PCE INSTRUMENTS PCE-TDS 200 Ultrasonic Flow Meter User Manual

Contents

PCE INSTRUMENTS PCE-TDS 200 Ultrasonic Flow Meter

Specifications

- **Model:** PCE-TDS 200 Series
- **Measurement Parameters:**
  - PCE-TDS 200: Flow velocity, volume flow, and volume
  - PCE-TDS 200+: Flow velocity, volume flow, volume, temperature, flow measurement
- **Measurement Range:** N/A
- **Accuracy:** N/A
- **Reproducibility:** N/A
- **Media:** N/A

Product Usage Instructions

Safety Information

Read and understand all safety notes provided in the manual before operating the device.

System Description

Details about the device and its function keys are explained in this section.

Getting Started

Power Supply: Follow the instructions to connect the appropriate power source.
Preparation: Prepare the device for operation as per the guidelines provided.

Menu

Explore the menu options to navigate through different settings and features.

Measurement

Learn how to perform measurements using the device.

Contact

Find information on how to get in touch with customer support or technical assistance.

Disposal

Properly dispose of the device following the recommended guidelines.

Frequently Asked Questions

Q: Where can I find technical support for the PCE-TDS 200 Series?

A: You can contact our customer support team at **support@pce-instruments.com** for technical assistance.

Q: What is the measurement range of the PCE-TDS 200 Series?

A: The measurement range varies based on the specific model within the series. Refer to the user manual for detailed information.

User manuals in various languages (français, italiano, español, português, nederlands, türk, polski, русский,) can be found by using our product search on: **www.pce-instruments.com**

Safety notes

Please read this manual carefully and completely before you use the device for the first time. The device may only be used by qualified personnel and repaired by PCE Instruments personnel. Damage or injuries caused by non-observance of the manual are excluded from our liability and not covered by our warranty.

- The device must only be used as described in this instruction manual. If used otherwise, this can cause dangerous situations for the user and damage to the meter.
- The instrument may only be used if the environmental conditions (temperature, relative humidity, …) are within the ranges stated in the technical specifications. Do not expose the device to extreme temperatures, direct sunlight, extreme humidity or moisture.
- Do not expose the device to shocks or strong vibrations.
- The case should only be opened by qualified PCE Instruments personnel.
- Never use the instrument when your hands are wet.
- You must not make any technical changes to the device.

- The appliance should only be cleaned with a damp cloth. Use only pH-neutral cleaner, no abrasives or solvents.
- The device must only be used with accessories from PCE Instruments or equivalent.
- Before each use, inspect the case for visible damage. If any damage is visible, do not use the device.
- Do not use the instrument in explosive atmospheres.
- The measurement range as stated in the specifications must not be exceeded under any circumstances.
- Non-observance of the safety notes can cause damage to the device and injuries to the user.

We do not assume liability for printing errors or any other mistakes in this manual.
We expressly point to our general guarantee terms which can be found in our general terms of business.

Specifications

Technical specifications

Handheld device

Model	**PCE-TDS 200 Series**
Measured parameters	PCE-TDS 200: flow velocity, volume flow and volume PCE-TDS 200+: flow velocity, volume flow, volume, temperature, heat output and heat quantity
Flow measurement	
Measurement range	±32 m/s
Resolution	0.001 m/s
Accuracy	DN ≥50 mm / approx. 2 in: ±1.5 % of rdg. for velocities >0.3 m/s DN <50 mm / approx. 2 in: ±3.5 % of rdg. for velocities >0.3 m/s
Repeatability	±0.5 % of rdg.
Media	all liquids with an impurity of <5 %
Temperature measurement (PCE-TDS 200+ only)	
Measurement range	Type B: +600…+1800 °C / +1,112 … +3,272 °F Type E: -100… +900 °C / -148 … +1,652 °F Type J: -100… +1150 °C / -148 … +2,102 °F Type K: -100… +1370 °C / -148 … +2,498 °F Type N: -100… +1150 °C / -148 … +2,102 °F Type R: 0… +1700 °C / +32 … +3,092 °F Type S: 0… +1500 °C / +32 … +2,732 °F Type T: -100… +400 °C / -148 … +752 °F

Accuracy measuring input	Type B: ± (0.5 % + 3 °C / 37.4 °F) Type E: ± (0.4 % + 1 °C / 33.8 °F) Type J: ± (0.4 % + 1 °C / 33.8 °F) Type K: ± (0.4 % + 1 °C / 33.8 °F) Type N: ± (0.4 % + 1 °C / 33.8 °F) Type R: ± (0.5 % + 3 °C / 37.4 °F) Type S: ± (0.5 % + 3 °C / 37.4 °F) Type T: ± (0.4 % + 1 °C / 33.8 °F)
Resolution	0.1 °C / 32.18 °F
General	
Display	2.8“ LCD
Units	metric / imperial
Menu languages	English, German, French, Spanish, Italian, Dutch, Portuguese, Turkish, Polish, Russian, Chinese, Danish, Japanese
Operating and storage conditions	temperature: -20 … +65 °C / -4 … 149 °F humidity: 10 … 95 % RH, non-condensing
Data logger	32 GB memory capacity / 100 records with a maximum of 100,000 data points per record
Interface	USB (for online measurement and to read out internal memory)
Protection class	IP 52
Power supply	internal: rechargeable LiPo battery (3.7 V, 2500 mAh) external: USB 5 VDC, 500 mA

Sensors

Sensor type / order code	PCE-TDS 200 S sensor	PCE-TDS 200 M sensor	PCE-TDS 200 SR sensor	PCE-TDS 200 MR sensor
				
Sensor cable length	5 m approx. 197 in	5 m approx. 197 in	5 m approx. 197 in	5 m approx. 197 in
Nominal diameter	DN 15 … 100 20 … 108 mm approx. 3/4 ... 4 in	DN 50 … 700 57 … 720 mm approx. 2 ... 28 in	DN 15 … 100 20 … 108 mm approx. 3/4 ... 4 in	DN 50 … 700 57 … 720 mm approx. 2 ... 28 in
Liquid temperature	-30 … 160 °C -22 ... 320 °F	-30 … 160 °C -22 ... 320 °F	-30 … 160 °C -22 ... 320 °F	-30 … 160 °C -22 ... 320 °F
Dimensions	45 x 30 x 30 mm 1.7 x 1.1 x 1.1 in	70 x 40 x 40 mm 2.8 x 1.6 x 1.6 in	200 x 25 x 25 mm 7.9 x 1.0 x 1.0 in	280 x 40 x 40 mm 11.0 x 1.6 x 1.6 in
Weight	75 g / 0.16 lb	260 g / 0.57 lb	250 g / 0.55 lb	1080 g / 2.38 lb

Sensor type / order code	PCE-TDS 200 L sensor
	
Sensor cable length	5 m
Nominal diameter	DN 300 … 6000 315 … 6000 mm
Liquid temperature	-30 … 160 °C
Dimensions	91 x 52 x 44 mm
Weight	530 g

Delivery contents

- 1 x ultrasonic flow meter PCE-TDS 200
- 2 x flow sensor (depending on the model)
- 2 x temperature sensor TF-RA330 (PCE-TDS 200+ models only)
- 2 x 5 m connection cable
- 2 x Velcro cable tie
- 1 x mains adaptor
- 1 x USB-C cable
- 1 x ultrasonic coupling gel
- 1 x PCE tape measure
- 1 x plastic carrying case
- 1 x user manual

Models of the series

The delivery and functional scope of the PCE-TDS 200 series depends on the model. A basic distinction is made between the PCE-TDS 200 and PCE-TDS 200+ product series. The devices of the PCE-TDS 200 product series are mere flow meters. In addition to measuring flow, the devices of the PCE-TDS 200+ series also measure the heat output and heat quantity. Therefore, two TF-RA330 temperature sensors are always included with these

devices. The models with their included sensors are listed below. Each model is also available as a PCE-TDS 200+ version.

Product code	Sensors included
PCE-TDS 200 S	2x PCE-TDS 200 S sensor
PCE-TDS 200 M	2x PCE-TDS 200 M sensor
PCE-TDS 200 L	2 x PCE-TDS 200 L sensor
PCE-TDS 200 SM	2 x PCE-TDS 200 S sensor 2 x PCE-TDS 200 M sensor
PCE-TDS 200 SL	2 x PCE-TDS 200 S sensor 2 x PCE-TDS 200 L sensor
PCE-TDS 200 ML	2 x PCE-TDS 200 M sensor 2 x PCE-TDS 200 L sensor
PCE-TDS 200 SR	1x PCE-TDS 200 SR sensor
PCE-TDS 200 MR	1x PCE-TDS 200 MR sensor

Optional accessories

Product code	Description
PCE-TDS 200 S Sensor	Flow sensors for pipes DN 15 … 100 (without rail)
PCE-TDS 200 M Sensor	Flow sensors for pipes DN 50 … 700 (without rail)
PCE-TDS 200 L Sensor	Flow sensors for pipes DN 300 … 6000 (without rail)
PCE-TDS 200 SR Sensor	Flow sensors for pipes DN 300 … 6000 (on rail)
PCE-TDS 200 MR Sensor	Flow sensors for pipes DN 300 … 6000 (on rail)
TT-GEL	Ultrasonic coupling gel for temperatures -10 … 80 °C / +14 … +176 °F (100 ml)
K-GEL	Ultrasonic coupling gel for temperatures up to 350 °C / +662 °F (100 ml)
PCE-TDS 200-SC05	2 x 5 m sensor cable for PCE-TDS 200 Series
Temperature sensor TF-RA330	Pipe contact sensor (PCE-TDS 200+ only)
PCE-TDS 200 SW	Software for flow meter

System description

Device

Front side

Top side

- Sensor sockets
- Display
- Keys
- USB port
- Flow sensor connection (front sensor)
- Flow sensor connection (back sensor)
- Temperature sensor connection (channel 2)
- Temperature sensor connection (channel 1)

Function keys

Key	Description	Function
	ON/OFF	Turn meter on/off
	MENU	Open main menu
	BACK	Cancel, return, reset maximum value
	OK	Confirm
	REC	Open data logger dialogue
	UP	Navigate up
	DOWN	Navigate down
	RIGHT	Navigate right
	LEFT	Navigate left

Getting started

Power supply

The meter is powered by an internal rechargeable LiPo battery. With a fully charged battery, an operating time of approx. 8 … 10 hours is possible, depending on the brightness of the display. The battery is charged via the USB socket at the bottom of the meter, using a suitable USB charger. The charging process can be shortened by switching off the device during the charging process.
The current charge level of the battery is displayed in the status bar at the top right. As soon as the charge level of the battery is no longer sufficient for proper operation of the instrument, it switches off automatically and the screen shown below is displayed.

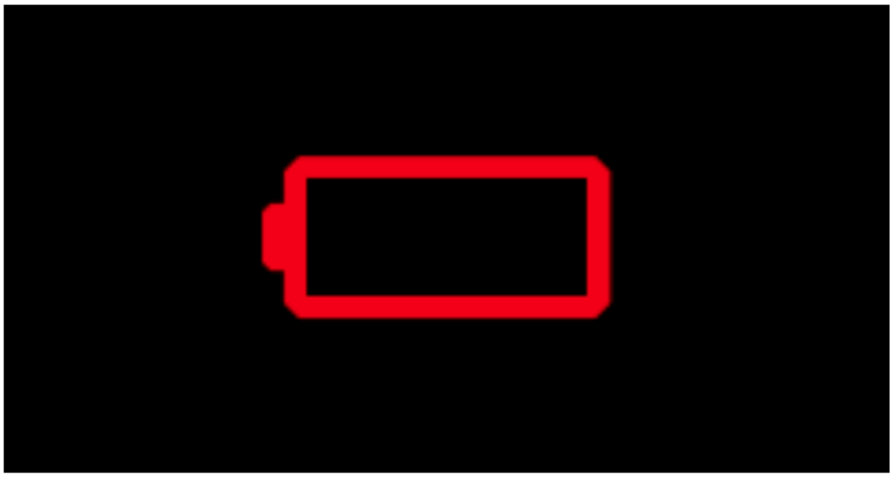


Fig. 1 Automatic power off

Preparation

The meter is switched on by pressing the ON/OFF key. When the device is switched on, the start screen appears for approx. 1 second and then the device enters the measurement screen. To switch off the meter, keep the ON/OFF key pressed. A dialogue with a countdown now appears on the display to announce that the instrument is about to power off. The flow sensors are connected by simply plugging them into the sockets provided at the top of the device. They are disconnected by pulling the plugs, touching the ribbed surface to unlock the plug connection. Screw the plugs into the sensors using the knurled nut. The thermocouples are also connected by plugging them into the sockets provided. The plugs have a wide and a narrow contact. These determine the orientation of the plug when it is plugged in.

Menu

The main menu can be opened at any time by pressing the MENU key. The arrow keys are used to navigate between the menu items which can be activated with the OK key. Submenus can be left with the BACK key. The main menu of the PCE-TDS 200 series consists of the submenus Measurement, Data logger, Settings, Calibration, Manual and Info. The submenus are explained in more detail in the following chapters.

Measurement
In the submenu Measurement, the options relevant for the measurement can be set:
Pipe, medium, sensors, measurement method, temperature, units, alarm, overview display, damping, absolute values and lower threshold.

Pipe
In the Pipe menu, all parameters of the pipe are set. The following parameters are to be set:

Parameter	Description
Pipe material	Material of the pipe Selection of standard materials or custom entry of the transversal sound velocity · Custom · Copper CU · Steel FE · Stainless steel VA · Aluminium AL · Brass ME · Cast iron CI · Iron FE · Nickel NI · Titanium TI · Zinc ZI · Acrylic AC · Polyethylene PE · Polypropylene PP · Polyvinylchloride PVC · Nylon NY The abbreviations for the standard materials are shown in the *Pipe* menu in the *Pipe material* menu item.
Pipe wall thickness	Wall thickness of the pipe
Inner diameter	Inner diameter of the pipe
Outer diameter	Outer diameter of the pipe

Liner material	Material of the pipe liner Selection of standard or custom entry of t he materials longitudinal sound velocity · No liner · Custom · Epoxy resin · Rubber · Mortar · Polystyrol PS · Polyethylene PE · Polytetrafluorethylene PTFE · Polyurethane PU · Polypropylene PP	
Wall thickness of liner	Wall thickness of the der pipe liner	

The material selection is made via selection menus. The numerical parameters are edited via an input dialogue. Each decimal place can be selected with the RIGHT/LEFT arrow keys and edited with the UP/DOWN arrow keys.

Fig. 2 Input dialogue

To completely set the pipe parameters, first set the pipe material via the selection menu. Then enter the wall thickness of the pipe via an input dialogue. In the next step, you can enter either the inner or the outer diameter; the other variable is calculated automatically on the basis of the parameters. The last settings to be entered are the liner material and the wall thickness of the lining.
The pipe parameters that have now been completely set can be saved as a preset to avoid having to enter all the parameters again. To save the parameters, select the menu item Save as preset. Successful storage is confirmed by a dialogue.
The saved presets are now listed in the Presets menu. The name of the presets is composed of the material abbreviation, the outer diameter, the inner diameter and the pipe wall thickness. By selecting a preset, all pipe parameters are adopted.

Medium
The Medium menu allows you to select one of the standard media or to enter the sound velocity and kinematic viscosity of a user-defined medium. The following standard media are available:

- Water
- Sea water
- Oil
- Crude oil
- Methanol
- Ethanol
- Diesel
- Gasoline
- Petroleum

A user-defined medium is selected by entering the sound velocity and the kinematic viscosity of the medium. To do this, select the menu item Custom. A dialogue for entering the sound velocity opens. Here, each decimal place can be selected with the RIGHT/LEFT arrow keys and edited with the UP/DOWN arrow keys.

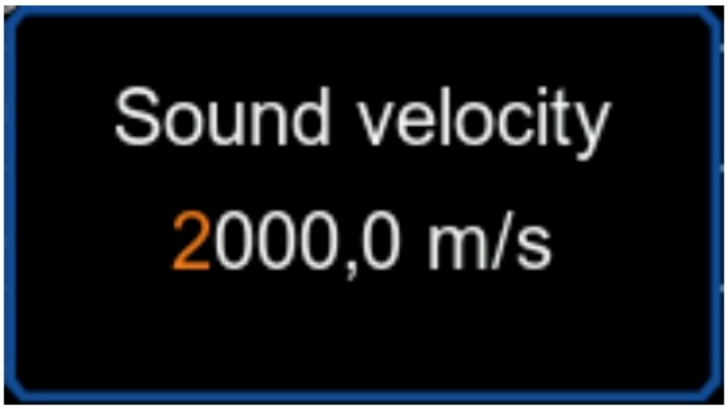


Fig. 3 Input dialogue sound velocity

Then confirm with the OK key. The dialogue changes so that you can enter the kinematic viscosity. Enter the kinematic viscosity of your medium and confirm again with the OK key. The dialogue is closed and the parameters are adopted.
Note: The kinematic viscosity can be calculated from the dynamic viscosity and the density of the medium using the following formula.

$$Kinematic\ viscosity\ [mm^2/s] = \frac{dynamic\ viscosity\ [mPa \cdot s]}{1000 \cdot density\ [\frac{kg}{m^3}]}$$

Sensors
The flow sensors used are selected in the Sensors menu. The following sensors are available for selection.

Sensor description	Possible measuring methods	Pipe diameter
TDS-S	Z, V, N, W	20 … 108 mm / 0.79 … 4.25 in
TDS-M	Z, V, N, W	57 … 720 mm / 2.24 … 28.35 in
TDS-L	Z, V, N, W	315 … 6000 mm / 12.40 … 236.22 in
TDS-SR	V, W	20 … 108 mm / 0.79 … 4.25 in
TDS-MR	Z, V, N, W	57… 720 mm / 2.24 … 28.35 in

Measurement method
In the Measurement method menu, the method for mounting the sensors is selected. The Z, V, N and W methods are available for selection. A more detailed explanation of the measurement methods can be found in chapter 6.1.

Temperature

- The Temperature menu is used to enter the manual compensation temperature. This is used for compensation of the sound velocity and the kinematic viscosity for the medium water (all other media are not temperature compensated).
- In addition, the thermocouple types and any offsets required for the two temperature measure-ment channels are set in this menu (PCE-TDS 200+ only).
- To set a thermocouple type, select the Type menu item for the desired channel with the OK key. The thermocouple type displayed in the menu item on the right now appears in orange. With the arrow keys UP/DOWN, you can now select between the different types (B,E,J,K,N,R,S,T). The setting is adopted by confirming with the OK key again.
- To enter an offset, select the corresponding menu item by pressing the OK key. A dialogue for entering the offset opens.

Fig. 4 Input dialogue offset channel 1

- Here, each decimal place can be selected with the RIGHT/LEFT arrow keys and edited with the UP/DOWN arrow keys.

Units

This menu allows you to set the units of all measured parameters. The following chart shows the available units.

Parameter	Unit	Abbreviation
Dimensions	Millimetres	[mm]
	Inches	[in]
Flow velocity	Metres per second	[m/s]
	Feet per second	[ft/s]
Volume flow	Cubic metres	[m³]
	Litres	[l]
	USA gallons	[gal]
	Imperial gallons	[igl]
	Million USA gallons	[mgl]
	Cubic feet	[cf]
	USA barrels	[bal]
	Imperial barrels	[ib]
	Oil barrels	[ob]
	The time can be specified per day, per hour, per minute and per second.	

Volume	Cubic metres	[m³]
	Litres	[l]
	USA gallons	[gal]
	Imperial gallons	[igl]
	Million USA gallons	[mgl]
	Cubic feet	[cf]
	USA barrels	[bal]
	Imperial barrels	[ib]
	Oil barrels	[ob]
Temperature	Celsius	[°C]
	Fahrenheit	[°F]

Alert
The configuration for the visual and audible alarm of the meter is carried out in the Alert menu. Five modes are available for monitoring.

Mode	Description
Off	The alarm is deactivated.
Above	The alarm is triggered when the measured parameter exceeds the upper limit value.
Below	The alarm is triggered when the measured parameter falls below the lower limi t value.
Window mode	The alarm is triggered when the measured parameter lies between the upper a nd the lower limit value.
Inverse window mode	The alarm is triggered when the measured parameter lies outside the range be tween the upper and the lower limit value.

In addition to selecting the alert mode, the measured parameter to be monitored can be selected under the menu item Measured parameter.
The limit values can be set under the menu item Limits by selecting the respective menu item with the help of an input dialogue.

- **Overview screen**
  The meter enables the numerical and graphical display of several measured parameters in the measurement display, the Overview screen. It is possible to display up to four individually selectable measured parameters numerically and up to two individually selectable measured parameters graphically. The selection of the measured parameters to be displayed is made under the menu items Graphical view and Numerical view by placing check marks.
- **Damping**
  The damping influences the measured parameters flow velocity and volume flow. It can be set to a value within the range of 0 … 60 s. The setting 0 s deactivates the damping of the measurement.
- **Absolute values**
  The Absolute values menu item makes it possible to prevent negative values from being displayed for the parameters flow velocity and volume flow. With the setting ON, in case of a negative volume flow, the measured value is displayed with a positive sign. The arrangement of the upstream and downstream sensor thus has no influence on the sign in front of the measured values in terms of the flow direction.
- **Lower cutoff**
  The Lower cutoff represents the flow velocity above which the meter displays a flow velocity of 0 m/s. In the event that the zero point fluctuates despite a set zero point, this value can be increased.
- **Data logger**
  The Data logger of the instrument allows to record all measured parameters. The time period as well as the memory interval can be freely configured with the help of this menu.
  Note: To prevent the meter from accidentally switching off during recording, manual switch-off is not possible and automatic power off is deactivated.
- **Start condition**
  The data logger can be started either manually by pressing a key while you are in the data logger dialogue or automatically from a date that is set in this menu.
- **Stop condition**
  Three different options are available for stopping the data logger. It can be stopped manually by pressing a key when you are in the data logger dialogue, on a certain date or after an adjustable time interval.

- **Interval**
  The time interval for saving the measured values can be set to a value between 1 s and 12 h via an input dialogue.
- **Records**
  In this menu, all saved records are displayed and by selecting a record, information on the start and stop time as well as the number of saved data points are displayed. One data point reflects the one-time storage of all measured parameters listed hereinafter for the models PCE-TDS 200 and PCE-TDS 200+.

Model	Saved measured parameter per data point
PCE-TDS 200	Flow velocity, volume flow, volume
PCE-TDS 200+	Flow velocity, volume flow, volume, temperature channel 1, temperature channel 2, temperature difference, heat output, heat quantity, cost

Note: If the maximum number of 100,000 data points for the current recording is reached, the device automatically starts another new recording.

- **Delete all**
  By selecting this menu item and confirming via the dialogue, all saved data records are deleted.
- **Data logger dialogue**
  The data logger dialogue can be opened in any screen via the REC key and shows the current settings as well as the status of the data logger. When the dialogue is open, a recording can be started or stopped at any time by pressing and holding OK. In addition, the data logger menu opens when the dialogue is open and the MENU key is pressed.

Note: If the maximum number of records (a maximum of 100 records is possible) is reached, the error message SD card error is displayed in the dialogue. In this case, it is necessary to delete one or more records to be able to add more records.

Setting

- **Decimal separator**
  Either a dot or a comma can be selected as the decimal separator for measured values.
- **Date & time**
  The date and time can be set in this menu. In addition, the date and time format can be selected.
- **Display**
  In this tab, the display brightness can be adjusted between 50 and 100 %. In addition, an automatic dimming function can be activated. After the set time, the display is dimmed to a lower brightness to save power. Pressing any key resets the brightness to the originally set value.
- **Language**
  The following menu languages are available: English, German, French, Spanish, Italian, Dutch, Portuguese, Turkish, Polish, Russian and Chinese.
  Note: To reset an incorrectly set language, switch off the meter using the ON/OFF key. Then switch on the

meter while pressing and holding the BACK key. You will automatically be taken to the language settings. The default setting of the meter is English.

- **Auto power off**
  This option can be used to activate an automatic power-off function for the device. The instrument switches off when the auto power off mode is activated if no key has been pressed for a certain period of time. You can select 1 minute, 5 minutes or 15 minutes. In addition, automatic poweroff can be completely deactivated.
- **Factory settings**
  With the help of this option, the device can be reset to the factory settings. A distinction is made between the device settings and the pipe presets. These can be reset separately.
  When resetting the device settings, the default values for the measurement parameters and the remaining menu options are restored.
  When resetting the pipe presets, all presets saved on the meter will be deleted.
- **Calibration**
  The Calibration menu allows you to set a scaling factor that can be determined by calibration. Since a special measurement setup is required for calibration, this menu is protected by a code. Please send the device to PCE Instruments for calibration. You will find our contact details at the end of the manual.
- **Manual**
  A QR code is displayed in this menu. The QR code can be scanned with an appropriate reader such as a mobile phone and leads directly to this user manual.
- **Info**
  The Info menu displays the model name, serial number and firmware version.

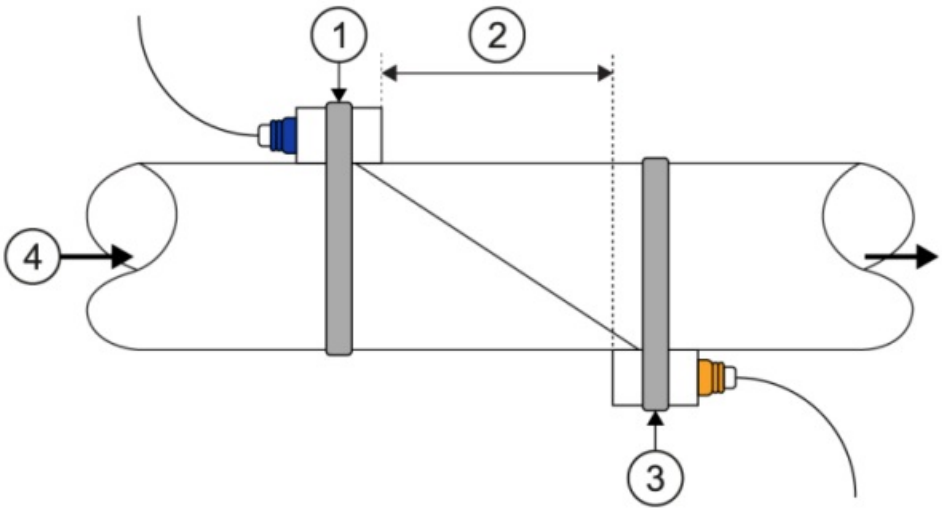
Measurement

Measuring principle and measuring methods

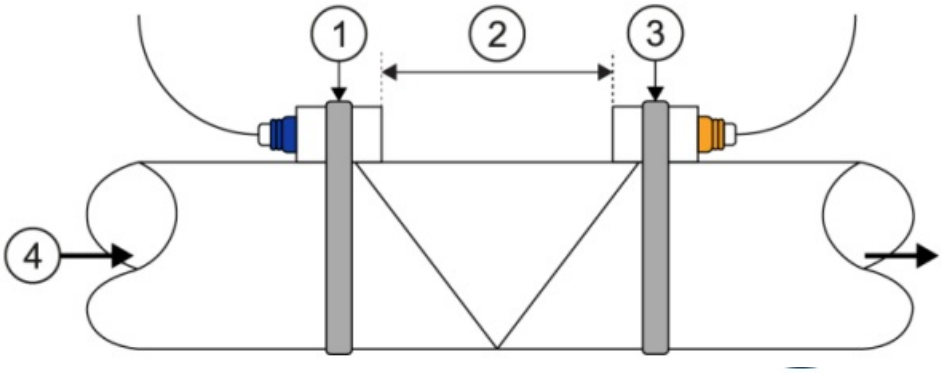
The flow meter enables the flow velocity of liquids in pipes to be measured without interfering with the pipe and without affecting the flow in the pipe. To enable non-invasive measurement, the PCE-TDS 200 uses two sensors that work as both ultrasonic transmitters and receivers. The sensors are attached to the outside of the pipe wall at a defined distance. To enable the transmission of the ultrasound, a coupling gel must be applied to the sensors in this case. When ultrasonic signals are transmitted with and against the flow direction of the liquid, differences in transit time occur which can be converted into the flow velocity. The sensors can be mounted according to four different measurement methods which are shown below.

Z method

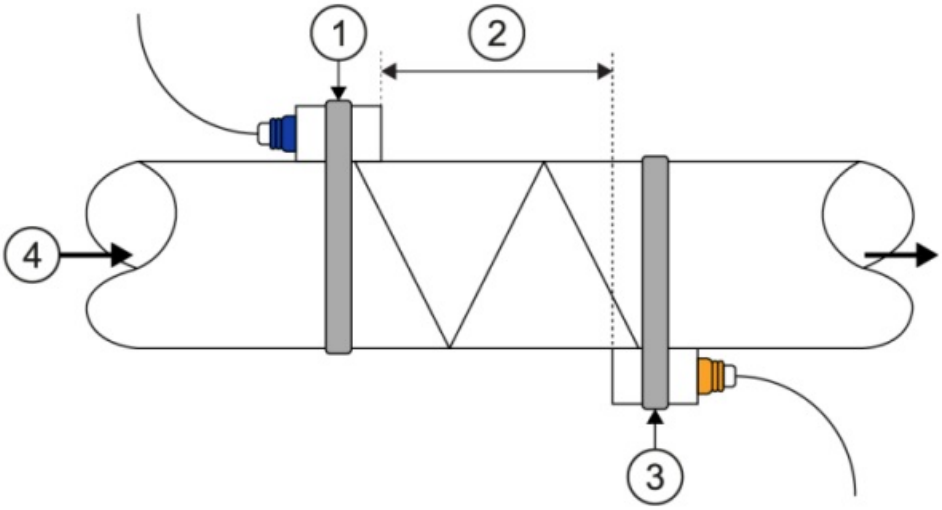
Z method



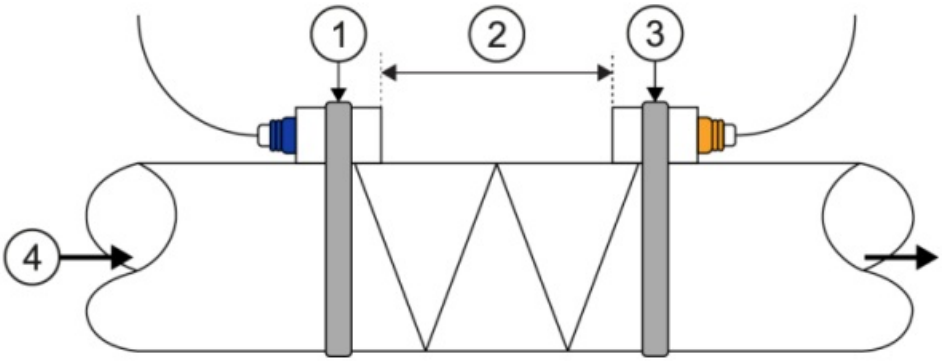
V method



N method



W method



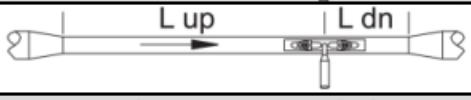
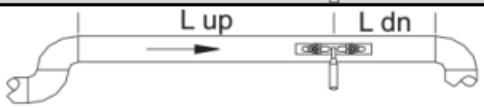
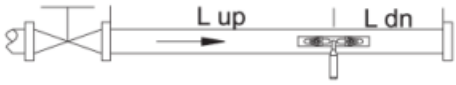
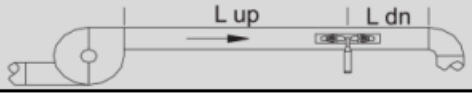
1 Upstream sensor, 2 Sensor distance, 3 Downstream sensor, 4 Flow direction
The more frequently the sound crosses the liquid, the more accurately even very small flow velocities can be measured. However, the signal strength decreases with each crossing, which is why the W and N method cannot

be used for every pipe, for example. It is recommended to use the V method if the pipe parameters allow it as this produces the best results in terms of signal quality and zero point stability. However, if the signal quality is too low, the Z method can be used.

Getting started

Measuring location
The first step of the installation should be to find a suitable place to mount the sensors. This is a prerequisite for obtaining accurate measurement results. For this, a basic knowledge of the pipelines / the piping system is necessary. Therefore, an infinitely long, straight pipe would be the ideal position. The liquid should not have any air pockets or impurities. The piping can be vertical or horizontal. To avoid inaccuracies due to turbulence in the liquid, a straight flow-calming section should be considered upstream and downstream of the measuring location. Generally speaking, the length upstream of the measuring location should be at least 10 x the pipe diameter and downstream of the measuring location 5 x the pipe diameter.

The following chart shows some examples of good positions:

Pipe routings and sensor position	Upstream L_{up} x ø	Downstream L_{dn} x ø
	10D	5D
	10D	5D
	10D	5D
	12D	5D
	20D	5D
	20D	5D
	30D	5D

Sensor installation
The PCE-TDS 200 has piezoelectric sensors which can transmit and also receive ultrasonic waves. The time the ultrasonic waves take to pass through the pipe walls and the liquid allows conclusions about the flow velocity. Since the transit time of the ultrasonic pulses is very short, the sensors should be installed as precisely as possible to ensure highest system accuracy.
Take the following steps to install the sensors:

1. Some pipes have a liner. There can be a boundary layer between the outer diameter of the pipe and the inner liner. This boundary layer can divert or weaken the ultrasonic waves. In this case, a measurement will be very difficult. The same applies to external coatings on the pipe, such as paint. This must be removed before the measurement so that you can measure.
2. Find an ideal position in the piping system, i. e. a straight section with new and clean pipes with even surfaces.
3. It is very important that the pipes are clean. Grind or polish the locations where you would like to place the sensors so that the contact surface is even.

4. There must not be an air gap between the sensors and the surface of the pipe. Attach the sensors using sufficient contact gel. Also, tighten the fastening straps firmly enough so that the position of the sensors cannot change during the measurement.
5. To avoid air bubbles from causing measurement errors, place the sensors on the pipe laterally. Note that in this case, the flow could not be calculated correctly by the device due to the pipe not being completely filled.

Spacing between the sensors

The distance between the upstream and the downstream sensor can be seen in the installation view of the measurement screen (see 6.4). The window specifies the inner distance between the two sensors which can be used as an indication for the sensor installation. The fine adjustment is carried out by arranging the spacing in a way that the distance indicator is as central as possible within the graph (see 6.3).
In order for the PCE-TDS 200 to calculate the correct distance, the following parameters must be entered beforehand:

1. Outer diameter of the pipe
2. Material thickness of the pipe
3. Material of the pipe
4. Material thickness of the pipe liner
5. Material of the pipe liner
6. Type of liquid
7. Type of connected sensors
8. Mounting method of the sensors
9. Temperature of the medium

Procedure

Before making the measurement, also read the previous chapters 6.1 and 6.2 to gain an understanding of the measurement principle and its influencing factors.
To carry out a measurement, it is first necessary to set all parameters in the Measurement menu (see 5.1) completely in line with the pipe used, the medium, the sensors, the measurement method and the temperature. After all parameters have been set and checked, go back to the measurement screen and navigate to the installation view. The installation view shows the measurement method, the set sensors and the distance between the sensors.

Note:
Note that in the case of the Z method, the sensors may also overlap.

Mount the sensors according to the described measurement method with the appropriate distance and apply sufficient coupling gel to the sensors. The meter should now be able to receive a signal and display this via the quality indicator. If the quality indicator is within the green range, you can continue with the distance setup. If there is no signal or a poor signal, check the settings again and follow the preparation steps described in chapters 6.1 and 6.2.
Now adjust the distance of the sensors so that the distance indicator is as central as possible within the green area. A good setting is shown below.

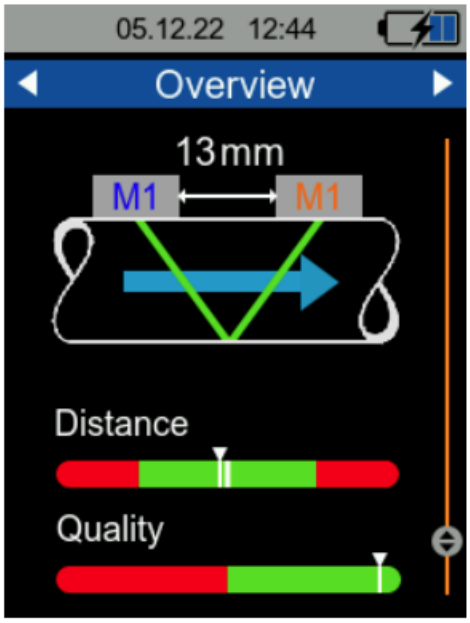


Fig. 5 Installation view with good setting

After setting the distance, the meter is ready for operation and the measurement can be made.
Since the zero point may be shifted depending on the measuring conditions (installation, pipe material, etc.), it is possible to reset the zero point in the installation view. To do this, it is necessary to ensure that the liquid in the pipe does not move!
In the installation view, press and hold the OK key until the confirmation dialogue opens and confirm the setting of the zero point. While the meter is determining the zero point, a waiting dialogue is displayed. After this has closed, the zero point is set.

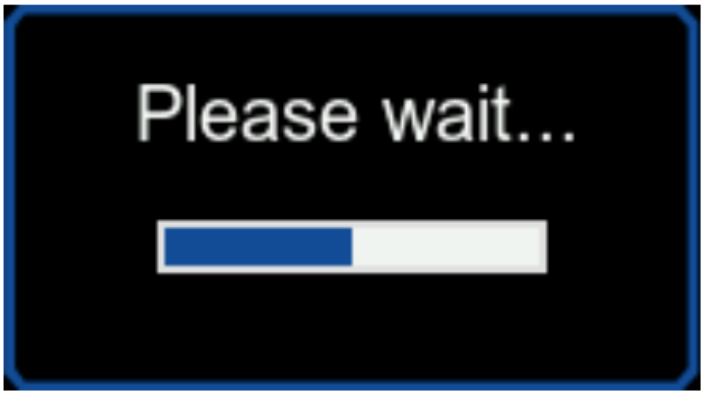


Fig. 6 Waiting dialogue

In order to carry out a heat quantity and heat output measurement, it is also necessary to connect the temperature sensors to the device and attach them to the corresponding measuring locations. Temperature channel 1 must be attached to the warmer measuring location (e. g. the feed line of a heating system) and channel 2 to the colder measuring location (e. g. the return line of a heating system).

Measurement display

Navigation

- To ensure a clear presentation of the measured parameters, the measurement display consists of several views. Each view represents a measured parameter which is displayed in the upper blue area of the view.

Switching between the views of the measured parameters is possible with the RIGHT and LEFT arrow keys.

- Some parameter views also have several formats for displaying the parameter, such as the simple numerical display, the graphical display or the display of the statistical values (minimum value, maximum value and average). The display format can be changed using the UP and DOWN arrow keys. The following illustrations show the different display formats for viewing the parameter flow velocity.

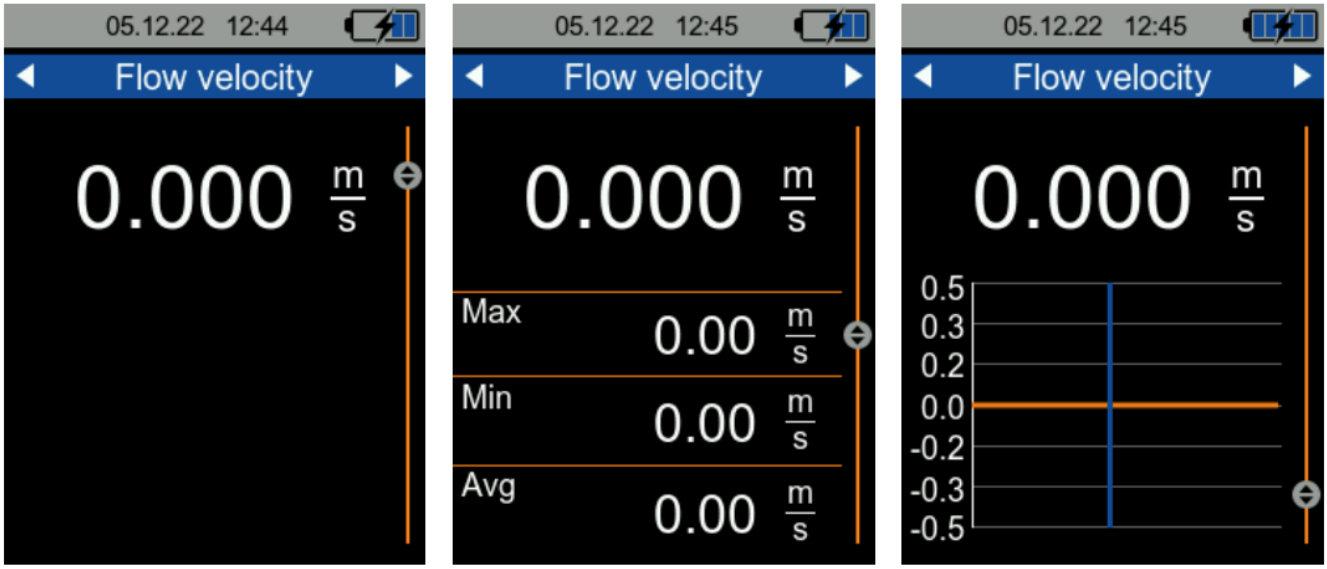


Fig. 7 Numerical, statistical and graphical representation

- The following chart shows the available formats of representation of the measured parameters.

	Flow velocity	**Volume flow**	**Heat output**	**Heat quantity**	**Tempe- rature**
Numerical	Flow velocity	Volume flow, volume sum, volume positive, volume negative	Heat output	Heat quantity, cost	Temperature channel 1, channel 2 and difference
Statistical	Minimum, maximum and average value of the flow velocity	Minimum, maximum and average value of the volume flow	Heat output	–	Minimum, maximum and average value for temperature channel 1, channel 2 and difference
Graphical	Flow velocity	Volume flow	Heat output	–	Temperature channel 1, channel 2

- In addition to the parameter views, the measurement display has an overview. The overview shows the numerical and graphical representation as well as the installation view which has already been explained in 6.3.
- The numerical display enables the presentation of up to four freely selectable measured parameters. In the graphical display, two measured parameters can be displayed graphically parallel to each other.
- The selection of the displayed parameters is made via the menu Overview screen described in 5.1.8.

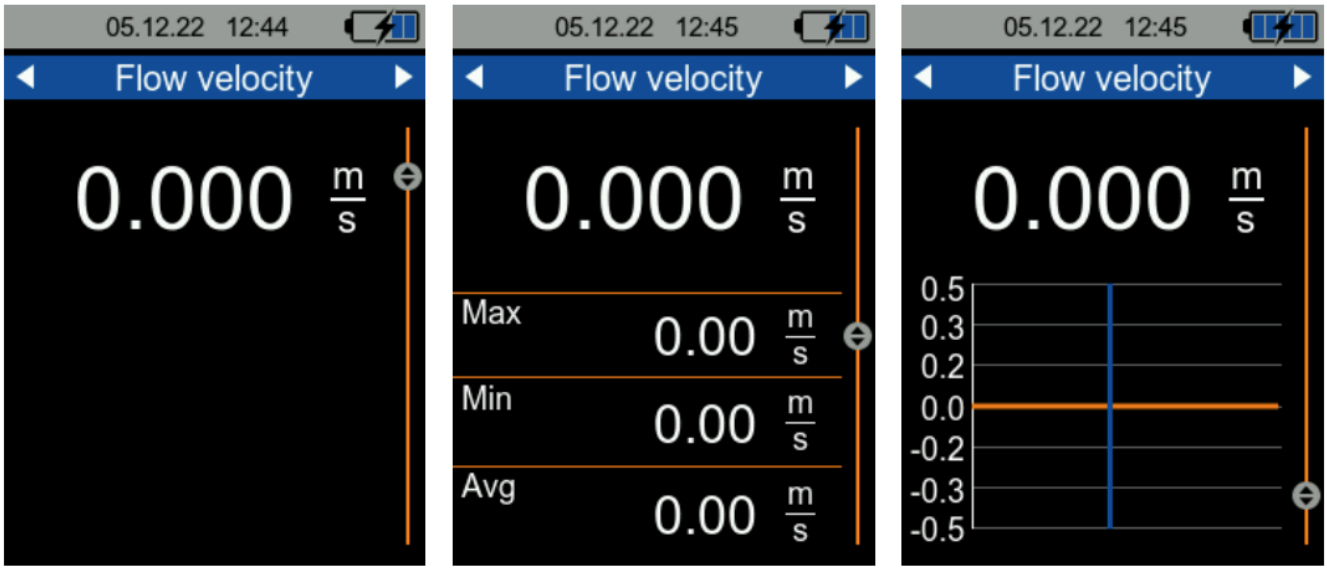


Fig. 7 Numerical, statistical and graphical representation

Keyboard shortcuts

- To simplify navigation to the overview display, press the BACK key once. Pressing the BACK key again takes you to the installation view.
- Resetting the currently displayed statistical values is possible by holding down the OK key. This is possible in the statistical display of the views flow velocity, flow rate, heat output and temperature.
- In the numerical displays of the heat quantity and flow rate views, the volume flow counter or the measured heat quantity can be reset to 0 by holding down the OK key.

Contact

If you have any questions, suggestions or technical problems, please do not hesitate to contact us. You will find the relevant contact information at the end of this user manual.

Disposal

- For the disposal of batteries in the EU, the 2006/66/EC directive of the European Parliament applies. Due to the contained pollutants, batteries must not be disposed of as household waste. They must be given to collection points designed for that purpose.
- In order to comply with the EU directive 2012/19/EU we take our devices back. We either re-use them or give them to a recycling company which disposes of the devices in line with law.
- For countries outside the EU, batteries and devices should be disposed of in accordance with your local waste regulations.
- If you have any questions, please contact PCE Instruments.

PCE Instruments contact information

- **Germany**

  PCE Deutschland GmbH Im Langel 26 D-59872 Meschede Deutschland

  Tel.: +49 (0) 2903 976 99 0

  Fax: +49 (0) 2903 976 99 29

  info@pce-instruments.com

  www.pce-instruments.com/deutsch
- **United Kingdom**

  PCE Instruments UK Ltd Unit 11 Southpoint Business Park Ensign Way, Southampton Hampshire United Kingdom, SO31 4RF

  Tel: +44 (0) 2380 98703 0

  Fax: +44 (0) 2380 98703 9

  info@pce-instruments.co.uk

  www.pce-instruments.com/english
- **The Netherlands**

  PCE Brookhuis B.V. Institutenweg 15 7521 PH Enschede Nederland

  Telefoon: +31 (0)53 737 01 92

  info@pcebenelux.nl

  www.pce-instruments.com/dutch
- **France**

  PCE Instruments France EURL 23, rue de Strasbourg 67250 Soultz-Sous-Forets France

  Téléphone: +33 (0) 972 3537 17 Numéro de fax: +33 (0) 972 3537 18

  info@pce-france.fr

  www.pce-instruments.com/french
- **Italy**

  PCE Italia s.r.l. Via Pesciatina 878 / B-Interno 6 55010 Loc. Gragnano Capannori (Lucca) Italia

  Telefono: +39 0583 975 114

  Fax: +39 0583 974 824

  info@pce-italia.it

  www.pce-instruments.com/italiano
- **United States of America**

  PCE Americas Inc.

  1201 Jupiter Park Drive, Suite 8 Jupiter / Palm Beach 33458 FL USA

  Tel: +1 (561) 320-9162

  Fax: +1 (561) 320-9176

  info@pce-americas.com

  www.pce-instruments.com/us
- **Spain**

  PCE Ibérica S.L.

  Calle Mayor, 53

  02500 Tobarra (Albacete) España

  Tel. : +34 967 543 548

  Fax: +34 967 543 542

info@pce-iberica.es

www.pce-instruments.com/espanol

- **Turkey**

  PCE Teknik Cihazları Ltd.Şti. Halkalı Merkez Mah. Pehlivan Sok. No.6/C 34303 Küçükçekmece – İstanbul

  Türkiye

  Tel: 0212 471 11 47

  Faks: 0212 705 53 93

  info@pce-cihazlari.com.tr

  www.pce-instruments.com/turkish

- **Denmark**

  PCE Instruments Denmark ApS Birk Centerpark 40 7400 Herning Denmark

  Tel.: +45 70 30 53 08

  kontakt@pce-instruments.com

  www.pce-instruments.com/dansk

Documents / Resources

	PCE INSTRUMENTS PCE-TDS 200 Ultrasonic Flow Meter [pdf] User Manual PCE-TDS 200 Ultrasonic Flow Meter, PCE-TDS 200, Ultrasonic Flow Meter, Flow Meter, Meter

References

- France.fr : Actualités, destinations et infos du tourisme en France
- iberica.es
- Make an offer on the domain instruments.co.uk - Domains.co.uk
- Computer Instruments | Home
- Discover Italy: Official Tourism Website - Italia.it
- PCE Instruments Denmark ApS | PCE Instruments
- PCE Deutschland GmbH Prüfgeräte vom Hersteller | PCE Instruments
- PCE Brookhuis B.V. | PCE Instruments
- PCE Instruments UK: Test Instruments | PCE Instruments
- PCE Iberica S.L. Instrumentación | PCE Instruments
- PCE Instruments France | PCE Instruments
- PCE Italia s.r.l. / Strumenti di Misura | PCE Instruments
- PCE Teknik Cihazlar Paz. Tic. Ltd.Şti. | PCE Instruments
- User Manual