PTU200 Series Transmitters

USER'S GUIDE

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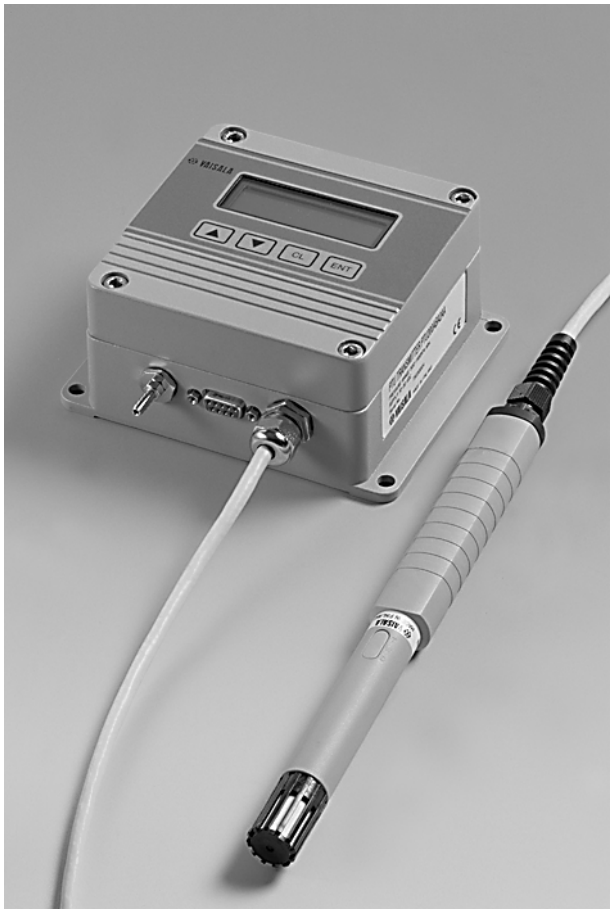


VAISALA

Table of contents

CHAPTER 1 GENERAL INFORMATION

Safety

Throughout the manual important instructions regarding the safety considerations are focused as follows.

WARNING	Warning denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in injury to or death of personnel.

CAUTION	Caution denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product.

NOTE	Note highlights important information. It calls attention to an essential procedure, practice, condition or the like.

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 OF 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 DESCRIPTION

The PTU200 transmitter combines three measurement parameters: pressure, temperature and humidity. The applications of the PTU200 range from calibration laboratory environmental condition monitoring to laser interferometer active wavelength compensation and GPS meteorological measurements.

The PTU200 transmitters are available with one or two pressure transducers. Three different kinds of sensor heads can be used with PTU200: HMP45A-P, HMP45D and Pt100.

The PTU200 transmitters use a RS232 or RS485 (optional) serial interface and they are available also with a local display.

In outdoor applications, it is recommended to use the PTU200MIK mounting kit with the PTU200 transmitters. In addition, a mounting tripod is available to support the PTU200MIK in temporary field installations.

Pressure measurement

The PTU200 series transmitters use a BAROCAP® silicon capacitive absolute sensor developed by Vaisala for barometric pressure measurement applications. The measurement principle of the PTU200 series digital transmitters is based on an advanced RC oscillator and three reference capacitors against which the capacitive pressure sensor and the capacitive temperature compensation sensor are continuously measured. The microprocessor of the transmitter performs compensation for pressure linearity and temperature dependence.

Humidity and temperature measurement

The HMP45A-P and HMP45D probes are designed for the measurement of relative humidity and temperature. The humidity measurement is based on a capacitive thin film polymer sensor, HUMICAP®180. The temperature measurement is based on resistive platinum sensors. Both the humidity and the temperature sensors are located at the tip of the probe and protected by a membrane filter.

The HMP45A-P probe has the HUMICAP®180 polymer sensor and the Pt 1000 resistive platinum sensor for RH and T measurements, respectively. The 20 metres cable of the HMP45A-P is connected to a board with a plug and thus the user can cut the cable to suitable length and reconnect it easily. The HMP45A-P and the HMP45D have a similar humidity output, but the temperature output is active in the HMP45A-P (voltage output 0-1V) and passive in the HMP45D (resistive output Pt 100). The HMP45D comes with a 3.5-meter connection cable. The cable is soldered directly to the board inside the transmitter.

When the humidity measurement is not required, the PTU200 can be supplied with a small, high stability wire-type Pt100 temperature sensor head.

CHAPTER 3 GETTING STARTED

Mounting

Choose a place, which represents the environment to be measured, and is as clean as possible. Air should circulate freely around the probe; it ensures that the sensor head and the ambient air are at the same temperature.

NOTE	For outdoor installation of the PTU200 transmitter, it is recommended to use a PTU200MIK mounting kit. For further information, please contact Vaisala or Vaisala distributor.

Please take into a consideration that the pressure fitting supplied with the transmitter is not a static pressure head and that the transmitter cannot be used successfully as such in turbulent or high speed static wind conditions.

NOTE	The barometric pressure measurement accuracy quoted for the PTU200 series digital transmitters does not include any wind or air conditioning system measurement errors.

Electrical connections

PTU200 series transmitters have as a standard a RS 232C and as an option a RS485/422 serial interface. Connect the RS 232C serial interface and a power supply according to the following pin assignment.

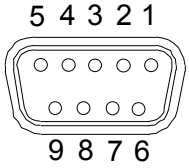


FIGURE 3-1 9-pin female sub D-connector

TABLE 3-1 Pin assignment for RS 232C/TTL serial output

PIN	SIGNAL
1	TX with diode
2	TX/TXD/TXD inverted
3	RX/RXD/RXD inverted
4	external power on/off control
5	ground for the RS 232C
6	
7	ground for supply voltage
8	
9	supply voltage (10...30 VDC)

TABLE 3-2 Pin assignment for optional RS 232C/485/422

PIN	SIGNAL
1	TX with diode
2	TX/TXD/TXD inverted
3	RX/RXD/RXD inverted
4	external power on/off control
5	ground for the RS 232C
6	RS 485/422 LO
7	ground for supply voltage and TTL level serial interface
8	RS 485/422 HI
9	supply voltage (10...30 VDC)

The factory settings of the PTU200 series transmitters are the following:

TABLE 3-3 Serial interface factory settings

Baud rate	9600
Parity	even
Data bits	7
Stop bits	1
Duplex	full duplex

After having made the electrical connections, switch the power on, and the transmitter responds indicating its type and the software version.

```
PTU200 / 1.01
>
```

The transmitter is now ready to respond to any command available.

At power-up, the display will first show the transmitter type and the software version. Then it switches to display the reading as defined with the DFORM command (page 9).

Set the desired sending form according to software settings (described starting from page 12) and select the sending mode for the transmitter (see page 11).

Should there be any problems please check the jumper settings in connector X15 and the settings in dip switch S1 inside the transmitter. The settings should be as indicated in the figure below.

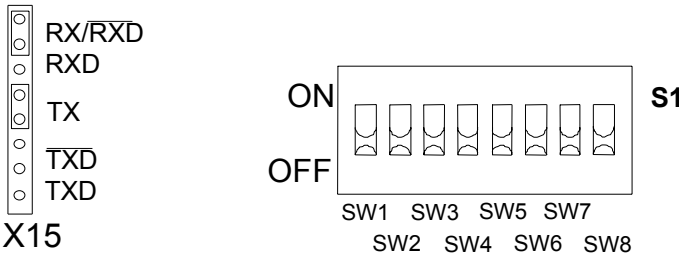


FIGURE 3-2 Basic RS 232C jumper and dip switch S1 settings

Connecting the probe

As the cable of HMP45A-P is connected via screw terminals the user can shorten the cable to desired length and reconnect it easily. The cable wires are connected as shown in **FIGURE 3-3**.

NOTE	It is not recommend to unsold and then re-sold the wires of HMP45D and PT100 sensor head.

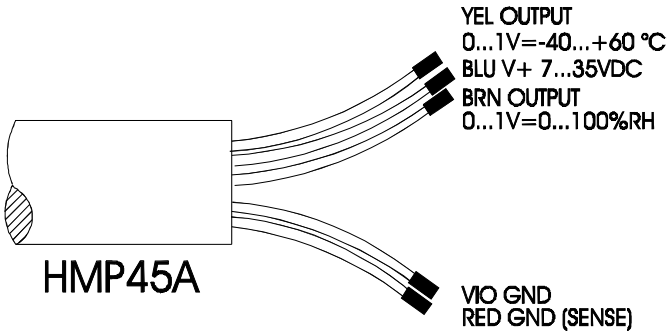
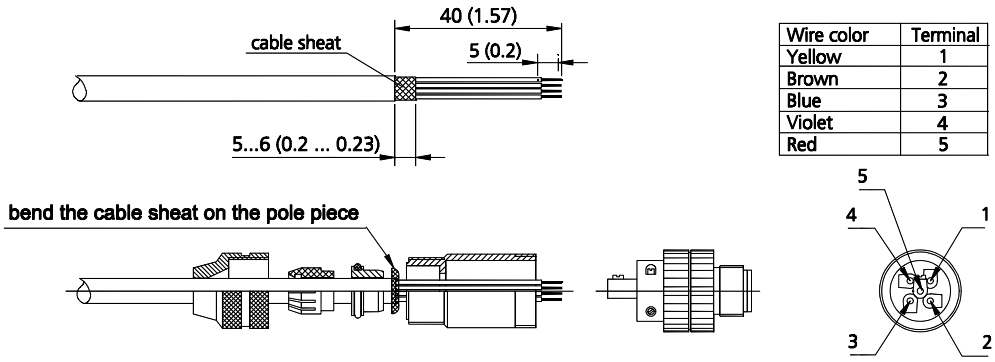


FIGURE 3-3 Wire colours of HMP45A-P.



Wire color	Terminal
Yellow	1
Brown	2
Blue	3
Violet	4
Red	5

FIGURE 3-4 Connecting the cable. Dimensions in mm (inches).

CHAPTER 4 COMMISSIONING

Display and keypad

The optional LCD display has an on/off selectable backlight for better readability at any light conditions. The two rows of the display can be defined to indicate different kind of information. The keypad of the display cover can be used to inspect and change the parameters available.

The format of the display is defined by using the serial command DFORM (see page 15). There are two rows containing 16 characters each; the user can define a maximum of 32 characters to be displayed, 16 characters on each row. The following fields in the display format can be used:

pressure quantities (pressure, average, difference)
three-hour pressure trend and pressure tendency code
temperature quantity and relative humidity
units
error status and stability indicator
number and text fields

The following basic rules apply to the use of the keypad:

1. Use ENT key to acknowledge a new selection.
2. Use CL key to activate a parameter or unit to be changed or to revert to the original display.
3. Use arrow keys to make a selection between functional alternatives.

Only the display contrast can be adjusted if the KEYLOCK is ON. The transmitter displays NO MODIFICATIONS ALLOWED message for a few seconds before reverting to the original display. It is also possible to inspect the settings of the transmitter although the KEYLOCK has been turned ON.

Example of changing units:

1. Press ENT and the text UNIT starts blinking. Acknowledge it with the ENT key (enter).
2. Press CL and the pressure unit in use starts blinking. Use arrow keys to choose a desired unit and acknowledge it with enter.
3. The temperature unit in use starts blinking. Use arrow keys to choose a desired unit and acknowledge it with enter. The transmitter now returns to the original display.

Example of changing serial settings:

1. Press ENT and the text UNIT starts blinking. Choose SER by using the arrow keys and acknowledge with enter.
2. Press CL and BAUD starts blinking. After pressing ENT, all the available baud rates will be displayed. Use arrow keys to choose a desired value and acknowledge it with enter. PARI starts blinking. Press CL to exit or continue to change other serial parameters in same way as the baud rate.

NOTE Note that modifications made using the keyboard will affect the serial interface settings, too.

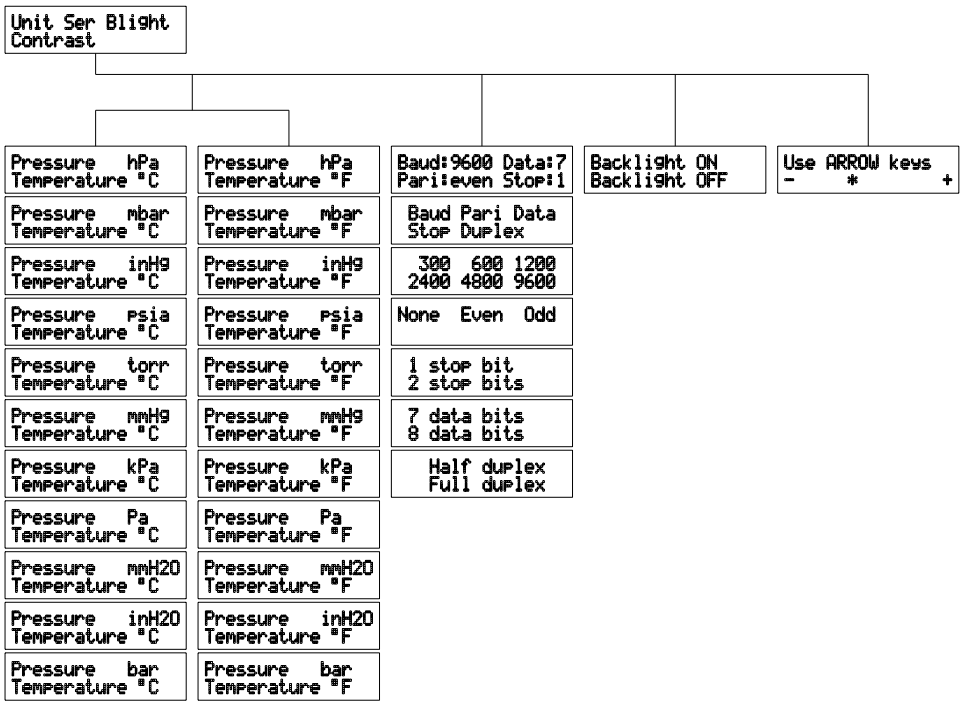


FIGURE 4-1 Available functions and selections of the local display

Operating modes

Select the desired sending mode for the transmitter. This is done with a command SMODE.

SMODE Selecting the sending mode

SMODE x <cr>

where:

x = STOP, RUN, SEND or POLL

The SMODE command is used to set or inspect the sending mode of the transmitter. The PTU200 series transmitters have four sending modes: STOP, RUN, SEND and POLL.

In STOP mode, after power-up the transmitter outputs its type and software version and then waits for further commands.

In RUN mode, continuous outputting starts automatically from power-up.

In SEND mode, a single message is automatically output after power-up.

POLL mode allows the communication with multiple transmitters or other digital instruments connected to one serial bus. The transmitter does not echo in POLL mode.

Examples:

```
>smode <cr>
Serial mode   : STOP
>smode run <cr>
Serial mode   : RUN
>smode send <cr>
Serial mode   : SEND
>smode poll <cr>
Serial mode   : POLL
>smode stop <cr>
Serial mode   : STOP
>reset<cr>
```

NOTE Remember to give the RESET command to initialize the new sending mode.

Software settings

SERI Serial bus settings

SERI b p d s x <cr>

where: (* = factory setting)

b	=	baud rate (300...9600*...38400)
p	=	parity (E = even*, O = odd, N = none)
d	=	data bits (7* or 8)
s	=	stop bits (1* or 2)
x	=	duplex (F = full* or H = half)
<cr>	=	carriage return is generated by the ENTER or RETURN key of the host computer

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

Examples:

```
>seri <cr>
9600  E 7 1 F
>seri 1200 N 8 1 H <cr>
1200  N 8 1 H
>reset <cr>

PTU200 / 1.01
>
```

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

ECHO Setting the serial bus echo on/off

ECHO x <cr>

where:

```
x  =  ON or OFF
```

The ECHO command can be used to set or inspect the echoing condition of the transmitter. In OFF mode the transmitter does neither output the '>' prompt character nor echo the given commands.

Examples:

```
>echo <cr>
Echo             :  ON
>
>echo off <cr>
Echo             :  OFF
```

FORM Defining the output format

FORM <cr>

The FORM command can be used to set or inspect the output format of the transmitter. The maximum length of FORM is 80 characters. The user can define the following fields into the output format:

amount of decimals	give number of decimals before a quantity. Giving 4.2 before the pressure quantity outputs a reading with the following form: 1013.12
pressure quantities	P1, P2, P (average), PD (difference)
pressure trend *)	TRE (three-hour trend)
pressure tendency	A (three-hour tendency)
temperature quantity of PT100 and HMP45D sensor heads *)	T
temperature quantity of HMP45A-P *)	TH
relative humidity	RH
units	U, UU, UUU, UUUU, UUUUU
serial number of the transmitter	SN
error status	ERR (three characters)
stability indicator	OK (uses three characters)
checksums	CS2, CS4 CSX
number fields	n.m where: n = 0 - 9, m = 0 - 9
text fields	within " " characters
CR	\ r or #r
LF	\ n or #n
TAB	\ t or #t
nnn ASCII code	\ nnn or # nnn (cannot be 000)

*) The PTU200 transmitter cannot output + sign for pressure trend or temperature reading; a space is output instead.

Example of setting the output format:

```
>form
P1 " " UUU " " T " " UU " " RH " " UUU \r \n
? 4.1 P " " UUU " " "Tend" " " 1.0 A " " 3.1 T UU " "
3.0 RH UUU \r \n
>send
1007.9 hPa Tend 7  24.9'C  28%RH
>
```

Inspecting the output format:

```
>form
P1 " " UUU " " T " " UU " " RH " " UUU \r \n
?<esc>
```

Use ESC-key to abort without changing the settings.

EFORM Defining the error output format

EFORM <cr>

The EFORM command can be used to define a user specific error output format for the serial line. In case of an error, the transmitter outputs the defined format instead of *****.

Example of an EFORM definition:

```
>eform <cr>

? "ERROR" \r \n <cr>
>send
1007.8 hPa  OK      (correct operation)
>send <cr>
ERROR               (incorrect operation)
>
```

Any previous EFORM definition may be removed with the following command:

```
>eform * <cr>
>
```

DFORM Defining the display format

DFORM <cr>

The DFORM command is used to define the format for the optional LCD display. There are two rows containing 16 characters each. The user can define the following fields into the display format:

pressure quantities	P1, P2, P (average), PD (difference)
pressure trend *)	TRE (three-hour trend)
pressure tendency	A (three-hour tendency)
temperature quantity of PT100 and HMP45D sensor heads *)	T
temperature quantity of HMP45	TH
relative humidity	RH
units	U, UU, UUU, UUUU, UUUUU
serial number of the transmitter	SN
error status	ERR (three characters)
stability indicator	OK (uses three characters)
number fields	n.m where: n = 0 - 9, m = 0- 9
text fields	within " " characters

*) The PTU200 transmitter cannot output + sign for pressure trend or temperature reading; a space is output instead.

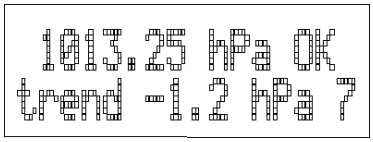
Any previous DFORM definition may be removed and the original factory setting restored with the following command:

```
>dform * <cr>
>
```

Example of setting the display format to show pressure, stability indicator, pressure trend and pressure tendency:

```
>dform <cr>
4.2 P " " UUUUU OK \r \n
? " " 4.2 P " " UUU OK " trend " 2.1 TRE " " UUU " " A
<cr>
>
```

The display will look similar to the following:



The PTU200 transmitter will show * instead of numeric values for pressure trend and pressure tendency for three hours from power-up.

In case of error, the relevant error message will automatically appear on the display. In this case, any other information defined using the DFORM command will be replaced with an error message.

PROMPT Setting the prompt outputting ON or OFF

PROMPT x

where:

x = ON or OFF

```
>PROMPT<cr>
Prompt         :  ON
>PROMPT OFF<cr>
Prompt         :  OFF
send<cr>
1007.9 hPa Tend 7  24.9 'C  28 %RH
PROMPT ON<cr>
Prompt         :  ON
>
```

UNIT Setting the pressure and temperature units

UNIT x <cr>

where (* = factory setting)

x = hPa*, kPa, Pa, bar, mbar, inHg, mmHg, torr, mmH2O, psia, C*, F

This command is used to set and inspect the pressure and temperature unit.

Example of changing the pressure and temperature units:

```
>unit <cr>
P unit    : hPa
T unit    : 'C
>unit C <cr>
>send
  1018.33 hPa     24.19 'C     32.96 %RH
>unit torr <cr>
P unit    : torr
T unit    : 'C
>unit F <cr>
>send
   763.84 torr     75.62 'F     32.89 %RH
>
```

AVRG Setting the averaging time

AVRG x <cr>

where:
x = 1 ... 600 (seconds)

The AVRG command is used to set and inspect the averaging time during which the individual measurement samples are integrated to get an averaged reading. The averaging time is the total averaging time of the transmitter.

In case of two internal pressure transducers, the defined averaging time is divided by three to get an averaging time for each pressure transducer. The third transducer is the VMT for measuring RH/T.

Note that if the averaging time is defined to be long, the settling time at power-up will be long, too.

The output reading is a running average pressure reading. The measurement is updated in normal measurement mode approximately every 1 to 4 seconds, depending on the AVRG setting.

A minimum of one-second averaging time is recommended per each pressure transducer. These selections are used as the factory setting averaging times.

Example of setting the averaging time to 60 seconds (WMO averaging time for barometric pressure measurement):

```
>avrg <cr>
Averaging time:    1.0 ?<cr>
>

>avrg 60 <cr>
Averaging time:   60.0
>
```

INTV Setting the output interval

INTV x y <cr>

where:

x = output interval (0...255)
y = unit (s, min, h)

This command is used to set and inspect the output interval. The R command is used to start the outputting.

Examples:

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

>intv 10 s <cr>
Output intrv. :     10 s
>r <cr>
```

NOTE In case of the half duplex RS 485/422 serial communication, the user is requested to set the interval time to one second or more. This enables an interruption of outputting, if the R command is given by mistake.

ADDR Setting the transmitter address (for POLL mode)

ADDR x <cr>

where:

x = the address (0 ... 99)

This command is used to set and inspect the address of the transmitter for the POLL mode. The address feature is important when multiple transmitters are connected to one RS232C interface or when a transmitter is used on an RS485/422 serial interface.

Example of setting the address to 7:

```
>addr 7 <cr>
Address       :        7
>
```

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

```
>addr 0 <cr>
Address       :        0
>
```

NOTE If the transmitter is not closed in the POLL mode, it will respond to any SEND command despite of the address. The transmitter has to be set to POLL mode and then closed with CLOSE command (see Chapter POLL mode).

SCOM User specific SEND command

SCOM <cr>

This command is used to define a user specific SEND command for one message output. The standard SEND command of the transmitter will always function normally whatever the SCOM definition may be.

The new command must be defined within " " signs, then some end characters also can be defined.

Note that the SCOM command is case sensitive. It is in fact recommended to use the opposite case characters for SCOM definition to avoid incocsistency with other commands. Note also that the PTU200 does not react on <eot> at the end of a command.

Example of setting a P (note the upper case character in comparison to the rest of the lower case characters) command for one message output:

```
>scom <cr>

? "P" \ r <cr>
>P <cr>
1020.30 hPa
>
```

Example of defining a similar command without an end character:

```
>scom <cr>
"P" \r
? "P" <cr>
>P1020.30 hPa
>
```

Any previous SCOM definition may be removed with the following command:

```
>scom * <cr>
>
```

PSTAB Setting the pressure stability indicator

PSTAB x <cr>

where:

x = pressure reading (in current unit)

The PSTAB command is used to define the pressure stability indicator reflecting maximum allowed pressure difference between two successive averaged measurements. The user has to also define the FORM command to include the "OK" stability indicator field. The factory setting for the stability indicator level is 0.5 hPa.

```
>pstab 0.5 <cr>
Stab. level   :      0.50 hPa
>form
? 4.2 P " " UUU " " OK \r \n
>send <cr>
1020.30 hPa OK     (accepted)
>send <cr>
1020.30 hPa        (rejected)
>
```

PDMAX Setting the pressure difference limit

PDMAX x <cr>

where:

x = pressure reading

This command is used to define the maximum pressure difference between the pressure readings from two pressure transducers (P1 and P2). If the defined value is exceeded, the relevant digits in the ERR field will change from 0 to 1. More than one ´1´ in the ERR field indicates that the pressure reading output is not reliable.

For an acceptable measurement crucial conditions are:

- two transducers: P high - P low ≤ Pdmax

The factory setting for Pdmax is 1 hPa.

Example of setting the limit to 0.5 hPa:

```
>pdmax <cr>
Pd max         :    1.000 ? 0.5 <cr>
>
```

Example of exceeding the Pdmax limit:

```
>form <cr>
4.2 P " " UUUU \r \n
? 4.2 P1 " " P2 " " P " " UUU " " ERR \r \n <cr>
>send <cr>
1020.30 1020.32 1020.31 hPa 00
>send <cr>
1020.30 1022.30 1021.30 hPa 11
>
```

Please use the ERRS command to analyze problems.

KEYLOCK Setting the keyboard lock on/off

KEYLOCK x <cr>

where:

x = ON or OFF

The KEYLOCK command is used to set or inspect the keypad lock condition of the display cover keypad. The PTU200 transmitters with display cover are supplied with the keypad locked (KEYLOCK OFF). It is thus possible to inspect the settings but not to change them. With the keypad locked the settings can be inspected but not changed.

Example:

```
>keylock on <cr>
Keylock        :  ON
>
```

If anyone tries to change the settings using the keypad with the KEYLOCK ON, the transmitter will display NO MODIFICATIONS ALLOWED for a few seconds and then returns to the original display.

Hardware settings

Inside the transmitter, there is a connector X15 (see **FIGURE 4-2**) and a dip switch S1 (see **FIGURE 4-3**). These are used to make the main hardware settings of the PTU200.

With the connector X15 the user can select the RS 232C (RX, TX) or TTL levels for serial communication. With TTL levels, the user also has phase alternatives available for both input (RXD, RXD inverted) and output (TXD, TXD inverted).

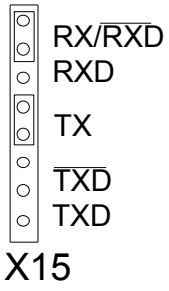


FIGURE 4-2 RS 232C/TTL level and phase selections

The half duplex two-wire RS485/422 serial interface of the PTU200 does not require any hardware settings to be made to the transmitter. See page 53 for quick reference information on how to use the RS485/422 interface of the PTU200 series digital transmitters.

Normally, the dip switch S1 settings are all OFF as in **FIGURE 4-3**

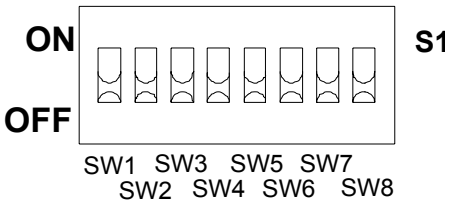


FIGURE 4-3 Basic dip switch S1 settings

An external power control can be used to switch the PTU200 transmitter ON/OFF. The control is activated with the switch SW2 in position ON as shown in **FIGURE 4-4**. The TTL signals are: 0VDC OFF and 5VDC ON.

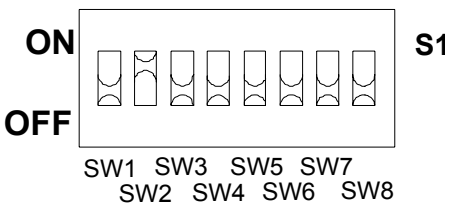


FIGURE 4-4 External power control ON

TABLE 4-1 Summarized settings of the dip switch S1.

SW1	OFF	not used
SW2	OFF ON	external power control OFF (TTL: 0 VDC) external power control ON (TTL: 5 VDC
SW3	OFF	not used
SW4	OFF ON	memory write DISABLE memory write ENABLE
SW5	OFF	not used
SW6	OFF	not used
SW7	OFF	not used
SW8	OFF ON	factory settings OFF / user settings ON factory settings ON (9600, E, 7, 1, F)

CHAPTER 5 OPERATING

Only a few commands are needed to operate a PTU200 transmitter in the RUN, STOP and POLL modes. In the SEND mode, no commands are needed.

In the RUN or STOP modes, the commands R, S and SEND can be used. The user may also use his own SEND command if he has previously specified one using the SCOM command.

In the POLL mode, the transmitter responds to a SEND command only if it includes the address. OPEN and CLOSE commands are also available for temporary communication with one single transmitter.

In the SEND mode, no commands are needed. The transmitter will automatically output one message at power-up, or when triggering the transmitter on using pin 4.

RUN and STOP modes

TABLE 5-1 summarizes the commands that are used in the RUN and STOP modes. In addition, the user may use his own SEND command if he has previously specified one with the SCOM commissioning command. The commands are not case sensitive except for the SCOM command.

TABLE 5-1 Commands used in RUN and STOP modes

Function	Command
starting output	R
stopping output	S
single message output	SEND
resetting the transmitter	RESET

R Starting the continuous output

R <cr>

This command is used to start continuous outputting in the STOP and RUN modes and after setting the output interval (see page and 18).

Example (in STOP mode):

```
>reset <cr>

PTU200 / 1.01
>r <cr>
1013.25 hPa 22.9 %RH 22.4 'C
1013.25 hPa 22.9 %RH 22.4 'C
1013.25 hPa 22.) %RH 22.4 'C
...
```

Example of restarting the outputting (in RUN mode):

```
>SMODE<cr>
Serial mode   : RUN
>RESET<cr>
1009.1 hPa 42.4 %RH 24.2 'C
1009.1 hPa 42.4 %RH 24.2 'C
...
S<cr>      (text invisible)
>R<cr>
1009.2 hPa 42.5 %RH 24.2 'C
1009.1 hPa 42.5 %RH 24.2 'C
...
```

S Stopping the output

S <cr>

This command is used to stop the continuous outputting (activated with power-up or reset in RUN mode or using the R command).

Example:

```
>r <cr>
1013.25 hPa 22.9 %RH 22.4 'C
1013.25 hPa 22.9 %RH 22.4 'C
1013.25 hPa 22.9 %RH 22.4 'C
s <cr>              (text invisible)
>
```

SEND Outputting a single message only

SEND <cr>

This command is used to output one message at a time in the STOP and RUN modes.

```
>reset <cr>

PTU200 / 1.01
>send <cr>
1013.25 hPa 22.9 %RH 22.4 'C
>
```

The user may also use his own one-message command if he has previously specified one using the SCOM command (see Chapter on page 11).

RESET Resetting the transmitter

RESET <cr>

The RESET command is used to reset the transmitter. All software settings remain in the memory after reset or any power failure. The RESET command must always be given if the serial bus settings, DIP switch settings or the operating mode of the transmitter have been changed.

Example:

```
>reset <cr>

PTU200 / 1.01
>
```

POLL mode

TABLE 5-2 Commands used in RUN and STOP modes

Function	Command
single message output	SEND
opening a transmitter	OPEN
closing a transmitter	CLOSE

The POLL mode is used when several PTU200 series transmitters are connected to one RS232C serial interface. It is also used when several intelligent transmitters are connected to a half duplex RS 485/422 serial interface.

In the POLL mode, the transmitter must have a specific address so that the host system is able to direct the outputting commands to the particular transmitter. The addressable SEND command is used to ask for a single message output from the transmitter.

The OPEN command can be used to open a single transmitter temporarily to STOP mode. The CLOSE command will restore the POLL mode.

SEND Outputting one single message

SEND a <cr>

where:

a = the address of the transmitter (0...99)

This command is used to output one message from the transmitter in the POLL mode (see SMODE command).

Example:

```
>addr 7 <cr>
Address       :        7
>smode poll <cr>
Serial mode   : POLL
>close <cr>

line closed
send 7 <cr>              (text invisible)
1013.25 hPa
```

OPEN Setting a transmitter from POLL mode to STOP mode

CLOSE Setting a transmitter from STOP mode to POLL mode

OPEN a <cr> CLOSE <cr>

where:

a = the address of the transmitter (0...99)

These commands are used to set a transmitter *temporarily* to STOP mode and back to POLL mode again. The OPEN command is useful when several transmitters are connected to one serial bus and communication with a single transmitter is needed. The CLOSE command is a global command and requires no address.

The PTU200 series transmitters must always be closed after the POLL mode selection. The RESET command and powering-up will close the PTU200 series transmitters automatically.

```
>addr 7 <cr>
Address        :         7 <cr>
>smode poll <cr>
Serial mode    : POLL
>close <cr>

line closed
```

Example of opening and closing a transmitter with address 7:

```
open 7 <cr>                (text invisible)

PTB  7 line opened for operator commands

>
```

Any commands (except for the ? command) can now be used for the transmitter with address 7 without affecting other transmitters with different addresses connected to the same serial interface. However, if the RESET command is given or the transmitter is powered-up, the transmitter will automatically return to the POLL mode.

Example of closing a transmitter:

```
>close <cr>

line closed
```

SEND mode

In the SEND mode, the transmitter will automatically output one message at power-up or when triggering the transmitter on using pin 4 of the transmitter. The trigger signal must be a TTL level signal. TTL HIGH (5 VDC) turns the transmitter ON and TTL LOW (0 VDC) turns the transmitter OFF.

Examples of outputting with the prompt (ECHO ON) and without the prompt (ECHO OFF):

```
>echo <cr>
Echo          :  ON
>smode send <cr>
Serial mode   : SEND
>reset <cr>
1013.25 hPa
>

>echo off <cr>
Echo          :  OFF
reset <cr>                    (text invisible)
1013.25 hPa
```

Example of outputting a minimum amount of (six) characters by excluding the <cr> and <lf> characters, the pressure unit and the decimal point with the FORM command:

```
>form <cr>
4.2 P " " UUUU \r \n
? 6.0 P <cr>
>unit Pa
P unit        : Pa
>smode send <cr>
Serial mode   : SEND
>echo off <cr>
Echo          :  OFF
reset <cr>                    (text invisible)
101325
or
 (power-up)
101325
```

CHAPTER 6 CALIBRATION AND ADJUSTMENT

Pressure

The user can select a simple offset or a two-point offset and gain adjustment and use the LCI command for adjustment of pressure transducer. The MPCI 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 attempt to readjust the transducer. 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.

Entering new linear or multipoint corrections or changing their status will also automatically cancel the date of calibration of the transmitter (see CALD command).

TABLE 6-1 Adjustment and calibration commands

Function	Command
listing corrections	CORR
linear corrections on/off	LC ON/OFF
multipoint corrections on/off	MPC ON/OFF
entering multipoint corrections	MPCI
calibration date	CALD

The linear and multipoint corrections are protected by switch SW4 (see figure 6.2). The switch SW4 is normally in write DISABLE position (OFF) and the user must change it to write ENABLE position

(ON) to be able to enter new linear and multipoint corrections to the transmitter.

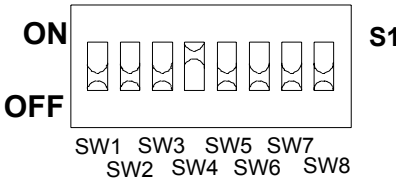


FIGURE 6-1 Switch SW4 in write ENABLE position (ON)

NOTE	Always remember to return the switch SW4 to write DISABLE position (OFF).

CORR Listing linear and multipoint pressure corrections

CORR <cr>

The CORR command is used to indicate the status of linear and multipoint pressure corrections. In case the status is ON, the corrections and valid date of calibration are listed. The listing varies according to the number of transducers in the transmitter. The transmitter lists * in the second column if there exists only one pressure transducer in the transmitter.

Example of the listing of a transmitter with one pressure transducer:

```
>corr
Linear adjustments         ON
    Reading Correction     Reading Correction
     500.010      0.120*******.**********.***
     1100.320     0.150*******.**********.***
Multipoint adjustments     ON
    Reading Correction     Reading Correction
    499.660      -0.110*******.**********.***
    599.110      -0.080*******.**********.***
    698.580      -0.060*******.**********.***
    800.950      -0.030*******.**********.***
    900.400       0.010*******.**********.***
    947.200       0.020*******.**********.***
    999.840       0.050*******.**********.***
   1099.090       0.070*******.**********.***
```

```
Transducer 2
 CORRECTIONS:
  TXD0,TXD1,TXD2   :   -0.12000    1.00000   0.00000
  V0XD0,V0XD1,V0XD2:    0.00000    1.00000   0.00000
  V1XD0,V1XD1,V1XD2:    0.00000    1.00000   0.00000

Calibration date          1998-12-11
>
```

LC Linear pressure corrections

LC x <cr>

where:

x = ON or OFF

The LC command is used to activate or deactivate the linear offset or offset/gain pressure corrections. Plain command LC outputs the linear corrections in use.

The linear corrections are protected with switch SW4 (see **FIGURE 6-1**) Turn the switch SW4 to write ENABLE position (ON) to be able to turn the linear corrections on or off.

NOTE Changing the linear corrections on or off will automatically cancel the date of calibration of the transmitter.

The listing varies according to the number of pressure transducers.

Example of linear adjustments performed on a transmitter with two transducers:

```
>lc off <cr>
Linear adj.    :  OFF
>lc on <cr>
Linear adj.    :  ON
>lc <cr>
Reading Correction    Reading Correction
1013.250     -0.100    800.000      0.050
1013.250     -0.100   1000.000     -0.020
>
```

NOTE Always remember to return the switch SW4 to write DISABLE position (OFF).

LCI Entering linear pressure corrections

LCI n <cr>

where:

n = number of the pressure transducer (1 or 2)

The LCI command is used to enter new linear offset and offset/gain pressure corrections to the transmitter. Note that the linear corrections are given to each pressure transducer separately.

Entering new linear corrections is protected by switch SW4. Turn the switch SW4 to write ENABLE position (ON) to be able to enter new linear and multipoint corrections to the transmitter.

Deactivate the previous corrections by using the LC OFF. Pre-calibration of the transmitter then gives the required new corrections.

NOTE The new linear corrections will always cancel the previous corrections as well as the valid date of calibration of the transmitter (see CALD command).

Activate the new linear corrections with the LC ON command. Use ESC to abort without executing the command.

In the following, an example of performing an offset adjustment for pressure transducer P1 and an offset and gain adjustment for pressure transducer P2 is given.

>lc off <cr>

```
Linear adj.   :  OFF
>lci 1 <cr>
P1  1.  reading ? 1013.25 <cr>
correction ? -0.1 <cr>
P1  2.  reading ? <cr>
>lci 2 <cr>
P2  1.  reading ? 800.00 <cr>
correction ? 0.05 <cr>
P2  2.  reading ? 1000.00 <cr>
correction ? -0.02 <cr>
>lc on <cr>
Linear adj.   :  ON
Reading Correction    Reading Correction
1013.250     -0.100    800.000      0.050
1013.250     -0.100   1000.000     -0.020
>
```

NOTE Always remember to return the switch SW4 to write DISABLE position (OFF).

MPC Multipoint pressure corrections

MPC x <cr>

where:

x = ON or OFF

The MPC command is used to activate or deactivate the multipoint corrections. Plain command MPC outputs the corrections in use.

The multipoint corrections are protected with switch SW4 (see **FIGURE 6-1**). Turn the switch SW4 to write ENABLE position (ON) to be able to turn the multipoint corrections on or off.

NOTE Changing the multipoint corrections on or off will automatically cancel the previous date of calibration of the transmitter (see CALD command).

Example of multipoint adjustments performed on a transmitter with one pressure transducer:

```
>mpc off <cr>
Multipoint adj:  OFF
>mpc on <cr>
Multipoint adjustments    ON
>mpc<cr>
    Reading Correction    Reading Correction
    499.660     -0.110*******.**********.***
    599.110     -0.080*******.**********.***
    698.580     -0.060*******.**********.***
    800.950     -0.030*******.**********.***
    900.400      0.010*******.**********.***
    947.200      0.020*******.**********.***
    999.840      0.050*******.**********.***
   1099.090      0.070*******.**********.***
Multipoint adj:  ON
>
```

NOTE Always remember to return the switch SW4 to write DISABLE position (OFF).

MPCI Entering multipoint pressure corrections

MPCI n <cr>

where:

n = number of the pressure transducer (1 or 2)

The MPCI command is used to enter new multipoint corrections to the transmitter. Note that the user must give the multipoint corrections to each pressure transducer separately.

Turn the switch SW4 to write ENABLE position (ON) to be able to enter new linear and multipoint corrections to the transmitter.

Deactivate the previous corrections first using the LC OFF and/or MPC OFF commands. 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.

NOTE The new multipoint corrections will always cancel the previous corrections as well as the valid date of calibration of the transmitter (see CALD command).

Use ESC to abort without executing the command. The new multipoint corrections are activated with the MPC ON command.

In the following, an example of performing a multipoint adjustment for pressure transducer P1 is given.

```
>lc off <cr>
Linear adj.   :  OFF
>mpc off <cr>
Multipoint adj:  OFF
>mpci 1 <cr>
 P1  1.  reading ? 499.72 <cr>
      correction ? -0.07 <cr>
 P1  2.  reading ? 599.20 <cr>
      correction ? -0.08 <cr>
 P1  3.  reading ? 698.71 <cr>
      correction ? -0.01 <cr>
 P1  4.  reading ? 801.12 <cr>
      correction ? -0.01 <cr>
 P1  5.  reading ? 900.61 <cr>
```

```
      correction ? -0.03 <cr>
 P1  6.  reading ? 947.42 <cr>
      correction ? -0.02 <cr>
 P1  7.  reading ? 1000.10 <cr>
      correction ? -0.04 <cr>
 P1  8.  reading ? 1099.58 <cr>
      correction ? -0.04 <cr>
>mpc on <cr>
Multipoint adj:  ON
>
```

NOTE	Always remember to return the switch SW4 to write DISABLE position (OFF).

CALD Storing the date of calibration

CALD yyyy-mm-dd <cr>

This command is used to store the date of calibration in the memory of the transmitter.

Example:

```
>cald <cr>
Calibration date          ????-??-??
>cald 1997-01-01 <cr>
Calibration date          1997-01-01
>
```

Changing the status (ON/OFF) of the linear or multipoint corrections or entering new linear or multipoint corrections will automatically cancel the date of calibration.

NOTE	Always remember to return the switch SW4 to write DISABLE position (OFF).

Humidity

Calibration of the HMP45A-P/D probes should be performed at regular intervals, depending on the conditions of use and desired accuracy. The recommended calibration interval is one year.

The HMP45A-P/D probes are easy to maintain, calibrate and adjust. The probe consists of a probe head and a handle with cable. All calibration electronics are in the probe head, which can be disconnected from the handle without disconnecting the wires. The probe heads are interchangeable.

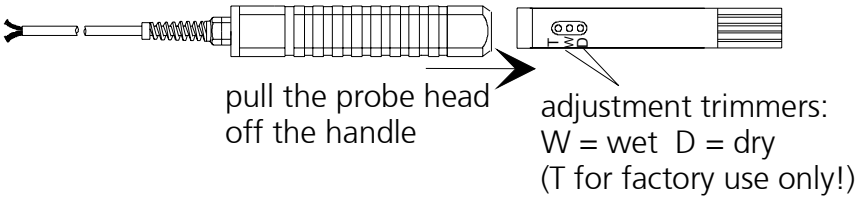


FIGURE 6-2 Adjustment trimmers and probe head connection/ disconnection

Humidity adjustment

For a high-accuracy two-point adjustment, use a Vaisala HMK15 or HMK13B calibrator and saturated salt solutions as described in the respective manuals. If there is no local display, read the outputs via the serial line.

Leave the calibrator and the probe head in the same space for at least four hours so that their temperatures have time to equalize. Unscrew the plastic grid of the probe.

The adjustment is done first for the dry end and then for the wet end with trimmer potentiometers marked “D” (dry, <50 %RH) and “W” (wet, >50 %RH). The potentiometers are located under a protective plug; see **FIGURE 6-2**. Use a ceramic screwdriver with 2.5 mm blade for adjusting the potentiometers. Note: if zero point is adjusted in Nitrogen (N_2), the minimum output signal of 0.008 V corresponds to a relative humidity of 0.8 %RH.

TABLE 6-2 Greenspan’s calibration table

Temperature	°C	15	20	25	30	35
LiCl	%RH	*)	11.3	11.3	11.3	11.3
NaCl	%RH	75.6	75.5	75.3	75.1	74.9
K_2SO_4	%RH	97.9	97.6	97.3	97.0	96.7

*) Do not use or store the LiCl solution in temperatures below +18°C as its humidity equilibrium may change permanently

As the D (dry) and W (wet) adjustments may affect each other, check again the humidity reading at the low end. If needed repeat the procedure in low and high ends until the reading is correct.

Temperature

The temperature channels of PTU200 transmitters are very stable and the probes have been calibrated and adjusted at the factory. Unless there is a strong reason to believe that the adjustments have changed, DO NOT perform a temperature adjustment. This is a very demanding procedure and requires extremely accurate references. Furthermore, it is important to allow enough time for the stabilization during calibration. If for some reason, it is necessary to perform the temperature adjustment, follow attentively the instructions given below.

NOTE	The temperature channel has to be calibrated if the probe head has been changed.

The temperature adjustment can be done via the serial line using linear offset and gain corrections. Entering any corrections is protected by switch SW4. Turn it to write ENABLE position (ON) to be able to enter new offset and gain corrections.

NOTE	If there is need for an adjustment, check first whether there exist any previously set corrections. Before entering new corrections, it is recommended to set the offset to 0 and the gain to 1. Then measure the temperature again at two reference points, and calculate the new offset and gain corrections.

Offset

It is recommended to perform the one-point offset correction in temperature, which is close to average measurement temperature. The offset can be calculated by using equation 6-1.

$$Offset = T_{ref} - T_{meas} \quad (6\text{-}1)$$

where:
T_{ref} = T measured with an accurate reference thermometer
T_{meas} = T measured with PTU200

Example:

T_{ref} = 23.15°C
T_{meas} = 23.28°C
Offset = -0.13°C

Gain

The gain correction can be calculated with the equation 6-2. It is reasonable to use the low (T_1) and the high (T_2) end of needed temperature range.

$$Gain = 1 + \frac{\left(T_{ref1} - T_{meas1}\right) - \left(T_{ref2} - T_{meas2}\right)}{T_{meas1} - T_{meas2}} \quad (6\text{-}2)$$

where:
T_{ref1} = measured with a reference thermometer at temperature T_1
T_{ref2} = measured with a reference thermometer at temperature T_2
T_{meas1} = measured with PTU200 at temperature T_1
T_{meas2} = measured with PTU200 at temperature T_2

Example:
T_{ref1} = -14.97°C and T_{meas1} = -14.90°C
T_{ref2} = +30.12°C and T_{meas2} =+30.29°C
Gain = 0.99779

Offset = T_{ref2} -*Gain**T_{meas2} = -0.10

T = 0.99779 * 30.29°C - 0.10 = 30.12°C

TXCI Entering corrections for HMP45D and PT100 temperature measurement

TXCI x

where:

x = 2 if there is one pressure transducer installed
3 if there is two pressure transducers installed

The TXCI command is used to enter new offset and offset/gain corrections for temperature measurement of HMP45D and PT100.

```
>txci
TXD0     : -1.199999971E-01 ? -0.10<cr>      (offset)
TXD1     :  1.000000000E+00 ? 0.99779<cr>    (gain)
TXD2     :  0.000000000E-01 ?<cr>        (factory use only)
>
```

The factory setting TXD2 is passed by pressing enter. Use ESC to abort without executing the command.

Reset the transmitter to activate the given corrections.

NOTE Always remember to return the switch SW4 to write DISABLE position (OFF).

V0XCI Entering corrections for HMP45A-P temperature measurement

V0XCI x

where: x = 2 if there is one pressure transducer installed
3 if there is two pressure transducers installed

The V0XCI command is used to enter new offset and offset/gain corrections for temperature measurement of HMP45A-P.

Entering new corrections is protected by switch SW4. Turn it to write ENABLE position (ON) to be able to enter new offset/gain corrections.

The factory setting V0XD2 is passed by pressing enter. Use ESC to abort without executing the command.

Reset the transmitter to activate the given corrections.

In the following, an example of performing an offset and gain adjustment:

```
>V0XCI 2
V0XD0    :  0.000000000E-01 ? -0.10<cr>
V0XD1    :  1.000000000E+00 ? 0.99778<cr>
V0XD2    :  0.000000000E-01 ?<cr>
>
```

NOTE Always remember to return the switch SW4 to write DISABLE position (OFF).

CHAPTER 7 SELF-TESTING AND PROBLEM HANDLING

Returning the serial communication parameters

To restore factory software and hardware settings, set the dip switch S1 on the CPU board as in **FIGURE 7-1**. Other switches except the SW8 must be OFF. In addition, the serial interface has to be set for basic RS 232C operation according to **FIGURE 7-1**. With these selections, one single transmitter can be operated through the RS 232C serial interface using factory serial bus settings as in **TABLE 7-1**. Returning the SW8 to OFF will restore the original, application specific software settings.

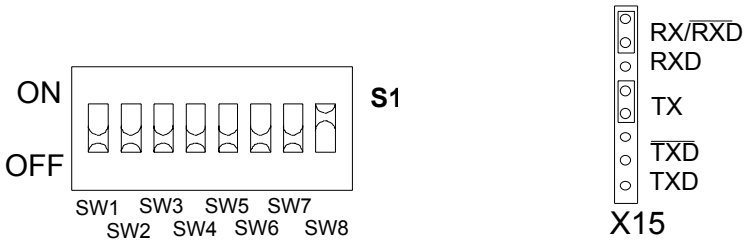


FIGURE 7-1 Factory settings for the dip switch S1 and Basic RS 232C settings

TABLE 7-1 Serial interface factory settings

Baud rate	9600
Parity	even
Data bits	7
Stop bits	1
Duplex	full duplex

Diagnostic commands

The PTU200 series digital transmitters respond to a set of diagnostic commands, which are useful for analyzing the basic settings and general operation of the transmitters. The diagnostic commands are listed in

TABLE 7-2 Diagnostic commands

Function	Command
basic information on settings	?
software version	VERS
serial number	SNUM
outputting error messages	ERRS

? Basic information on the transmitter settings

? <cr>

The ? command lists the basic information of the transmitter.

```
>?
Software version          PTU200 / 1.02
Serial number             T5030004
Configuration             12
Linear adjustments        ON
Multipoint adjustments    ON
Calibration date          1999-03-12
Baud Parity Data Stop Dpx 9600  E 7 1 F
Echo                      ON
Sending mode              STOP
Address                   0
Output interval           3 s
Output format             4.1 P " " UUU " " 2.1 RH " " UUU #r #n
Error output format
SCOM format
Pressure unit             hPa
Temperature unit          'C
Transducer 1:
 TYPE: PMT
Transducer 2:
 TYPE: VMT
Transducer 3:
 TYPE: NONE
>
```

NOTE Use this command only for one transmitter at a time. Any PTU200 series transmitter will always respond to ?-command whatever its settings are, provided that the serial interface settings are correct.

VERS Software version

VERS <cr>

The VERS command is used to output the software version of the transmitter.

```
>vers <cr>
PTU200 / 1.01
>
```

SNUM Serial number

SNUM <cr>

The SNUM command is used to output the serial number of the transmitter.

```
>snum
CPU  serial no : T2210005
TR1  serial no :         0
TR2  serial no :         0
TR3  serial no :         0
CTR1 serial no :         0
CTR2 serial no :         0
CTR3 serial no :         0
>
```

ERRS Error message output

ERRS <cr>

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

```
>errs <cr>
E00 Nothing special to report
>
```

Complete list of error codes:

```
E00 Nothing special to report
E10 CPU  EEPROM ackn. error
E20 CPU  EEPROM csum  error
E11 TR1  Transducer not present
E21 TR1  EEPROM csum error
E31 TR1  serial number error
```

```
E41 TR1  f out of range
E51 TR1  y-value out of range
E61 TR1  pressure out of range
E71 TR1  P difference too large
E12 TR2  Transducer not present
E22 TR2  EEPROM csum error
E32 TR2  serial number error
E42 TR2  f out of range
E52 TR2  y-value out of range
E62 TR2  pressure out of range
E72 TR2  P difference too large
E13 TR3  Transducer not present
E23 TR3  EEPROM csum error
E33 TR3  serial number error
E43 TR3  f out of range
E53 TR3  y-value out of range
E63 TR3  pressure out of range
E73 TR3  P difference too large
```

CHAPTER 8 TECHNICAL DATA

Barometric pressure

Operating range

Pressure ranges	500 ... 1100 hPa, 50...1100 hPa

Accuracy class

Pressure range	**500...1100 hPa**		**50...1100 hPa**
	class A	**class B**	
Linearity *	± 0.05 hPa	± 0.10 hPa	± 0.20 hPa
Hysteresis *	± 0.03 hPa	± 0.03 hPa	± 0.08 hPa
Repeatability *	± 0.03 hPa	± 0.03 hPa	± 0.08 hPa
Calibration uncertainty **	± 0.07 hPa	± 0.15 hPa	± 0.20 hPa
Accuracy at +20 *C ***	± 0.10 hPa	± 0.20 hPa	± 0.30 hPa
Temperature dependence****	± 0.1 hPa	± 0.1 hPa	± 0.30 hPa
Total accuracy including one year drift	± 0.15 hPa	± 0.25 hPa	± 0.45 hPa
Long-term stability	± 0.1 hPa / year		± 0.20 hPa/year

Response time (100% response)	**class A**	**class B**
one sensor	2 seconds	1 second

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

** Defined as ±2 standard deviation limits of inaccuracy of the working standard including traceability to NIST.

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

**** Defined as ±2 standard deviation limits of temperature dependence over the operating temperature range.

Humidity

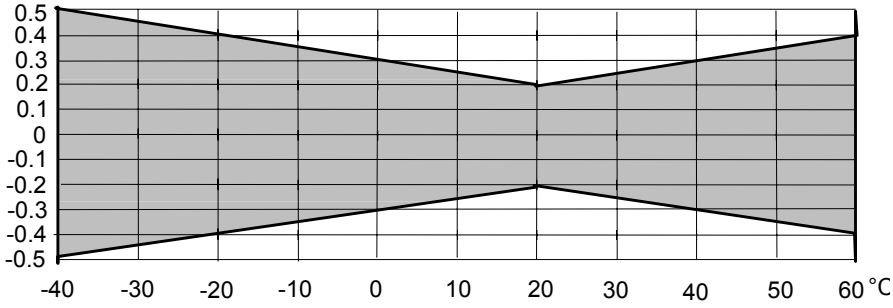
Measurement range	0.8 ... 100 %RH
Accuracy at +20 °C (incl. non-linearity and hysteresis)	
against factory references	±1 %RH (0...90 %RH)
	±2 %RH (90...100 %RH)
field calibration against references	±2 %RH (0...90 %RH)
	±3 %RH (90...100 %RH)
Typical long-term stability	< 1 %RH / year
Temperature dependence	±0.05 %RH/ °C
Response time (90%)at +20 °C	15 s with membrane filter
Humidity sensor	HUMICAP®180

Temperature

HMP45A-P & HMP45D

Measurement range	-36 ... +60 °C (HMP45A-P)
	-40 ... +60 °C (HMP45D)
Accuracy at 20°C	±0.2 °C

Accuracy over the whole measurement range:



Temperature sensor	
HMP45A-P	Pt 1000 IEC 751 1/3 Class B
HMP45D	Pt 100 IEC 751 1/3 Class B

Pt100 sensor head

Measurement range	-40 ... +60 °C
Accuracy over the whole measurement range	±0.2 °C
Temperature sensor	Pt 100 IEC 751 1/4 Class B

General

(* factory settings)		
Temperature range		
operating	-40 ... +60 ºC	
with local display	0 ... +60 ºC	
storage	-40 ... +60 ºC	
with local display	-20 ... +60 ºC	
Humidity range	non-condensing	
Supply voltage	10 ... 30 VDC, reverse polarity protected	
Supply voltage sensitivity	negligible	
Current consumption	less than 30 mA	
with local display	less than 30 mA (without backlight) less than 50 mA (with backlight)	
hardware shutdown mode	less than 0.1 mA	
Serial I/O	full duplex RS 232C * or bidirectional TTL level or half duplex two-wire RS 485/422	
code	ASCII	
parity	even*, odd, none	
data bits	7* or 8	
stop bits	1* or 2	
Baud rates	300, 600, 1200, 2400, 4800, 9600*	
Electrical connections		
excitation	supply, GND, CTRL (for shutdown)	
serial communication	TX, RX, GND, TXD, RXD, GND, TXD inverted, RXD inverted, GND, RS 485/422HI, RS485/422LO	
Units		
pressure	hPa*, kPa, Pa, mbar, bar, inHg, mmHg, torr, mmH_2O, psia	
humidity	%RH	
temperature	°C*, °F	
Resolution	0.1 hPa*, 0.1 %RH, 0.01 °C	
Settling time at power-up	**class A**	**class B**
one pressure sensor	6 seconds*	5 seconds*
Acceleration sensitivity	negligible	

Mechanics

Transmitter body

Pressure connector	M5 (10-32) internal thread
Pressure fitting	barbed fitting for 1/8" I.D. tubing
Optional quick connector	with shut off valve for 1/8" I.D. tubing
Maximum pressure limit	5000 hPa abs.
Minimum pressure limit	0 hPa
Electrical connector	female 9-pin subD-connector
Housing	epoxy painted aluminium

HMP45A-P and HMP45D

Housing	ABS plastic
Probe cable length	
HMP45A-P	20 m
HMP45D	3.5 m
Housing classification	IP 65 (NEMA 4)
Sensor protection (standard)	membrane filter, part no. 2787HM

PT100 sensor head

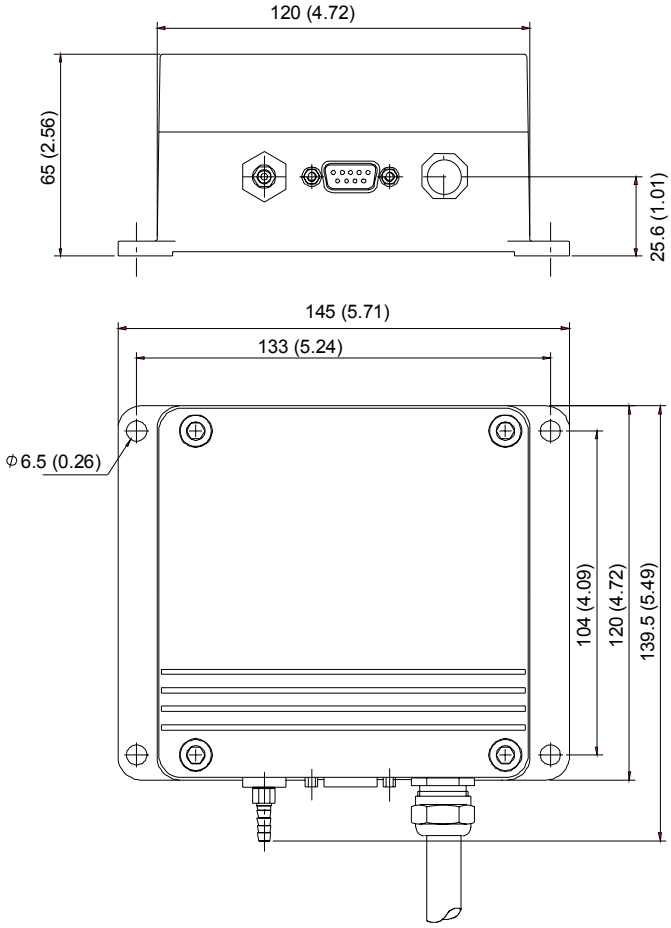
Cable length	2 m

Weight

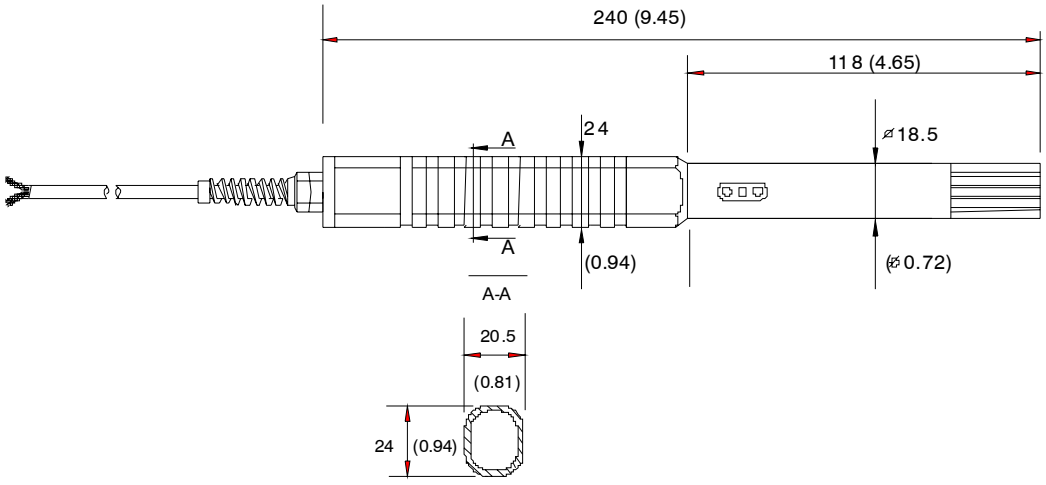
PTU200 with HMP45A-P	2.3 kg
PTU200 with HMP45D	1.3 kg
PTU200 with Pt100 sensor head	1.1 kg

Dimensions

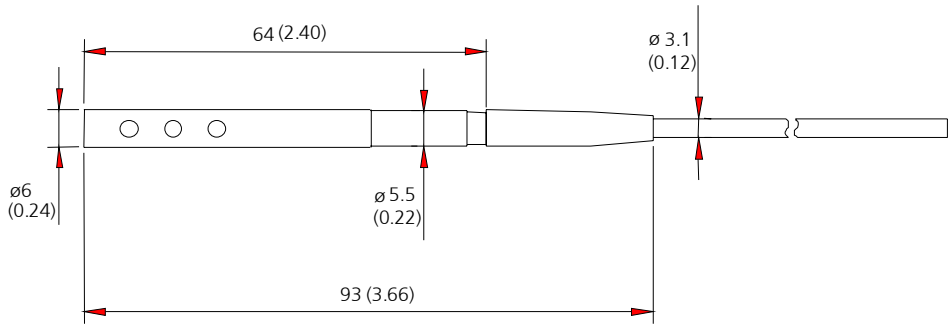
Transmitter body



HMP45A-P & HMP45D



Pt100 sensor head



Electromagnetic compatibility

EN 61326-1:1997 +Am 1:1998, Electrical equipment for measurement, control and laboratory use - EMC requirements; Generic environment.

Test methods:

Emission

Radiated emissions	CISPR16 class B (CISPR22 Class B)

Immunity

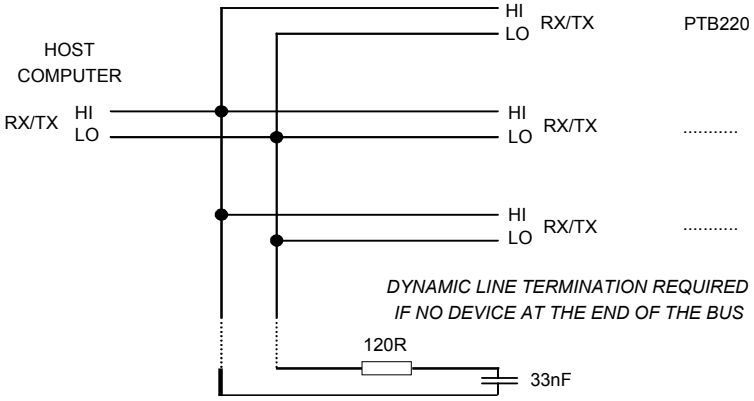
Electrostatic discharge (ESD)	EN/IEC 61000-4-2
EM field	EN/IEC 61000-4-3
EFT Burst	EN/IEC 61000-4-4
Surge	EN/IEC 61000-4-5
Conducted RF	EN/IEC 61000-4-6

Accessories

Order code	Description
PTU200MIK	outdoor installation kit
PTU200TRIPOD	tripod stand for outdoor installation

APPENDIX A OPTIONAL RS485/422 INTERFACE OF PTU200 TRANSMITTERS

The two-wire *non-isolated* half duplex RS 485/422 serial interface is the recommended way of connecting the PTU200 series transmitters with other intelligent transmitters.



At the ends of the serial bus there must be a PTU200 series transmitter, a dynamic line adapter (120 ohm resistor in series with a 33 nF capacitor) or a line master. If a branch line is made with a junction box, the branch should be shorter than 3 meters.

When using PTU200 series transmitters on RS485/422 interface select half duplex operation, set an address for each transmitter and activate the POLL/CLOSE mode. The transmitters can then be polled by the SEND a command or by using the OPEN/POLL commands. The time interval setting allows to enter a stop (S) command if a continuous outputting (R) command has been given by mistake (see page 18).

NOTE

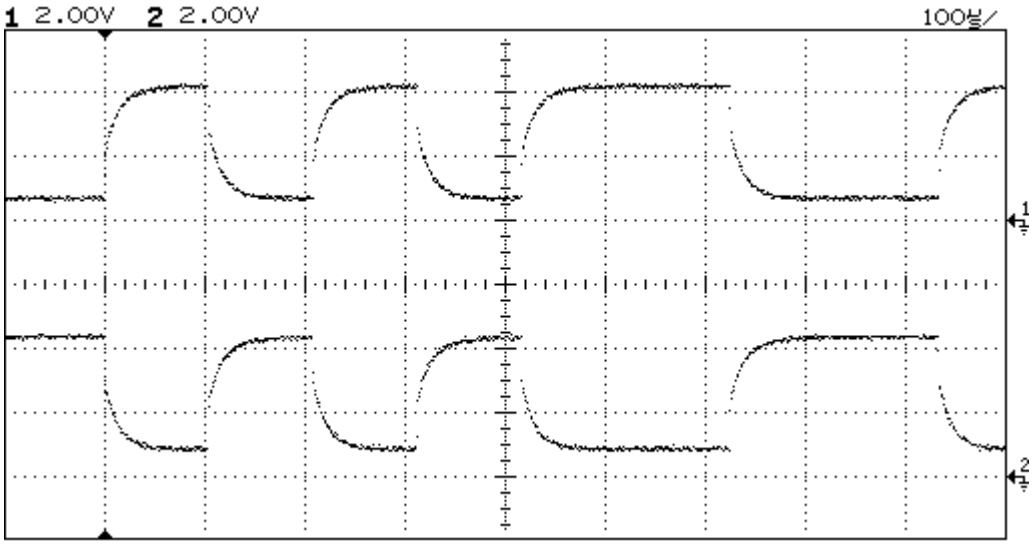
1. The sending of PTU200 is controlled with XON/OFF (software handshaking).
2. The buffer of the transmitter can be cleared with <cr>.

Example of required software commands:

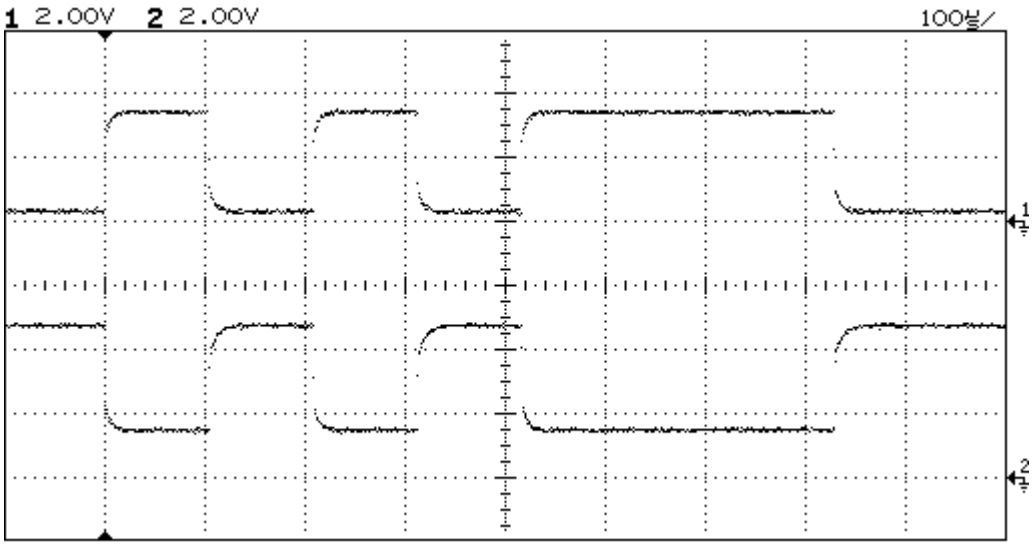
```
>seri <cr>
9600  E 7 1 F
>seri H <cr>            (select half duplex serial operation)
9600  E 7 1 H
>intv 1 s <cr>          (select at least 1 second outputting interval)
Output intrv. : 1 s
>addr 7 <cr>            (select address of the transmitter)
```

```
Address       :        7 <cr>
>smode poll <cr>       (select the POLL mode)
Serial mode   : POLL
>reset <cr>            (resetting will activate the new ettings)
                       (no title will appear after reset in POLL mode)
send 7 <cr>            (text invisible)
1013.25 hPa
```

The next picture (below) shows typical RS485/422 differential input signals RS485/422 LO (upper signal) and RS485/422 HI (lower signal) at baud rate 9600. The vertical scale is 2V/div for both signals. The ground level for each signal is shown with a small arrow at the right. At the left the signals are at rest.



The next picture (below) shows typical RS485/422 differential output signals RS485/422 LO (upper signal) and RS485/422 HI (lower signal) at baud rate 9600. The vertical scale is 2V/div for both signals. The ground level for each signal is shown with a small arrow at the right. At the left the signals are at rest.


1 2.00V 2 2.00V
100µ/

APPENDIX B ASHTECH PORT A/B 16 PIN CONNECTOR

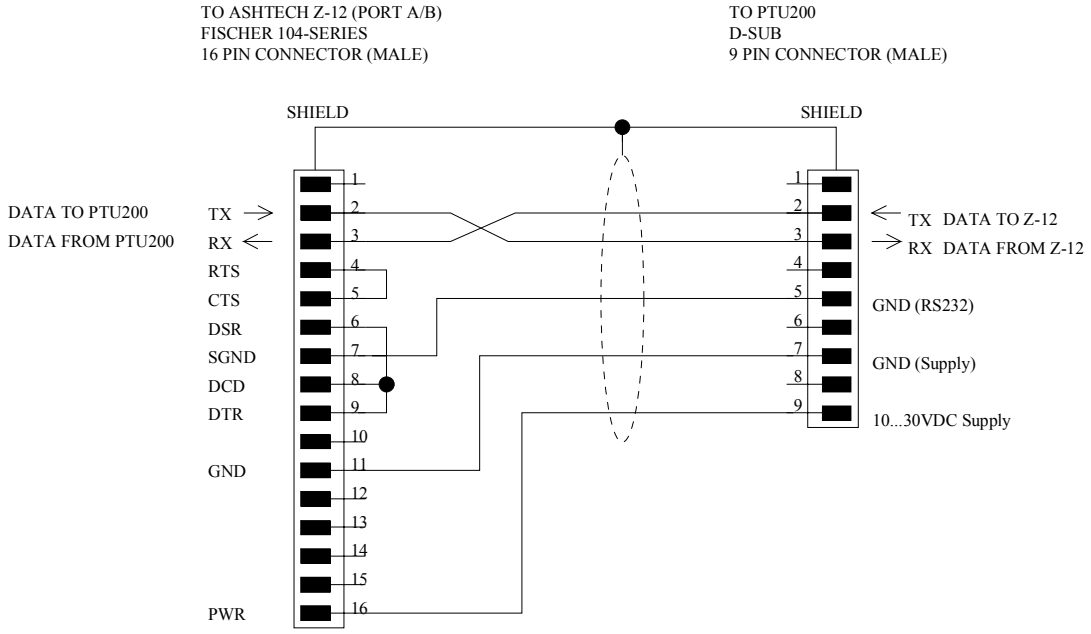


FIGURE B-1 Pin assignments between the PTU200 and an Ashtech Z-12 type receiver (serial number LPxxxxxxx).

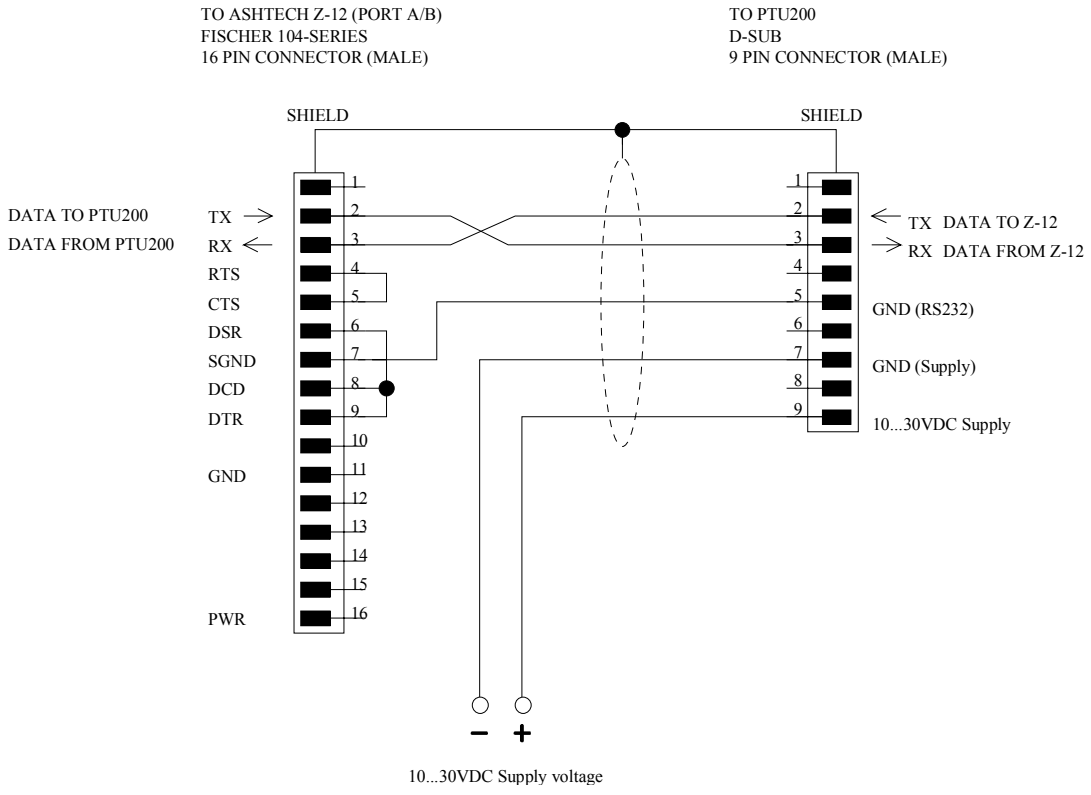


FIGURE B-2 Pin assignments between the PTU200 and an older Ashtech Z-12 type receiver.

The pin assignment of PTU200 for RS232 is as follows:

PIN	SIGNAL
1	
2	TX
3	RX
4	
5	GND (RS 232C)
6	
7	GND (Supply)
8	
9	10...30 VDC Supply voltage

NOTE To be compatible with the PTU200 the receiver must have a MET option.

NOTE To ensure that the pin 16 of the receiver can be used for powering the PTU200, measure its voltage with a multimeter.

APPENDIX C NMEA DATA FORMAT

The PTU200 transmitter can be used in a connection with a GPS receiver. It responds to a GPS input command by outputting a single predefined NMEA format message or the transmitter serial number.

NOTE The pressure unit has to be set as **bar** when the NMEA data output format is used.

The maximum length of FORM is 80 characters.

NOTE Please check that the transmitter has the same serial bus settings as the GPS receiver. It is recommended to use baud rate less than 9600.

FORM ... <cr>

Example 1:

"$PASHS,XDR,P,"1.5_P_",B,"_SN_",C,"_3.2_TH_",C,"_SN_",H,"_RH_",P,"_SN_#r #n

where,

"$PASHS,XDR,P,"	text field $PASHS,XDR,P, (P transducer type = pressure)
1.5	number field
P	pressure
",B,"	text field (B transmitter unit = Bar)
SN	transmitter ID (serial number)
",C,"	text field (C transducer type = temperature)
3.2	number field
TH or T	temperature (see also page 13)
",C,"	text field (C temperature unit = degrees Celcius)
SN	transmitter ID (serial number)
",H,"	text field (H transducer type = humidity)
RH	humidity
",P,"	text field (P humidity = % relative humidity)
SN	transmitter ID (serial number)
\r\n	CR LF
_	space

Output format:

```
>send<cr>
$PASHS,XDR,P,0.99710,B,S1630001,C,22.47,C.S1630001,H,20.84,P,S1660001
>
```

Example 2:

"$PASHS,XDR,P," 1.5_P_",B,,C,"_3.2_TH_",C,,H,"_RH_",P,"_#r_#n_

Output format:

```
>send<cr>
$PASHS,XDR,P,1.01148,B,,C, 27.11,C,,H, 54.29,P,
>
```

NOTE Please note that the symbol for temperature depends on the probe type of the PTU200 (see page 13).

GPS Commands

The PTU200 transmitter responds to following GPS specific application commands.

***0100P9**

Example:

```
>*0100P9
$PASHS,XDR,P,1.01496,B,T5030004,C,24.42,C,T5030004,H,41.18,P,T5030004
>
```

***0200P9**

Example:

```
>*0200P9
$PASHS,XDR,P,1.01496,B,T5030004,C,24.42,C,T5030004,H,41.18,P,T5030004
>
```

***9900P9**

Example:

```
>*9900P9
$PASHS,XDR,P,1.01496,B,T5030004,C,24.42,C,T5030004,H,41.18,P,T5030004
>
```

Serial number

***9900SN**

This command is used to give the serial number output to a GPS receiver.

Example:

```
>*9900SN
T5030004
>
```