometer module has been installed.

DPMAX [x]

where

x   =   Pressure

Example:

```
>dpmax 0.2
Max. diff.     : 0.20 hPa
>
```

Use the **AVRG command to** set barometer measurement averaging time (in seconds). Valid range of averaging time is 1...600 seconds.

AVRG [x]

where

x   =   Average time

Example:

```
>avrg
Average filter : 1.0 s ?
>
```

HHCP

The **HHCP** command shows or sets the altitude for height corrected pressure. The valid range of HCP height is -30...+30 m.

HQFE

The **HQFE** command displays or sets altitude for QFE corrected pressure. The valid range of QFE height is -30...+30 m.

HQNH

The **HQNH** command displays or sets altitude for QNH corrected pressure. The valid range of QNH height is -30...3000 m.

PSTAB

Use the **PSTAB command** to display or set pressure stability limits. Adding a PSTAB element to the FORM string enables checking the stability using the serial port.

User Port Serial Settings

Using Serial Line

Use the serial line command **SERI [b p d s]** to set communication settings for the user port.

SERI [b p d s]

where

b   =   Bit rate (110, 150, 300, 600, 1200, 2400, 4800, 9600,19200, 38400, 57600, 115200)

p   =   Parity (n = none, e = even, o = odd)

d   =   Data bits (7 or 8)

s   =   Stop bits (1 or 2)

Example:

```
>seri
Baud P D S     : 9600 N 8 1
>
```

You need to reset the barometer to activate the new communication settings set with the **SERI** command.

The settings can be changed one parameter at a time or all parameters at once:

```
>seri 0
Baud P D S     : 9600 N 8 1
>seri o
Baud P D S     : 9600 O 8 1
>
```

SMODE

Use the command **SMODE** to set the user port start-up operating mode.

SMODE [xxxx]

where

xxx =   STOP, RUN or POLL

Table 13   Selection of Output Modes

Mode	Output	Available Commands
STOP	Only with the SEND command	All (default mode)
RUN	Automatic output after power-up	Only command S
POLL	Only with the SEND [addr] command	Use with RS-485 buses

Selected output mode will be activated after power outages.

INTV

Use the command **INTV** to set the outputting interval for the **RUN** mode.

INTV [xxx yyy]

where

xxx =   Output inverval (0 ... 255). 0: the fastest possible output rate.

yyy =   Unit (s, min, h or d)

Example:

```
>intv 10 min
Output interval :  10 min
>
```

ECHO

Use the command **ECHO** to set the user port echo. The command either enables or disables echo of characters received.

ECHO [x] [y]

where

x   =   ON (default) or

y   =   OFF

NOTE	The SERI, SMODE, INTV and ECHO commands can be used to change/view the user port settings even if you are currently connected to the service port.

Example:

```
>echo off
Echo     : OFF
send
pressure = 1013.00 hPa
echo on
Echo     : ON
>
```

System Information Commands

?

Use the serial line command **?** to check the current barometer configuration. Command **??** is similar but can also be used if the barometer is in **POLL** mode.

Example:

```
>?
PTB330 / 1.01
Serial number  : A1234567
Batch number   : B8901234
Output format  : P #T P1 #T P2 #T DP12 #T QFE #RN
Adjust. date   : 2007-05-03
Adjust. info   : VAISALA
Date           : 2007-05-08
Time           : 13:42:01
Start mode     : STOP
Baud P D S     : 4800 E 7 1
Output interval: 1 s
```

```
Address         : 0
Echo            : ON
Module 1        : BARO-1
Module 2        : BARO-1
Module 3        : BARO-1
Module 4        : EMPTY
>
```

ERRS

Use the command **ERRS** to display all unacknowledged errors (and
clear them). If an error is still active, it will be displayed again with the
ERRS command.

Example:

```
>errs
PASS
No errors
>errs
FAIL
Error: Operating voltage out of range.
>
```

VERS

Use the command **VERS** to display software version information.

Example:

```
>vers
PTB330 / 1.00
>
```

Resetting barometer By Using
Serial Line

RESET

Resets the device. The user port switches to start-up output mode
selected with command **SMODE**.

Locking Menu/Keypad by Using Serial Line

LOCK

Use the **LOCK** command to display or turn on the menu lock with a 4-digit PIN code, for example 4444.

LOCK [x yyyy]

where

x   = 1 (menu locked)

yyyy = 4-digit PIN code

Example:

```
>lock 1 4444
Keyboard lock  : 1 [4444]
>
```

Use the **LOCK** command to turn on the menu lock without PIN code access possibility while retaining access to INFO and GRAPH buttons.

LOCK [x]

where

x   =   1 (Menu locked)

Example:

```
>lock 1
Keyboard lock  : 1
>
```

Use the **LOCK** command to disable the keypad completely.

LOCK [x]

where

x   =   2 (Keypad disabled)

Example:

```
>lock 2
Keyboard lock  : 2
>
```

NOTE	Open the locks with the serial command **LOCK 0.** You can open the menu lock also by using the keypad, if a PIN code has been set.

Data Recording

Data recording function is always on and collects data automatically into the memory of the device. Recorded data do not disappear from the memory when the power is switched off. Collected data can be observed in a form of a graph in the graphical view of the display or it can be listed out by using the serial connection or MI70 Link Interface Software.

Selecting Data Recording Quantities

If the device is provided with the optional display, the recorded quantities are always those selected for the display. Up to four quantities can be recorded at a time. See section Changing Quantities and Units on page 76 for instructions on how to select the display quantities with the keypad.

DSEL

Use the serial line command **DSEL** to select the quantities to be recorded if the barometer is not equipped with display/keypad.

DSEL [xxx]

where

xxx =   Data recording quantities, see Table 1 on page 18.

Example:

```
>dsel p HCP
P HCP
>
```

Enter the command without parameters and press **ENTER** to display current recording parameters.

View Recorded Data

If the device is provided with the optional display, the graphical display shows the data of the selected quantities, one at a time. See section Graphic History on page 55 for details about graphical display.

You can also dump the logged data to the serial line in numeric form with the commands presented below.

DIR

Use the serial line and enter the **DIR** command to check the available files.

The device records six files (six observation periods) for each selected quantity. Thus, total amount of the files depends on the amount of the selected quantities being at minimum 6 and at maximum 24. See Table 7, Periods for Trend and Max/Min Calculations, on page 56.

Select, for example, two quantities (P and P_1).

Example:

```
>dir
File description            Oldest data available No. of
points
1  P latest 20 minutes      2000-01-08 03:44:30135
2  P latest 3 hours         2000-01-08 00:44:30135
3  P latest 1 day           2000-01-07 01:07:00135
4  P latest 10 days         1999-12-27 22:07:00135
5  P latest 2 months        1999-11-01 16:07:00135
6  P latest 1 year          1998-11-29 04:07:01135
7  P1 latest 20 minutes     2000-01-08 03:44:31135
8  P1 latest 3 hours        2000-01-08 00:44:31135
9  P1 latest 1 day          2000-01-07 01:07:01135
10 P1 latest 10 days        1999-12-27 22:07:01135
11 P1 latest 2 months       1999-11-01 16:07:01135
12 P1 latest 1 year         1998-11-29 04:07:01135
>
```

PLAY

Use the **PLAY** command to output the selected file to the serial line.The command outputs trend, min and max values from the given log. Use the DIR command to find out what log index number corresponds to a particular log. Data in the output is delimited. This is compatible with most spreadsheet programs. Before giving the command, set the correct date and time with **TIME** and **DATE** commands, if needed.

PLAY [x]

where

x = 1 ... 24

Example:

```
>play 4
P latest 10 days              2000-12-20 18:31:17135
Date       Time          trend     min       max
yyyy-mm-dd hh:mm:ss       mbar      mbar      mbar
2000-12-21 20:31:17       974.22    972.83    975.21
2000-12-21 22:31:17       976.45    975.21    977.73
2000-12-22 00:31:17       979.29    977.69    980.94
.
.
>
```

The <**ESC**> key can be used to interrupt the output listing.

The **PLAY 0** command can be used to output all files.

DELETE/UNDELETE

Use the serial line to clear or restore the data files.

Use the **DELETE** command to clear all data files. Use the **UNDELETE** command to recover the deleted data.

NOTE	The **UNDELETE** command will only recover the part of the deleted data that has not been recorded over yet.

Operation of Relays

Quantity For Relay Output

A relay monitors the quantity chosen for the relay output. Any of the quantities available can be chosen.

Measurement-Based Relay Output Modes

Relay Setpoints

When the measured value is in between the "above" and "below" values, the relay is passive. When choosing lower value as "above" value and higher value as "below" value, the relay is passive when the measured value is not between the setpoints. You can also set only one setpoint. See Figure 41 on page 90 below for illustrative examples of the different measurement-based relay output modes.
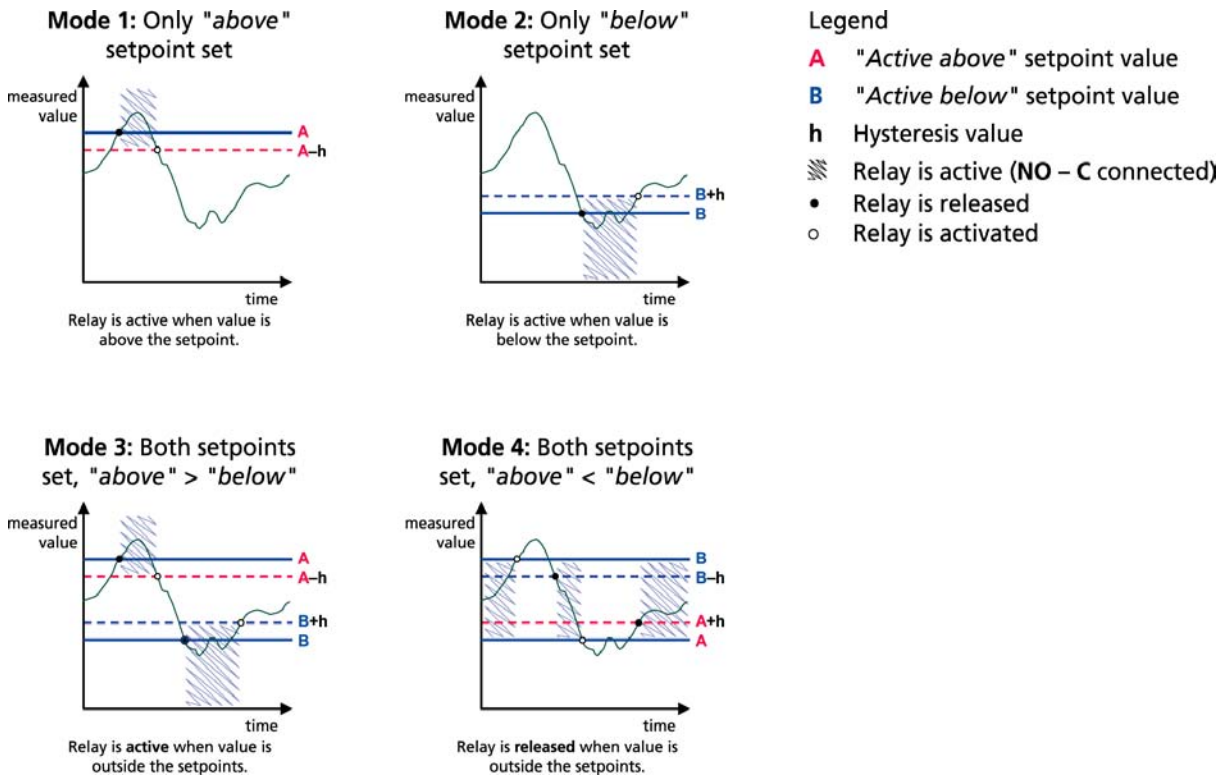
Figure 41   Relay Output Modes

Mode 4 is usually used if an alarm needs to be triggered when the measured value exceeds a safe range. The relay is active when measurement is in range, and is released if the value goes out of range or the measurement fails.

NOTE	If the measurement of the selected quantity fails or the barometer loses its power, the relay is released.

Hysteresis

The hysteresis function prevents the relay switching back and forth when the measured value is near to the setpoint values.The relay is activated when the measured value passes the exact value of the setpoint. When returning to and passing through the setpoint again, the relay is not released before the value reaches the setpoint increased/decreased by the hysteresis value, see Figure 41 on page 90. The hysteresis should be smaller than the difference of the setpoints.

| NOTE | If both setpoints are specified and the "above" setpoint is lower than the "below" setpoint, the hysteresis works in the opposite direction, that is, the relay is released when the measured value passes the exact value of the setpoint. |

Relay Indicating Barometer Error Status

You can set a relay to follow the operation status of the device. By selecting FAULT/ONLINE STATUS for output quantity a relay changes state on the basis of the operation status as follows:

FAULT STATUS

Normal operation: relay active (C and NO outputs are closed)

Not measuring state (error state or power off): relay released (C and NC outputs are closed).

ONLINE STATUS

Live measurement (data available): relay active (C and NO outputs are closed)

No live data (for example: error state or adjustment mode): relay released (C and NC outputs are closed).

See below for illustrative examples of the FAULT/ONLINE STATUS relay output modes.

Analog output vs. "*FAULT STATUS*" relay
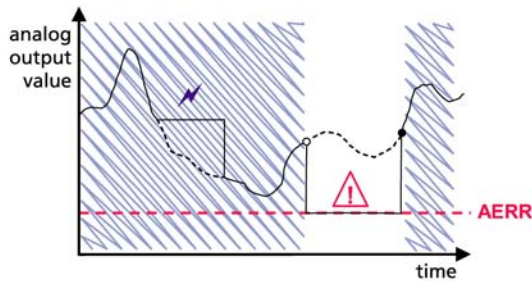
Relay is released in case of a measurement failure only.

Legend

AERR Analog output "fault indication" value set by user

Outputs frozen because of e.g. *Purge* or *Autocal*

Measurement failure because of e.g. damaged sensor

- - - - True value of the measurement parameter during the exceptional situation

Relay active (**NO – C** connected)

● Relay is activated

○ Relay is released

Analog output vs. "*ONLINE STATUS*" relay
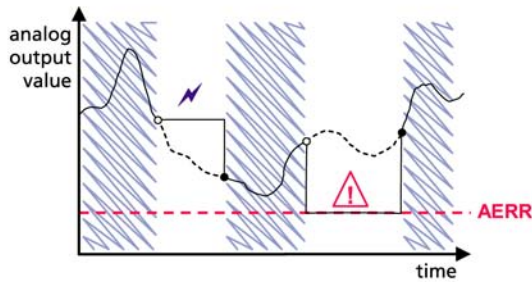
Relay is released when the output values are frozen, the adjustment mode is activated, or an instrument failure is detected

Figure 42 **FAULT/ONLINE STATUS Relay Output Modes**

FAULT/ONLINE STATUS relays are usually used in conjunction with an analog output to obtain validity information for the output value.

NOTE	If a barometer loses its power, all status-based relays are released similarly to the case of an instrument failure.

Enabling/Disabling Relays

You can deactivate the relay outputs for example for service purposes of your system.

Setting Relay Outputs

RSEL

NOTE	When only one relay module is installed, its relays are called "relay 1" and "relay 2".

Use the serial line to select the quantity, setpoints and hysteresis or enable/disable the relay outputs. The factory setting is that all the relays are disabled. Enter the **RSEL** command.

RSEL [q1 q2...]

where

q1   = quantity for the relay 1 or Fault/Online

q2   = quantity for the relay 2 or Fault/Online

and so on

Example of window limit switch:

Selecting relay 1 to follow pressure measurement and relay 2 to follow measurement of pressure from barometer module 1. Two relay setpoints are set for both relays.

```
>rsel P P1
Rel1 P    below: 980.00 hPa ?
Rel1 P    above: 995.00 hPa ?
Rel1 P    hyst : 0.10 hPa ?
Rel1 P    enabl: ON ? ?
Rel1 P1   below: 1001.00 hPa ?
Rel1 P1   above: 1005.00 hPa ?
Rel1 P1   hyst : 0.10 hPa ?
Rel1 P1   enabl: ON ?
>
```

Example of normal limit switch: Selecting relay 1 to follow pressure measurement and relay 2 to follow measurement of pressure from barometer module 1. One setpoint is chosen for both outputs.

```
>rsel P P1
Rel1 P    below: 980.00 hPa ? -
Rel1 P    above: 995.00 hPa ? 1020
Rel1 P    hyst : 0.10 hPa ? 1
Rel1 P    enabl: ON ? ON
Rel1 P1   below: 1001.00 hPa ? ---
Rel1 P1   above: 1005.00 hPa ? 1010
Rel1 P1   hyst : 0.10 hPa ? 2
Rel1 P1   enabl: ON ? ON
>
```

Example of using relay 1 as fault alarm:

selecting relay 1 to follow the fault status and relay 2 to follow the pressure measurement.

```
>rsel fault p
Rel1 FAUL below: -
Rel1 FAUL above: -
Rel1 FAUL hyst : -
Rel1 FAUL enabl: ON ?
Rel2 P    below: - ? -
Rel2 P    above: 1050.00 hPa ? 1050
Rel2 P    hyst : 12.00 hPa ? 10
Rel2 P    enabl: ON ? ON
>
```

Testing Operation Of Relays

Testing activates relays even if they are disabled.

Use the module push buttons to activate the relays. Press the REL 1 or REL 2 button to activate the corresponding relay.

Relay is activated:	**led is lit**
Relay is not activated:	led is not lit

RTEST

Use the serial line command **RTEST** to test the operation of the relays.

RTEST [x1 x2]

where

x   =   ON/OFF

Example: use the command to activate and then release the relays.

```
>rtest on on
ON ON
>rtest off off
OFF OFF
>
```

Enter the command **RTEST** without parameters to stop testing.

Operation of RS-485 Module

RS-485 interface enables communication between RS-485 network and the barometer. The RS-485 interface is isolated and offers a maximum communications rate of 115 200 bits/s. (For maximum bus length of 1 km, use bit rate 19200 b/s or less.)

When selecting an RS-232-RS-485 converters for the network, avoid self powered converters as they don't necessarily support the needed power consumption.

NOTE	User port on the barometer main board cannot be used and connected when RS-485 module is connected. Service port is operating normally.

Networking Commands

Set the RS-422/485 interface by using the following commands.

RS-485 configuration commands **SERI, ECHO, SMODE, ADDR INTV** can be entered by using either the service port or the RS-422/485 port. Also the optional display/keypad can be used, see section User Port Serial Settings on page 81.

SDELAY

With the **SDELAY** command you can set delay (response time) for the user port (RS232 or RS485), or view currently set delay value. Value corresponds to tens of milliseconds (for example, 5 = 0.050s minimum answer delay). The value can be set between 0...254. Example:

```
>sdelay
Serial delay   : 0 ? 10
>sdelay
Serial delay   : 10 ?
```

SERI

Use the **SERI** command to input RS-485 bus settings.

SERI [*b p d s*]

where

b = bit rate (300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200)

p = parity (n = none, e = even, o = odd)

d = data bits (7 or 8)

s = stop bits (1 or 2)

ECHO

Use the ECHO command to enable/disable echo of characters received over the serial line.

ECHO [*x*]

where

x = ON/OFF (default = OFF)

Echo function shall be always disabled (OFF) when using the 2-wire connection. When using the 4-wire connection you can disable/enable the echo setting.

SMODE

Use the **SMODE** command to set the default serial interface mode.

SMODE [*xxxx*]

where

xxxx = STOP, RUN or POLL

In STOP mode: measurements output only by the command **SEND**, all commands can be used.

where

In RUN mode: outputting automatically, only the command **S** or pressing the ESC key can be used to stop.

In POLL mode: measurements output only with command **SEND** [*addr*]

When several barometers are connected to the same line, each barometer must be entered an own address in the initial configuration, and POLL mode must be used.

INTV

Use the **INTV** command to set the RUN mode output interval.

INTV [*n xxx***]**

where

n   =   0...255

xxx =   S, MIN or H

Sets the RUN mode output interval. The time interval is used only when the RUN mode is active. For example, the output interval is set to 10 minutes.

```
>INTV 10 min
Output interval: 10 min
>
```

Setting RUN output interval to zero enables the fastest possible output rate.

ADDR

Addresses are required only for POLL mode (see serial line command). Use the **ADDR** command to input the RS-485 barometer address.

ADDR [*aa*]

where

aa = address (0 ... 255) (default = 0)

Example: the barometer is configured to address 99.

```
>ADDR
Address : 2 ?  99
>
```

SEND

Use the **SEND** command to output the reading once in POLL mode:

SEND [*aa*]

where

aa = address of the barometer

SCOM

Use the **SCOM** command to show or set an alias for the **SEND**
command. The given alias cannot be a command already in use.

Example:

```
>scom meas
Send command   : meas
>send
pressure = 1013.02 hPa
>measpressure = 1013.02 hPa
>
```

OPEN

When all barometers on the RS-485 bus are in POLL mode the **OPEN**
command sets one barometer temporarily to STOP mode so that other
commands can be entered.

OPEN [*aa*]

where

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

Example:

```
open 1
PTB330: 1 line opened for operator commands
>
```

CLOSE

Use the **CLOSE** command to switch the barometer back to the POLL mode.

```
>close
line closed
```

Operation of Analog Output

The analog outputs are set in the factory according to the order form. In case you want to change the settings, follow these instructions. See section Analog Output Module on page 42.

Changing Output Mode and Range

Both output channels have their own DIP switch module with 8 switches, see the position in Figure 22 on page 42 (DIP switches to select the output mode and range).

1. Select the current/voltage output, switch ON either of the switches, 1 or 2.
2. Select the range, switch ON one of the switches from 3 to 7.
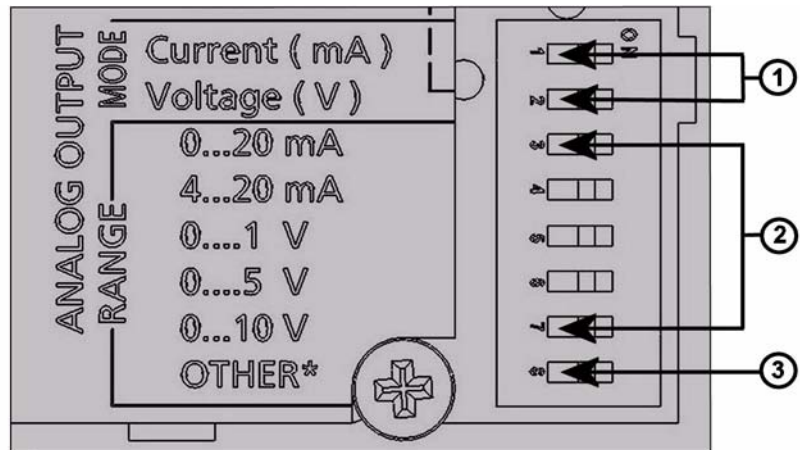
Figure 43   Current/Voltage Switches of Output Modules

The number refers to Figure 43 on page 100:

1   =   Current/voltage selection output switches (from 1 to 2)

2   =   Current/voltage range selection switches (from 3 to 7) in analog output 1 and 2.

3   =   Switch for service use only. Keep in OFF position always.

NOTE	Only one of the switches 1 or 2, must be ON at a time. Only one of the switches 3 to 7, must be ON at a time.

The example below illustrates how to select a 0 ... 5 V voltage output.

Figure 44   Dip Switch Selection Example

NOTE	If you have customized the error output setting (AERR), check that the set error values are still valid after changing the output mode/range, see section Analog Output Fault Indication Setting on page 102.

Analog Output Quantities

AMODE/ASEL

Use the serial line to select and scale the analog output quantities. Connect the barometer to the PC. Open the terminal connection between your PC and the barometer.

1. Check the analog output modes with the AMODE command.

    Example:

    ```
    >amode

    Ch1 output     : 0...1 V

    Ch1 slot       : 4

    Ch1 type       : T compensated

    >
    ```

2. Select and scale the quantities for the analog outputs with the command **ASEL**. Note that the optional quantities can be selected only if they have been selected when ordering the device.

ASEL [*xxx yyy*]

where

xxx =   Quantity of channel 1

yyy =   Quantity of channel 2

Enter always all the quantities for all the outputs. For quantities and their abbreviations see Table 1 on page 18.

Use the command **ASEL** [*xxx yyy*] as shown in the example below when using a device with two analog outputs.

```
>asel P
Ch1 P     low  : 900.00 hPa
Ch1 P     high : 1100.00 hPa
>
```

Analog Output Tests

ATEST

Use the serial line to set the analog output test value. The output value is forced to the inputted value and held until the command is fed without parameters. The number of quantities as parameters depends on the number of AOUT-1 modules. The valid range of test voltage/current is the same as the analog output range.

ATEST [*x*] [*y*]

where

x = volts

y = milliamperes

Example:

```
>atest 1.0
Ch1             :  1.000 (mA/V)   H'6644
>
```

Analog Output Fault Indication Setting

AERR

Use the serial line command **AERR** to set the analog output error value, when an error condition is active, in V or mA). The valid range (output range) for error value depends on the mode of the AOUT-1.

Example:

```
>aerr
Ch1 error out  : 0.000V ?
>
```

CHAPTER 5
MAINTENANCE

This chapter contains information that is needed in basic maintenance of the product.

Periodic Maintenance

Cleaning

Clean the barometer enclosure with a soft, lint-free cloth moistened with mild detergent.

Error States

In error state the quantity is not measured and the output is shown as follows:

- analog channel outputs 0 mA or 0 V (you can use the serial line command **AERR** or display/keypad to change this fault indication value, see section Analog Output Fault Indication Setting on page 102.

- the serial port outputs stars (***)

- the cover LED is blinking

- optional display: error indicator is lit.
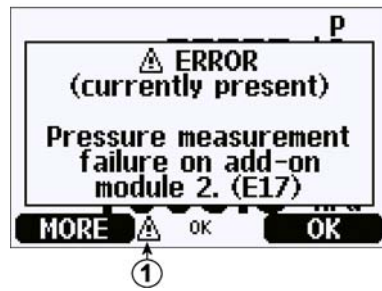
Figure 45   Error Indicator and Error Message

The number refers to Figure 45 on page 104:

1   =   Error Indicator

The error indicator disappears when the error state is over and you have checked the error message. Press the **INFO** button to display the error message.

You can also check the error message through the serial interface by using the command **ERRS**. In case of constant error, please contact Vaisala, see Vaisala Service Centers on page 125.

Table 14   Error Messages

Error Code	Error Message	Action
E10	Internal EEPROM read error.	Internal barometer failure. Return the barometer to the Vaisala Service Center.
E11	Internal EEPROM write error.	Internal barometer failure. Remove the barometer and return the faulty unit to Vaisala Service.
E12...E15	Add-on module 1/2/3/4 connection failure	Turn off the power and check the module connection. Turn on the power.
E8	Device internal temperature out of range	Ensure that the operating temperature is within the valid range
E6	Operating voltage out of range	Ensure that the operating voltage is within the valid range.
E7	Internal system voltage out of range	Internal barometer failure. Return the barometer to the Vaisala Service Center.
E20...E23	Configuration switches for analog output 1/2/3/4 set incorrectly	Check and re-set the switches of the analog output module, see section Changing Output Mode and Range on page 99.
E5	Communication module installed in incorrect add-on module slot	Disconnect the power and change the communication module to module slot 1.

Table 14   Error Messages

Error Code	Error Message	Action
E28...E31	Unknown/incompatible module installed in add-on module slot 1/2/3/4)	Ensure that the module is compatible with the PTB330.
E4	Pressure out of valid range	Check that the assumed pressure is within the measurement range for the barometer.
E3	Difference between pressure transducers too large	1) Check that the barometer modules are measuring the same pressure or 2) Check if one of the barometer modules is out of the valid range or 3) Check if the DPMAX value is set too low.
E16...E19	Pressure measurement failure on add-on module 1/2/3/4	Internal barometer failure. Return the barometer to the Vaisala Service Center.
E9	Checksum error in the internal configuration memory	Internal barometer failure. Return the barometer to the Vaisala Service Center.
E24...E27	EEPROM failure on add-on module 1/2/3/4	Internal barometer failure. Return the barometer to the Vaisala Service Center.

CHAPTER 6
CALIBRATION AND ADJUSTMENT

This chapter contains instructions for performing the calibration and adjustment of the product.

The PTB330 is fully calibrated and adjusted as shipped from factory. Calibration must be done always when there is reason to believe that the device is not within the accuracy specifications.When defining the calibration interval the long term specifications and the requirements of the customer must be taken into consideration. Contact Vaisala Service Centers for details. It is recommended that calibration and adjustment should be carried out by Vaisala. See . Calibration and adjustment are carried out through the serial port or with the optional display/keypad.

Pressure

The user can select a simple offset or a two-point offset and gain adjustment and use the **LCP** command for adjustment of the barometer module. The **MPCP** command is used for the more sophisticated multipoint correction capability at up to eight pressure levels. Check first what linear corrections the transmitter is currently using before attempting to readjust the barometer module. As the previous linear corrections will disappear when new linear corrections are input, the user has to take into account the previous linear corrections when deciding about the new ones.

NOTE	Entering new linear or multipoint corrections will always cancel the previous corrections. It is advisable to write down the previous linear and multipoint corrections so that they will not be lost by mistake.

Table 15   Adjustment and Calibration Commands for Barometer Module P1

Command	Function
LCP1 ON/OFF	Enables/Disables the linear corrections
LCP1	Enter linear corrections
MPCP1 ON/OFF	Enables/Disables the multipoint corrections
MPCP1	Enters multipoint corrections
CDATE	Shows or sets the calibration date
CTEXT	Shows or sets the calibration info text.

Opening and Closing the Adjustment Mode

The adjustment mode has to be available before you can proceed with the adjustment and calibration. The adjustment button with indicator LED is located in the upper corner on the left-hand side of the motherboard. See the position of the adjustment button in Figure 2 on page 20.

1. Open the barometer cover.

2. Press the **ADJ** button. The adjustment mode is now available. The red indicator LED is on.

3. Press the **ADJ** button again to lock the adjustment mode. The red indicator LED is off.

The adjustment menu on the display/keypad is visible only when the **ADJ** button (on the motherboard inside the transmitter) is pressed.

Figure 46   Adjustment Menu

Pressure Adjustment

In PTB330, the raw measured pressure value of each barometer module is first corrected using the corresponding multipoint adjustment values. The additional linear adjustment (if enabled) is applied to the corrected values. This allows the user to fine-tune the pressure display using the linear adjustment without performing a complete readjustment for the barometer module, see Figure 47 on page 109.
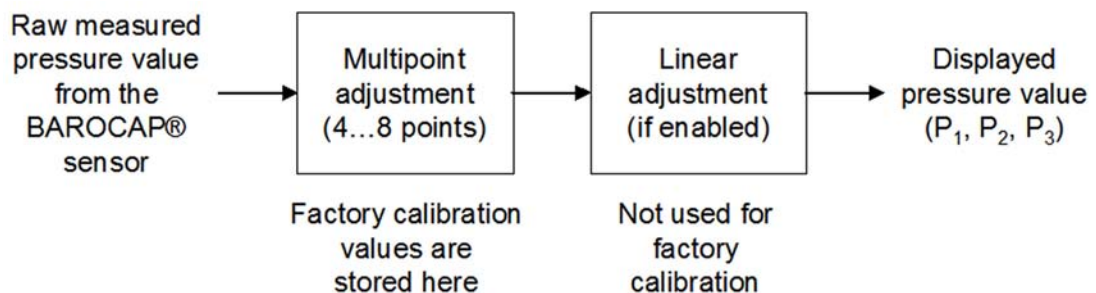
Figure 47   PTB330 Adjustments

For correct adjustment, the existing adjustment must be disabled before measuring the new adjustment data. If you are going to do only linear adjustment (one to two pressure points), leave the multipoint adjustments active.

If you want to perform a complete readjustment of your PTB330, disable both the multipoint and the linear adjustments, and calibrate the instrument at 2…8 pressure points. In such a case, the new adjustment values are entered to the multipoint adjustment function and the linear adjustment is not used (that is, it is left disabled).

Adjustments Using Display/Keypad

Use the display/keypad to view the active multipoint/linear adjustments.

1. Press the **ADJ** button located on the motherboard in the upper corner on the left-hand side to open the **ADJUST PTB330** menu.

2. Select **P1 adjustments**, press the right arrow button.

3. Select **Multipoint /Linear adjustment.** If the corresponding adjustment is already enabled, it is marked with a check mark.

4. If the adjustment is enabled, press the **SHOW** button to see the active adjustment values. Press **OK** to leave the adjustment active or **DISABLE** to disable the adjustment (confirm by pressing **YES**).

5. Press the left arrow key to go back to the **ADJUST PTB330** menu.

6. Exit the adjustment mode by pressing **EXIT**.

To measure new adjustment values and perform the actual adjustment, first disable the corresponding adjustment on each barometer module you are going to adjust (see the procedure above). If you are going to perform a multipoint adjustment, disable also the linear adjustments. If you are going to do only a linear adjustment, leave the multipoint adjustments untouched.

After disabling the previous adjustments, calibrate the PTB330 against your pressure reference. Make a note of the pressure reading of each PTB330 barometer module separately (quantities P_1, P_2, and P_3). Then use the display/keypad to enter and activate the new multipoint/linear adjustment factors.

1. Press the **ADJ** button located on the motherboard in the upper corner on the left-hand side to open the **ADJUST PTB330** menu.

2. Select **P1 adjustments**, press the right arrow button.

3. Select **Multipoint /Linear adjustment,** press the **SET** button.

4. Select an existing adjustment point or **Add adjustment point** and press the **SET** button to enter your new values. If asked, select **MODIFY** to replace the old values with your new ones.

5. Enter the P_1 value of the PTB330 at the **Reading** prompt using the up/down arrow buttons. Press the **OK** button.

6. Enter the corresponding pressure reference value to the **Reference** prompt using the up/down arrow buttons. Press the **OK** button.

7. Repeat steps 4…6 until you have entered all the pressure points you have.

8. To remove any excess old adjustment points, press **SET** and select **REMOVE** on each of them.

9. Once you have finished, press the **OK** button. Press the **YES** button to activate the adjustment you have configured.

10. Press the left arrow button to go back to the **ADJUST PTB330** menu and repeat steps 2…9 for each barometer module you are adjusting.

11. Exit the adjustment mode by pressing **EXIT**.

1-point Adjustment Using Serial Line

NOTE	Making adjustments is possible only after adjustments have been unlocked. To unlock the adjustment menu, press the ADJ button on the motherboard of the transmitter.

LCP1

The **LCP1 command** performs linear correction for barometer module/module P1. Use the command **LCP1**

-   to activate or deactivate the linear adjustment function

-   to enter new linear offset and offset/gain pressure corrections to the transmitter

-   to edit existing linear offset and offset/gain pressure corrections.

Key in the linear corrections for each barometer module separately. Feeding ON or OFF as a parameter enables or disables the linear correction. A single question mark shows the reading and reference information stored and the state of the linear correction. Each barometer module has its own adjustment commands. If there are three barometer modules installed, the commands **LCP1**, **LCP2**, and **LCP3** will be available. First deactivate the previous corrections by using the **LCP1 OFF** command.

LCP1 [x/y] [z]

where

x   =   ON

y   =   OFF

z   =   ?

Example

```
>lcp1
1. Reading ? 981.2
1. Reference ? 980.0
2. Reading ? 1102.1
2. Reference ? 1100.0
>
```

NOTE	The new linear corrections will always cancel the previous corrections as well as the valid date of calibration of the transmitter.

MPCP1

Use the **MPCP1** command.

- to perform multipoint correction for barometer module/module P1
- to activate or deactivate the multipoint adjustment function
- to enter new linear offset and offset/gain pressure corrections to the transmitter
- to edit existing linear offset and offset/gain pressure corrections.

The command operates like **LCP1**, but can take up to eight reading/ reference pairs. If there are three pressure barometer modules installed, the commands **MCP1**, **MCP2**, and **MCP3** will be available. First deactivate the previous corrections by using the **MPCP1** OFF command. Precalibration of the transmitter then gives the required corrections. When entering new multipoint corrections, always start at the low-pressure end and then go up the pressure range. Key in the multipoint corrections for each barometer module separately.

NOTE	The new multipoint corrections will always cancel the previous corrections as well as the valid date of calibration of the transmitter.

MPCP1 [x/y] [z]

where

x   =   ON

y   =   OFF

z   =   ?

Example:

```
>mpcp1
1. Reading ? 981.2
1. Reference ? 980.0
2. Reading ? 1102.1
2. Reference ? 1100.0
3. Reading ? 1203.4
3. Reference ? 1200.0
.
.
.
8. Reading ? 1703.3
8. Reference ? 1700.0
>
```

Analog Output Adjustment (Ch1)

In the analog output calibration the analog output is forced to the following values:

- current output: 2 mA and 18 mA

- voltage output: 10 % and 90 % of the range

Connect PTB330 to a calibrated current/voltage meter in order to measure either current or voltage depending on the selected output type.

NOTE	Normally, analog output module does not need to be adjusted once it has left from the factory. However, if accuracy of the unit is suspected, it is advisable to return the unit to Vaisala for re-adjustment/ calibration.

Using Display/Keypad

1. Press the **ADJ** button to open the **ADJUSTMENT MENU**.

2. Select **Adjust analog outputs**, press the right arrow key.

3. Select the output to be adjusted **Adjust analog output 1**, press the **START** button.

4. Measure the first analog output value with a multimeter. Give the measured value by using the arrow buttons. Press the **OK** button.

5. Measure the second analog output value with a multimeter. Give the measured value by using the arrow buttons. Press the **OK** button.

6. Press the **OK** button to return to the adjustment menu.

7. Press the **EXIT** button to close the adjustment mode and to return to the basic display.

Using Serial Line

The **ACAL** command adjusts the analog output (if an AOUT-1 module is present). The module parameter denotes which AOUT-1 module is adjusted. Connect a multi-meter to the analog output and input measured voltage/current values.

First, press the **ADJ** button inside the motherboard to enable adjustments.

where

x   =   1 ... 4

Example:

```
>acal 1
1st value ? 0.11
2nd value ? 0.92
>
```

Feeding Adjustment Information

This information is shown on the device information fields, see section .

Using Display/Keypad

1. If you are not in the adjustment menu, press the **ADJ** button on the motherboard to open the **ADJUSTMENT MENU**.

2. Select **Adjustment info**, press the right arrow button.

3. Select **Date**, press the **SET** button. Enter date by using the arrow buttons. Press the **OK** button.

4. Select **i**, press the **SET** button. Enter information text including 17 characters at maximum. Use the arrow buttons. Press the **OK** button.

5. Press the **EXIT** button to return to the basic display.

Using Serial Line

CTEXT

Use the CTEXT command to enter text to the adjustment information field.

Example:

```
>ctext Vaisala/MSL
Calibration text : Vaisala/MSL
>
```

CDATE

Use the CDATE command to enter date to adjustment information field. Set the adjustment date in format YYYY-MM-DD.

```
>cdate 2006-06-12
Calibration date : 2006-06-12
>
```

CHAPTER 7
TECHNICAL DATA

This chapter provides the technical data of the product.

Specifications

Performance

Barometric pressure range 500 ... 1100 hPa

Table 16   Barometric Pressure range 500 ... 1100 hPa at 20°C

	Class A	Class B
Linearity*	±0.05 hPa	±0.10 hPa
Hysteresis*	±0.03 hPa	±0.03 hPa
Repeatability*	±0.03 hPa	±0.03 hPa
Calibration uncertainty**	±0.07 hPa	±0.15 hPa
Accuracy at ±20 °C (+68 °F)***	±0.10 hPa	±0.20 hPa

Barometric pressure range 50 ... 1100 hPa

Table 17   Barometric pressure range 50 ... 1100 hPa at 20°C

	Class B
Linearity*	±0.20 hPa
Hysteresis*	±0.08 hPa
Repeatability*	±0.08 hPa
Calibration uncertainty**	±0.15 hPa
Accuracy at ±20 °C (+68 °F)***	±0.20 hPa

Table 18   Temperature Dependence****

	Class B
500 ... 1100 hPa	±0.01 hPa
50 ... 1100 hPa	±0.03 hPa

Table 19   Total Accuracy at -40 ... +60°C (-40 ... +140 °F)

	Class A	Class B
500 ... 1100 hPa	±0.15 hPa	±0.25 hPa
50 ... 1100 hPa		±0.45 hPa

Table 20   Long Term Stability

500 ... 1100 hPa		±0.10 hPa/year
50 ... 1100 hPa		±0.20 hPa/year

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

Defined as ±2 standard deviation limits of inaccuracy of the working standard including traceability to NIST.*Defined as the root sum of the squares (RSS) of endpoint non-linearity, hysteresis error, repeatability error and calibration uncertainty at room temperature ****Defined as ±2 standard deviation limits of temperature dependence over the operating temperature range.

Operating Environment

Table 21   Operating Environment

Pressure range	500 ... 1100 hPa, 50 ... 1100 hPa
Temperature range	
operating	-40 ... +60°C (-40 ... +140 °F)
with local display	0 ... +60°C (-32 ... +140 °F)
Maximum pressure limit	5000 hPa abs.
Electromagnetic compatibility	EMC standard EN61326-1:1997+ Am1:1998 + Am2:2001: Industrial Environment

Inputs and outputs

Table 22 **Inputs and outputs**

Supply voltage		10 ... 35 VDC
Supply voltage sensitivity		negligible
Power consumption @ 20 °C (Uin 24 VDC, one pressure sensor)		
	RS-232	typ 25 mA
	RS-485	typ 40 mA
	Uout	typ 25 mA
	Iout	typ 40 mA
	Display and backlight	+20 mA
Serial I/0		RS232C, RS485/422
Pressure units		hPa, mbar, kPa, Pa inHg, mmH$_2$0, mmHg, torr, psia
	Class A	Class B
Resolution	0.01hPa	0.1 hPa
Settling time at power-up (one sensor)	4 s	3 s
Response time (one sensor)	2 s	1 s
	fast measurement mode	0.2 s
Acceleration sensitivity		negligible
Pressure connector	M5 (10-32) internal thread	
Pressure fitting	barbed fitting for 1/8" I.D. tubing, quick connector with shutoff valve for 1/8" hose	
Analog output (optional)		
Current output		0 ... 20 mA, 4 ... 20 mA
Voltage output		0 ... 1 V, 0 ... 5 V, 0 ... 10 V
Pressure	500...1100 hPa	50...1100 hPa
Accuracy at +20 °C	±0.30 hPa	±0.40 hPa
Accuracy at -40 ... +60 °C	±0.60 hPa	±0.75 hPa
Display		LCD with backlight, graphic trend display of any parameter
Menu languages		English, German, French, Finnish, Spanish, Swedish, Japanese, Russian
Power control		5 VDC to supply voltage

Mechanics

Table 23   **Mechanics**

Cable bushing	M20x1.5 For cable diameter 8...11mm/0.31..0.43"		
Conduit fitting	1/2"NPT		
Housing material	G-AlSi 10 Mg (DIN 1725)		
Housing classification	IP 65 (NEMA 4)		
User cable connector (optional)	M12 series 8- pin (male)	Option1 with plug (female) with 5m/16.4ft black cable	
		Option2 with plug (female) with screw terminals	
	D9-connector		

Technical Specifications of Optional Modules

Table 24   **AC Power Supply Module**

Operating voltage	100...240 VAC 50/60 Hz
Connections	Screw terminals for 0.5...2.5 mm2 wire (AWG 20...14)
Bushing	For 8...11 mm diameter cable
Operating temperature	-40...+60°C (-40...+140°F)
Storage temperature	40...+70°C (-40...+158°F)

Table 25   **Analog Output Module AOUT-1**

Outputs	0...20 mA, 4...20 mA, 0...1 V, 0...5 V, 0...10 V	
Operating temperature range	-40...+60 °C (-40...+140 °F)	
Power consumption	Uout 0...1 V	max 30 mA
	Uout 0...5V/0...10V	max 30 mA
	Iout 0... 20 mA	max 60 mA
External loads	current outputs	RL< 500 ohms
Max load + cable loop resistance	540 ohms	
	0....1 V	RL> 2000 ohms
	0...5 V and 0... 10 V	RL> 10 000 ohms
Storage temperature range	-55...+80 °C (-67...+176 °F)	
3-pole screw terminal		
Max wire size	1.5 mm^2 (AWG16)	

Table 26   Relay Module

Operating temperature range	-40...+60 °C (-40...+140 °F	
Operating pressure range	500...1300 mHg	
Power consumption @24 V	max 30 mA	
Contacts SPDT (change over), for example,		
Contact arrangement Form C		
	Imax	0.5 A 30 VDC
Safety standard for the relay component	IEC60950 UL1950	
Storage temperature range	-55...+80 °C (-67...+176 °F)	
3-pole screw terminal / relay		
Max wire size	2.5 mm^2 (AWG14)	

Table 27   RS-485 Module

Operating temperature range	-40...+60 °C (-40...+140 °F)	
Operating modes	2-wire (1-pair) half duplex	
	4-wire (2-pair) full duplex	
Operating speed max	115.2 kbaud	
Bus isolation	300VDC	
Power consumption	@ 24V	max 50 mA
External loads	standard loads	32 RL> 10kohm
Storage temperature range	-55...+80 °C (-67...+176 °F)	
Max wire size	1.5 mm^2 (AWG16	

Options and Accessories

Table 28   Options and Accessories

Description	Item Code
MODULES	
Relay module	RELAY-1L
T-compensated analog output module	AOUT-1T
Isolated RS485 module	RS485-1
Power Supply module	POWER-1
AC-adapter	MI70EUROADAPTER
AC-adapter	MI70USADAPTER
AC-adapter	MI70UKADAPTER
AC-adapter	MI70AUSDAPTER
Static pressure head	SPH10
Static pressure head	SPH10
BAROMETER MOUNTING ACCESSORIES	
Wall Mounting Kit	214829
Installation Kit for Pole or Pipeline	215108
Outdoor installation kit (weather shield)	215109
DIN Rail Clips with Installation Plate	215094
Panel Mounting Frame	216038
CONNECTION CABLES	
Serial Interface Cable	19446ZZ
USB-RJ45 serial connection cable	219685
MI70 connection cable	211339
OUTPUT CABLES FOR 8-PIN CONNECTOR	
Connection Cable 5m with 8-pin M12 Female, Black	212142
Female Connector 8-pin M12 with Screw Terminals	212416
CABLE BUSHINGS	
PTB330/220/PTU200 DC and RS232 cable for PC	213019
PTB330/PTB220/PTU200 DC cable	213026
WINDOWS SOFTWARE	
Software interface kit	215005

Dimensions (in mm)
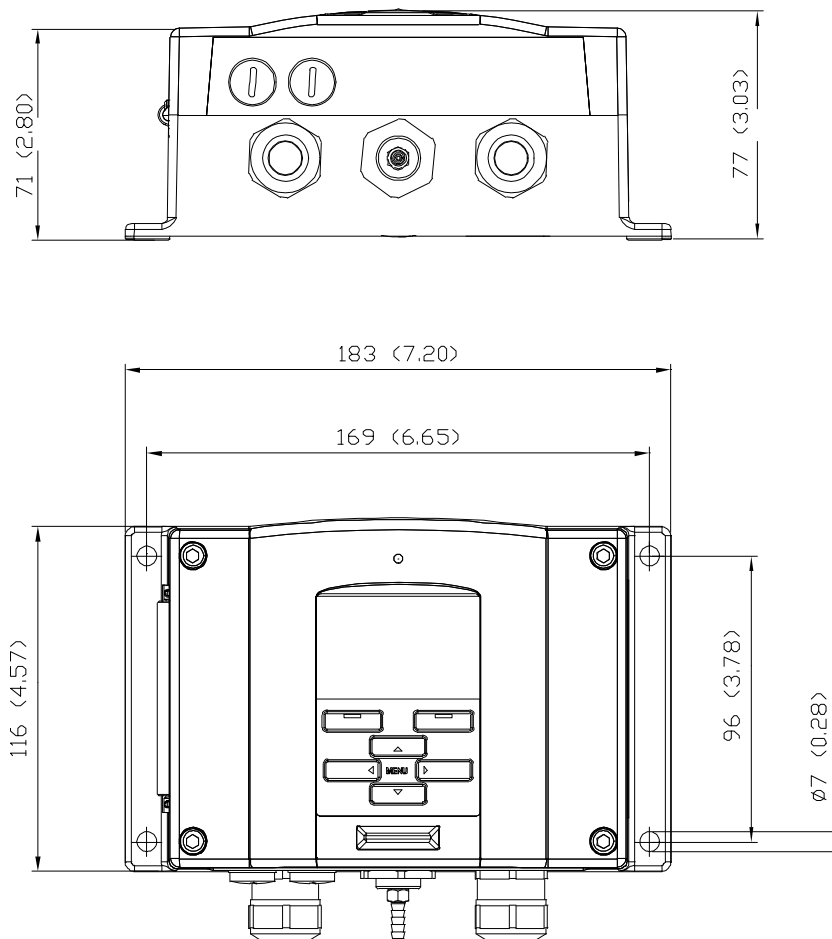
Figure 48   Barometer Body Dimensions

Technical Support

For technical questions, contact the Vaisala technical support:

E-mail   helpdesk@vaisala.com

Fax   +358 9 8949 2790

If the product needs repair, please follow the instructions below to speed up the process and to avoid extra costs to you.

Return Instructions

If the product needs repair, please follow the instructions below to speed up the process and avoid extra costs.

1. Read the warranty information.

2. Write a Problem Report with the name and contact information of a technically competent person who can provide further information on the problem.

3. On the Problem Report, please explain:

    -   What failed (what worked / did not work)?

    -   Where did it fail (location and environment)?

    -   When did it fail (date, immediately / after a while / periodically / randomly)?

    -   How many failed (only one defect / other same or similar defects / several failures in one unit)?

    -   What was connected to the product and to which connectors?

    -   Input power source type, voltage and list of other items (lighting, heaters, motors etc.) that were connected to the same power output.

    -   What was done when the failure was noticed?

4. Include a detailed return address with your preferred shipping method on the Problem Report.

5. Pack the faulty product using an ESD protection bag of good quality with proper cushioning material in a strong box of adequate size. Please include the Problem Report in the same box.

6. Send the box to:

    Vaisala Oyj Contact person / Division
    Vanha Nurmijärventie 21
    FIN-01670 Vantaa
    Finland

    or to the Vaisala Service Center in your region (see contact information below).

Vaisala Service Centers

Vaisala Service Centers perform calibrations and adjustments as well as repair and spare part services, see contact information below.

Vaisala Service Centers offer also extended services, for example accreditated calibrations, maintenance contracts and calibration reminder program. Do not hesitate to contact them to get further information.

NORTH AMERICAN SERVICE CENTER
Vaisala Inc., 10-D Gill Street, Woburn, MA 01801-1068, USA.
Phone: +1 781 933 4500, Fax: +1 781 933 8029
E-mail: us-customersupport@vaisala.com

EUROPEAN SERVICE CENTER
Vaisala Instruments Service, Vanha Nurmijärventie 21 FIN-01670 Vantaa, FINLAND.
Phone: +358 9 8949 2658, Fax: +358 9 8949 2295
E-mail: instruments.service@vaisala.com

TOKYO SERVICE CENTER
Vaisala KK, 42 Kagurazaka 6-Chome, Shinjuku-Ku, Tokyo 162-0825, JAPAN.
Phone: +81 3 3266 9617, Fax: +81 3 3266 9655
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BEIJING SERVICE CENTER
Vaisala China Ltd., Floor 2 EAS Building, No. 21 Xiao Yun Road, Dongsanhuan Beilu, Chaoyang District, Beijing, P.R. CHINA 100027.
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E-mail: china.service@vaisala.com

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APPENDIX A
CALCULATION FORMULAS

This appendix contains the calculation formulas used by the product.

Height compensated pressure values (QFE, QNH, and HCP) are calculated using the following equations:

$$QFE = p \cdot \left(1 + \frac{h_{QFE} \cdot g}{R \cdot T} \right) \quad (1)$$

where:

p   =   measured air pressure [hPa]

h_{QFE} =   height difference between the barometer and reference level [m]

g   =   9.81 [m/s2]

R   =   287 [J/kg/K]

T   =   temperature [K]

$$QNH = QFE \cdot e^{\dfrac{h_{QNH} \cdot g}{R \cdot \left(T_0 + \dfrac{\alpha \cdot h_{QNH}}{2} \right)}} \qquad (2)$$

where:

H_{QNH} = station elevation [m]

g = 9.81 [m/s^2]

R = 287 [J/kg/K]

T = 288.15 [K]

α = -0.0065 [K/m]

$$HCP = p + 0.1176 \cdot h_{HCP} \qquad (3)$$

where

p = measured air pressure [hPa]

h_{HCP} = height difference between the barometer and reference level [m]

APPENDIX B
UNIT CONVERSION TABLES

This appendix contains the unit conversion tables.

Multiplication factors　　　Note: conversions for mmHg and inHg are defined at 0°C temperature and for mmH2O and inH2O at 4°C temperature.

psia =
psi absolute

	FROM									
	hPa **mbar**	**Pa** **N/m2**	**mmHg** **torr**	**inHg**	**mmH2O**	**inH2O***	**atm***	**at***	**bar**	**psia**
TO　**hPa** **mbar**	1	0.01	1.333224	33.86388	0.09806650	2.490889	1013.25	980.665	1000	68.94757
Pa **Nm2**	100	1	133.3224	3386.388	9.806650	249.0889	101325	98066.5	100000	6894.757
mmHg **torr**	0.7500617	0.0075006	1	25.40000	0.07355592	1.8683	760	735.559	750.0617	51.71493
inHg	0.02952999	0.00029530	0.03937008	1	0.002895903	0.073556	29.921	28.959	29.52999	2.036021
mmH2O	10.19716	0.1019716	13.59510	345.3155	1	25.40000	10332.3	10000	10197.16	703.0696
inH2O*	0.40147	0.0040147	0.53525	13.596	0.039372	1	406.79	393.71	401.463	27.6799
atm*	0.00098692	0.000009869	0.00131579	0.033422	0.000096788	0.0024583	1	0.967841	0.98692	0.068046
at*	0.0010197	0.00001020	0.0013595	0.034532	0.0001	0.0025399	1.03323	1	1.01972	0.070307
bar	0.001	0.00001	0.001333224	0.03386388	0.00009807	0.0024909	1.01325	0.980665	1	0.06894757
psia	0.01450377	0.00014504	0.01933678	0.4911541	0.001422334	0.036127	14.6962	14.2233	14.50377	1

Example　　1013.25 hPa/mbar = 1013.25 x 0.02952999 inHg = 29.9213 inHg

Figure 49　　　　**Pressure Conversion Chart**

* A unit not available on PTB330.

The device supports several different units for quantities. The following tables show the gain and offset values used for unit conversions.

Table 29   Unit Conversion Table for all Pressure Quantities (Excluding deltaP and P_{3h})

Unit	Gain	Offset	Min...Max
hPa	1	0	0 ... 9999
psi	0.01450377	0	0 ... 99.9999
inHg	0.02952999	0	0 ... 99.9999
torr	0.7500617	0	0 ... 999.999
bar	0.001	0	0 ... 9.99999
mbar	1	0	0 ... 9999.99
mmHg	0.7500617	0	0 ... 999.999
kPa	0.1	0	0 ... 999.999
Pa	100	0	0 ... 999999
mmH_2O	10.19716	0	0 ... 99999.9
inH_2O	0.40147	0	0 ... 999.999

Table 30   Unit Conversion Table for Difference Pressure deltaP and Pressure Trend P_{3h} Quantities

Unit	Gain	Offset	Min...Max
hPa	1	0	-9999.99 ... 9999.99
psi	0.01450377	0	-99.9999 ... 99.9999
inHg	0.02952999	0	-99.999 ... 99.999
torr	0.7500617	0	-9999.99 ... 9999.99
bar	0.001	0	-9.99999 ... 9.99999
mbar	1	0	-9999.99 ... 9999.99
mmHg	0.7500617	0	-9999.99 ... 9999.99
kPa	0.1	0	-999.999 ... 999.999
Pa	100	0	-999999 ... 999999
mmH_2O	10.19716	0	-99999.9 ... 99999.9
inH_2O	0.40147	0	-9999.99 ... 9999.99

Table 31   Unit Conversion Table for Settings Pressure Stability P_{STAB} and Maximum Pressure Difference deltaP$_{MAX}$

Unit	Gain	Offset	Min...Max
hPa	1	0	0 ... 99.99
psi	0.01450377	0	0 ... 9.9999
inHg	0.02952999	0	0 ... 9.9999
torr	0.7500617	0	0 ... 99.999

Table 31   Unit Conversion Table for Settings Pressure Stability P_{STAB} and Maximum Pressure Difference deltaP$_{MAX}$

Unit	Gain	Offset	Min...Max
bar	0.001	0	0 ... 0.09999
mbar	1	0	0 ... 99.99
mmHg	0.7500617	0	0 ... 99.99
kPa	0.1	0	0 ... 9.999
Pa	100	0	0 ... 9999
mmH$_2$O	10.19716	0	0 ... 9999.9
inH$_2$O	0.40147	0	0 ... 99.99

Table 32   Unit Conversion Table for Settings HHCP and HQFE

Unit	Gain	Offset	Min...Max
m	1	0	-30 ... 30
ft	3.28084	0	-99 ... 99

Table 33   Unit Conversion Table for Settings HQNH

Unit	Gain	Offset	Min...Max
m	1	0	-30 ... 3000
ft	3.28084	0	-99 ... 9900

Table 34   Unit Conversion Table for Setting TQFE

Unit	Gain	Offset	Min...Max
°C	1	0	-80 ... 200
°F	1.8	32	-110 ... 390
K	1.0	-273.15	190 ... 470

APPENDIX C
PA11A EMULATION MODE

This appendix describes the PA11A emulation mode of the PTB330 series.

The PTB330 series digital barometers have an emulation mode that allows them to partially emulate the PA11A barometer. In the emulation mode, the PTB330 series can automatically output PA11A type of messages.

Activating the PA11A Emulation Mode

To activate the emulation mode, use the command **SMODE PA11A** on the serial line to set the start mode of the transmitter to PA11A. Then reset the transmitter with the **RESET** command:

```
>smode pa11a
Start mode      : PA11A
>reset
```

After start-up, the barometer will output messages in the PA11A format. You can start the automatic message output with the command **R**, and stop it with the command **S**. The command to output a single measurement message (**P**) is not available.

To disable the emulation mode, set a different mode using the SMODE command (for example **SMODE STOP**), and reset the transmitter.

PA11A Message Format

Message type 1 format is as follows:

\<sp\>P1\<sp\>P2\<sp\>P3\<sp\>status\<sp\>average\<sp\>trend\<cr\>

where

\<sp\>	=	Space character
P1	=	Pressure output from transducer 1 (in 0.1 hPa). The reading is written with 5 characters. If the transducer has a fault or has been switched off, the reading is replaced with error status /////.
P2	=	Pressure output from transducer 2, same format as P1
P3	=	Pressure output from transducer 3, same format as P1
status	=	Status of the average pressure measurement (binary, with 8 characters). 10000000 means OK with all three transducers included. Otherwise, the last three bits of the status will indicate the transducers that are included when calculating the average. For example, status 00000110 means that transducers 2 and 3 are included and transducer 1 is ignored.
average	=	Average pressure (with 5 characters) based on three consequent measurements of each transducer included, i.e. pressure average over approx. one minute. If the average pressure cannot be calculated, the reading is replaced with error status /////.
trend	=	Three hour pressure trend (with 3 characters). Falling trend is indicated with a minus "-" character before the reading. If the data is not available (when measurement has been running for less than three hours), the reading is replaced with ///.
\<cr\>	=	Carriage return character

NOTE	All pressure readings are in 0.1 hPa. The pressure unit selection has no effect.
	If a reading is shorter than the amount of characters reserved for it, it is left-padded with space characters. See the examples below.

Output examples:

- Pressure is 1014.4 hPa and three-hour trend is +0.8 hPa:

  ```
  10145 10144 10144 10000000 10144    8
  ```

- Pressure is 989.1 hPa, the three-hour trend is not available yet:

  ```
   9891  9890  9892 10000000  9891 ///
  ```

- Pressure is 1008.4 hPa, output from transducer 2 is ignored, the three-hour trend is not available yet:

  ```
  10084 ///// 10084 00000101 10084 ///
  ```

- Pressure is 1013.4 hPa and the three-hour trend is -0.4 hPa:

  ```
  10134 10134 10134 10000000 10134   -4
  ```