



# User Manual

PCE-COM 20 Conductivity Tester



User manuals in various languages (Deutsch, français, italiano, español, português, nederlands, türk, polski, русский, 中文) can be downloaded here:

[www.pce-instruments.com](http://www.pce-instruments.com)

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## 1 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.

If you have any questions please contact PCE Instruments. The contact details can be found at the end of this manual.

## 2 Specifications

### 2.1 Technical specifications

<b>Measuring frequency</b>	60 KHz, sine wave
<b>Conductivity measurement range</b>	0.5 ... 112 % IACS 0.3 ... 65 MS/m Resistance: 0.015388 ... 3.33333 $\Omega$ *mm <sup>2</sup> /m
<b>Resolution</b>	0.01 % IACS (at <51 % IACS) 0.1 % IACS (at 51 % IACS ... 112 % IACS)
<b>Accuracy</b>	$\pm 0.5$ % at +20 °C $\pm 1$ % at 0 ... +40 °C
<b>Lift-off compensation</b>	Probe compensation of 0.5 mm
<b>Temperature measurement range</b>	0 ... 50 °C
<b>Temperature accuracy</b>	$\pm 0.5$ °C
<b>Automatic compensation</b>	Conductivity reading is automatically adjusted to the value at 20 °C
<b>Operating conditions</b>	0 ... 50°C, 0 ... 95 % relative humidity
<b>Display</b>	LCD, backlit
<b>Power supply</b>	Internal rechargeable battery unit
<b>Probe</b>	$\varnothing 14$ mm
<b>Memory</b>	Up to 500 data records
<b>Interface</b>	Mini USB
<b>Dimensions</b>	220 x 95 x 35 mm
<b>Weight</b>	415 g (with probe)

## 2.2 Delivery content



- 1 x conductivity meter PCE-COM 20
- 1 x probe
- 1 x data cable
- 1 x user manual
- 1 x mains adaptor
- 3 x conductivity standard
- 1 x Allen key
- 1 x factory calibration certificate
- 1 x software
- 1 x carrying case

### 2.3 Accessories

As an addition to the included standard conductivity blocks, further blocks can be purchased. The following list shows the available materials and the approximate conductivity values.

Material	Conductivity MS/m	Conductivity % IACS
Titanium	0.60	1.03
Bronze	4.70	8.11
Bronze	6.91	11.93
Bronze	8.03	13.85
Brass	12.63	21.78
Copper	34.85	60.08
Copper	50.00	86.21
Copper	58.00	100.00
Aluminium	18.82	32.46
Aluminium	24.00	41.38
Aluminium	33.00	56.90
Aluminium	9.22	15.90
Magnesium	6.70	11.55
Magnesium	18.85	32.50

### 3 System description

#### 3.1 Device



- 01 Calibration key
- 02 Arrow key "Up"
- 03 Measuring key
- 04 Arrow key "Down"





- 05 Save key
- 06 Delete/unit key
- 07 Probe
- 08 Confirmation key

- 09 Menu key
- 10 Backlight key
- 11 a<sub>0</sub> key
- 12 On / off key



- 01** Probe connection
- 02** Temperature sensor
- 03** Connection for Mini USB cable
- 04** Connection for mains cable

**3.3 Function keys**

Key	Function
“MEAS“	Measurement
“SAVE“	Storage of measurement data
“CAL“	Calibration
“MENU“	Function set-up / settings
“OK“	Confirmation
“DEL/UNIT“	DEL: Deletion (in viewing mode) UNIT: Change of unit (in measurement mode)
“a <sub>0</sub> “	Selection of temperature coefficient
 “  “	Backlight
 “  “	On / off
“▲“	Increasing in steps or moving upwards
“▼“	Decreasing in steps or moving downwards



## 4 Getting started

### 4.1 Power supply


The device is powered by the included AC mains adaptor (input: 100 ... 240 V AC; 50/60 Hz; output: 4.2 V DC / 1 A). The mains adaptor is connected at the bottom of the device. During operation, the integrated 2200 mAh lithium battery can be used.

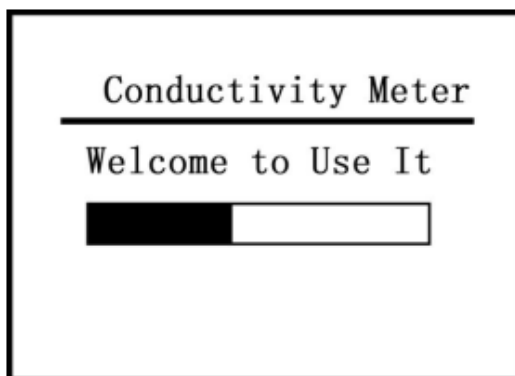
When the battery level is below 1/3, the device will emit two beep tones every 30 seconds to remind you to charge the battery.

When the meter is connected to the power supply, a red LED on the adaptor will start glowing. It will turn green when the battery is fully charged. A complete charging process takes five to six hours.

## 5 Operation


### 5.1 On / off

When the meter is switched off, press and hold the “” key for two seconds to switch it on. The following start screen will be displayed (*Image 1*):



*Image 1*

Now press the “MEAS” key to enter the measurement screen or wait until you are automatically directed from the start screen to the measurement screen.

In order to switch off the device, press and hold the “” key for two seconds. The settings made are saved automatically.

## 5.2 Measurement

By pressing the „MEAS“ key, you can directly enter measurement mode from the welcome screen, from the calibration menu or from the settings screen (Image 2).

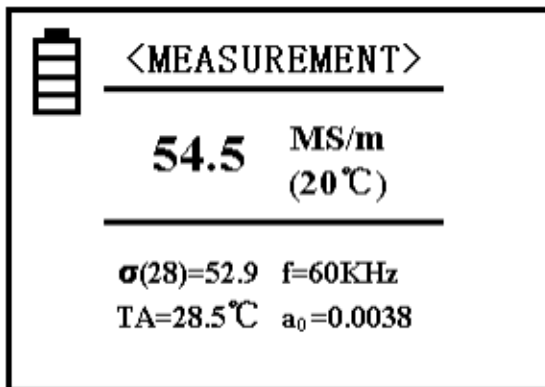



Image 2

### Notes

- In the upper area of the display (cf. „MEASUREMENT“) Image 2), you can see in what mode you currently are.
- The battery icon  shows the remaining battery power.
- In the middle of the display, you can see the conductivity value of the tested sample at +20°C in the unit MS/m or % IACS (if you want to change the unit, please see „DEL/UNIT“ at the bottom of this page and chapter 5.4.7 of this manual).
- In the lower area of the display on the left-hand side, you can find the conductivity value “ $\sigma(28) = \dots$ “ at the current temperature. The unit of measurement is identical with the unit in the middle of the display at 20 °C. The value within brackets shows the compensated temperature. Further information about this can be found in chapter 5.4.3.
- “TA = ...°C“ at the bottom of the display on the left-hand side shows the current ambient temperature.
- In the lower, right-hand area of the display, “f = ... kHz“ shows the operating frequency of the probe.
- In the lower right corner, “a<sub>0</sub>“ shows the current temperature coefficient of the tested sample. Further information about this can be found in chapter “5.4.4“.

To change the unit of measurement, press the “DEL/UNIT“ key. With each keystroke, the device changes to the other unit or format. When you switch on the device again or have left measurement mode, the unit will automatically change back to the unit originally set.

In order to make a measurement, the probe must be placed vertically and directly on the sample material for two seconds. The meter will then emit a sound to signalise that the conductivity measurement is completed. The measured data are automatically shown in the display and do not disappear before a new measurement is made.

Make sure that you have set the correct temperature coefficient and that you adapt the value to the compensation temperature of the material during the measurement. If this is not ensured, the measuring accuracy will suffer. In the chapters 5.4.3 and 5.4.4, you can see how to set these values correctly.

### 5.3 Notes on the measurement

- During a calibration or measurement, the probe must be held in a way that it always touches the material to be tested vertically and with moderate pressure. It is also important that the probe is moved to and away from the material carefully.
- Do not hold the probe in your hands for too long as your body temperature would make the temperature value of the meter increase. This will have a negative effect on the measuring accuracy.
- It is important to keep the probe, the sample, the device and the calibration body at a constant ambient temperature level.
- The device and the calibration body should only be used and stored in areas where it is not exposed to corrosion, shocks and electromagnetic fields.
- A measurement should only be carried out within the normal temperature range of 0 ... 40 °C.
- A measurement should only be made if no radiator or electric fan is in the direct environment and if the instrument is not exposed to direct sunlight.
- Do not touch the tip of the probe, the calibration block and the area of the material you wish to test with your fingers.
- If grease or dirt is on the probe, the calibration block or the sample material, make sure to clean the parts affected immediately.
- The meter and the probe must be protected from shocks and vibration. There must not be any scratches on the surface of the calibration block.
- If the end of the probe is worn, replace the probe.
- Do not touch the temperature sensor with your fingers.

1. Menu navigation

The shortcut “SET” is available in every mode and directs you to the settings as shown in the images 3-5.

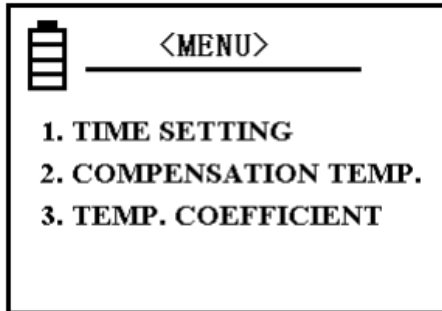


Image 3

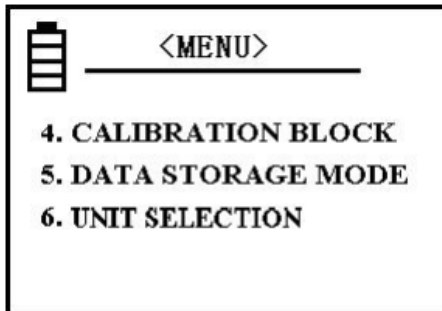


Image 4

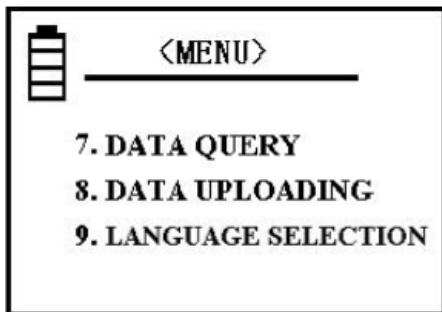


Image 5

Ten different settings are available. Use the arrow keys to navigate through the settings and to highlight the desired option. You can confirm your selection by pressing the "OK" key. If you want to return from one of the options to the overview of the different setting options, press the "SET" or "MEAS" key. If you press the "CAL" or "MEAS" key while you are in the settings overview, you will directly get back to the previous screen.

## 2. Time setting

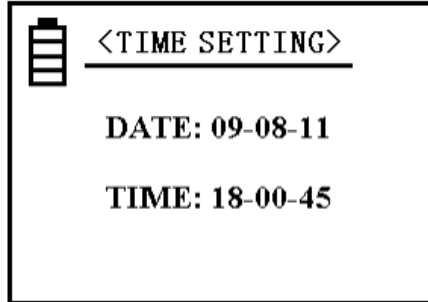


Image 6

When you are in the overview, press one of the arrow keys to select the option „TIME SETTING“ and confirm your selection by pressing „OK“. The „OK“ key is used to proceed and save whereas the arrow keys are used to adjust the numbers. When all numbers have been updated, you can leave the option by confirming again. The date format is YY-MM-DD, the time is shown in 24-hour format: HH:MM:SS.

## 3. Temperature compensation

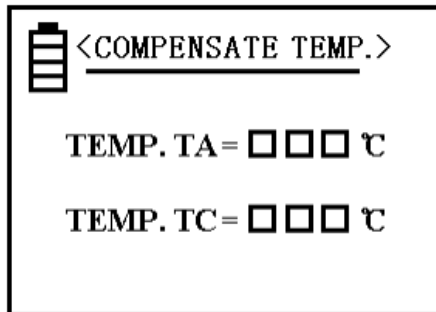


Image 7

The current temperature “TA” shows the ambient temperature during the measurement (measured by the temperature sensor).

When you have selected “TC” (underlined), press „OK” to move the cursor to the displayed number. You can now change the number by means of the arrow keys to enter the material temperature. Press “OK” to save the updated data and return to the main settings screen.

You can change the numbers more quickly by pressing and holding the respective arrow key. When the temperature is moderate and no considerable fluctuations are expected, you can make your measurement without changing the temperature settings.

This means that you enter 20 °C for “TC” (the temperature coefficient of the sample will then be irrelevant). Make sure that the temperatures of the calibration block and of the sample material remain the same during the measurement. After a calibration of the device, you can measure directly without having to consider the ambient temperature and the temperature coefficient.

If the temperature of the calibration block is different from the temperature of the tested material, you can enter the temperature of the calibration block for “TC” before the calibration. After this, you must return to the calibration screen. Enter the temperature of the sample under “TC” for the next measurement. Then return to the measurement screen and select the temperature coefficient  $a_0$ . You can now start your measurements.

#### 4. Temperature coefficient

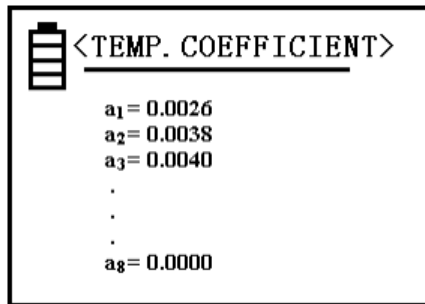


Image 8

Eight numerical values for the temperature coefficient can be set for a sample during a measurement. More detailed information on this setting can be found in chapter 5.4.12.

The values  $a_1$  and  $a_2$  are particularly useful as  $a_1$  represents the average value of the temperature coefficient and  $a_2$  is the coefficient of copper or aluminium. These values are factory-set and cannot be changed but you can enter your own values for  $a_3$  ...  $a_8$ .

To do so, first select one of the positions by placing the cursor on it, using the arrow keys.

After confirming your selection with “OK”, use the arrow keys to select a value within the range of 0.0000 ... 0.03000 and press “OK” again to confirm.

When setting this value, you can press and hold the arrow keys to increase/ decrease the number more quickly.

## 5. Calibration block

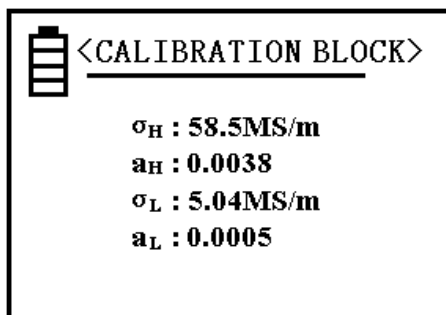


Image 9

The numerical values behind  $\sigma_H$  and  $\sigma_L$  can be set as conductivity values of the high-value calibration block and of the low-value calibration block at a temperature of 20 °C and are used for calibration. To select a unit, read chapter 5.4.7.

The values of  $a_H$  and  $a_L$  can be set as temperature coefficients of the respective block. These positions are factory-set.

When you see the screen shown in *image 9*, you can move the cursor up and down by means of the arrow keys to select the value you would like to adjust. After confirming your selection with "OK", you can change a value by using the arrow keys again. When you have entered the desired value, press "OK" to save the value. The cursor will then go to the next position.

You should correct the other values before you go back to the settings screen. If you want to go back to the settings screen, press "OK". To change the values more quickly, press and hold the arrow keys.

The possible values for  $\sigma_H$  and  $\sigma_L$  range from 4.50 to 64.0 MS/m and 7.70 to 111.0 %IACS.

The value  $\sigma_H$  must be higher than the value  $\sigma_L$ . For  $a_H$  and  $a_L$ , values from 0.0000 to 0.0300 can be selected.

### Note:

To open this setting, press the "SAVE" key four times. When you confirm with the "OK" key, the values can be changed.

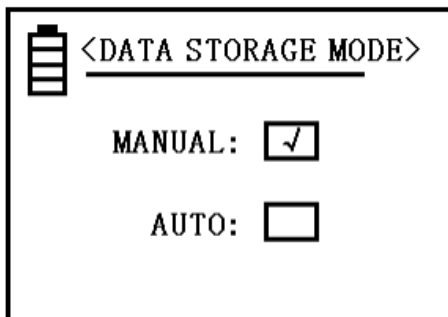


Image 10

For information on how to use this function, read chapter 5.4.11.

Use the arrow keys to select one of the two options and confirm with "OK". You will then automatically get back to the previous screen.

When you have switched the device off and back on, you will automatically be in manual storage mode. Wenn Sie das Gerät

## 7. Unit selection

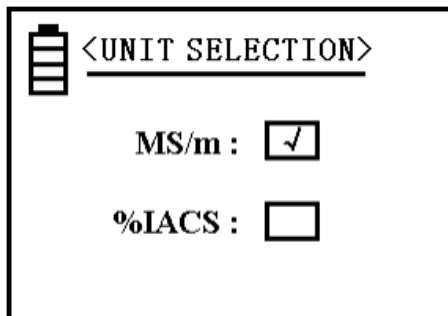


Image 11

When you have selected a unit of measurement, it will automatically be used for all information on conductivity values.



## 8. Memory

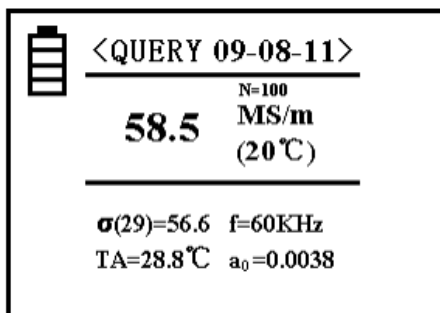


Image 12

In this option, you can see the saved data. Up to 500 data records can be saved.

In the upper part of the display, next to "QUERY", you can find the date of storage of the data record.

"N" shows the memory location within the memory. The most recent record can be found at memory location 1. The other data are saved in chronological order, starting with the lowest number. This means that whenever a value is saved, the records will be shifted back by one number.

To navigate through the records, use the arrow keys. By pressing the "OK" key, you can return to the settings screen.

To delete a data record, press and release the "DEL/UNIT" key. To clear the complete memory, press and hold the same key for *three* seconds. When you have deleted all records, the word "empty" will appear in the middle of the display. When you click on "OK" then, you will get back to the main settings screen.

## 9. Data uploading

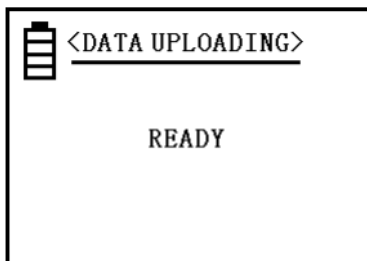


Image 13

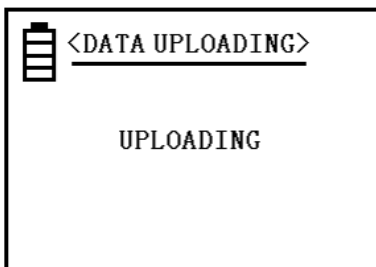


Image 14

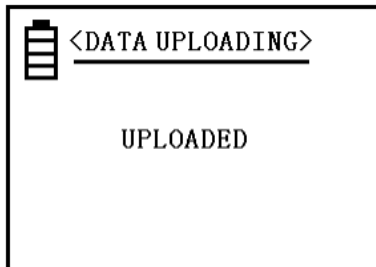


Image 15

This function is used to transfer measurement data to your connected computer. The transfer starts with the most current position and ends with the last one.

When you are in the settings overview and click on "DATA UPLOADING", "READY" (see *image 13*) will appear in the display. Now you should take all preparatory measures like, e. g. connecting the device with your computer. If you then press "OK", the instrument will start uploading. This will be indicated by the lettering "UPLOADING" (see *image 14*).

When the upload is finished, "UPLOADED" will appear in the display (see *image 15*). You can now get back to the main settings screen by pressing "OK".

## 10. Language selection

Press one of the arrow keys to move the cursor within the overview and to select one of the positions. Press "OK" to confirm your language selection and get back to the settings screen. You can select "German", "English" or "Chinese".

## 11. Measurement data storage

As you can see in chapter 5.4.6, there are two methods to save data. Your setting only applies to the main measurement function. The following current measurement data will be saved:  $\sigma(20)$ ,  $\sigma(TC)$ , unit of measurement, temperature, TA, measuring frequency  $f$ ,  $a_0$  and date. You can save up to 500 data records.

### Manual storage:

When you press "SAVE" after the measurement with the probe still on the tested material, the result will be saved manually. This is shown by a flashing "N" along with the assigned memory location number in the middle of the display, on the right-hand side.

### Auto storage:

Everytime new measurement data are added, a number displayed as "N = XXX" will appear in the middle of the display for a short time to confirm that the readings have been saved. It also shows the number of data records saved.

When the device is restarted, it will be in manual storage mode.

When the memory contains 500 records, you should delete either all or certain data (see chapter 5.4.8).

The device will then be able to save new readings.

The unit of conductivity saved will be the one that is used during the measurement and is independent from the unit selected via "DEL/UNIT".

## 12. Temperature coefficient setting

Press the  $a_0$  key on the keypad. A box around " $a_0$ " will then appear. When you press the "OK" key, a line will appear below the value after " $a_0$ ". The temperature coefficient can now be adjusted by calling up the different values which have been set for "temperature coefficient", using the arrow keys (see 5.4.4). When you have selected a value, confirm with "OK".

The measuring screen immediately changes to the original format but now shows the selected  $a_0$  value instead of the old one. This value will remain until you make further changes. If you do not press "OK", you will automatically get back to normal measurement mode after five seconds, without any changes.

During the measurement of an unknown material, you can enter an average temperature coefficient of  $a = 0.0026$ .  $a_3 \dots a_8$  are variable and can be changed by the user (see 5.4.4).

## 5.5 Software manual

### Requirements:

- a computer with Windows operating system, at least Windows XP SP3 with connected mouse, keyboard, screen and a free USB port (2.0 or higher)
- installed Dot-NET framework 4.0
- minimum resolution of 800x600, 4 GB RAM recommended
- optional: printer
- digital conductivity meter "PCE-COM 20"

### Installation

Please execute "Setup PCE-COM 20.exe" and follow the instructions of the setup.

### Description of the interface

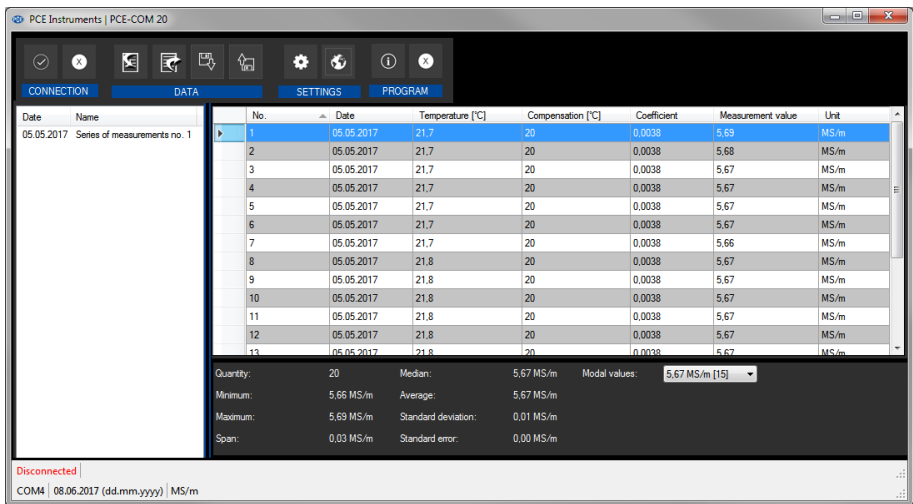


Fig. 1

The main window (Fig. 1) contains the following sections:

Below the title bar, there is a toolbar the icons of which can be selected and clicked on with your mouse. These icons are grouped according to their functions.

Under this toolbar, on the left-hand side of the window, there is a list of series of measurements. The right-hand side of the window is divided into an upper and a lower part.

The upper part shows the measurement values in a chart.











The lower part shows an overview of the statistical data.

At the lower edge of the main window, there are two status bars with important information, one above the other.

The lower one shows the statistical settings of the programme which can be made via a settings dialogue.

The upper status bar shows dynamic data like the connection status or an active data transfer from the "PCE-COM 20" to your PC.

Meaning of the individual icons of the toolbar

<b>Group "connection"</b>		
		Connect with the "PCE-COM 20"
		Disconnect from the "PCE-COM 20"
<b>Group "data"</b>		
		Import measurement data from the "PCE-COM 20"
		Export measurement data
		Load a series of measurements from a file
		Save a series of measurements in a file
<b>Group "settings"</b>		
		Open settings dialogue
		Select a language supported by the programme
<b>Group "programme"</b>		
		Display an information dialogue
		Exit programme



## First use of the software

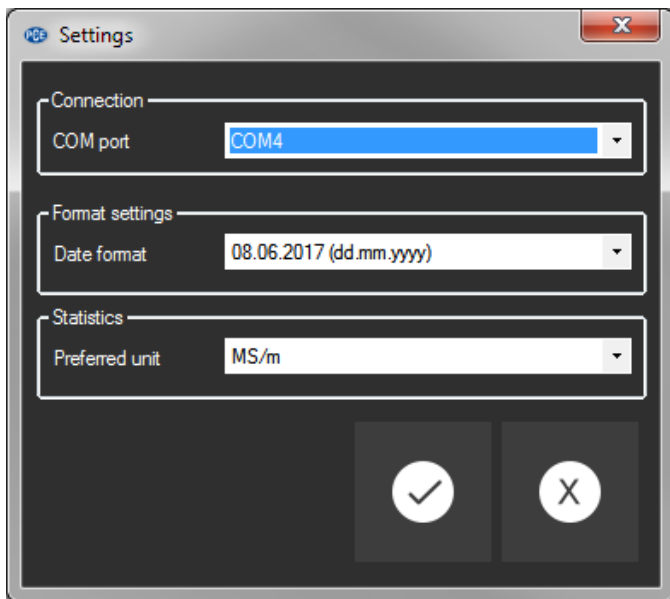
The language selected by the user during installation will be offered as the standard language of the software.

If you wish to use a different language than the one selected during installation, you can select it via the corresponding icon in the toolbar ("Selection of a language supported by the system").

To enable the "PCE-COM 20" to work with the software, the assigned COM port must be set once.

### Note:

The COM port for the software can be determined by means of the settings dialogue (*Fig. 2*). To find out what COM port is correct, have a look at the device manager of your Windows operating system.



*Fig. 2: settings dialogue*

In addition to the connection data, some other settings can be made here. You can select your desired date format and the unit for the statistical values.

You can either select "MS/m" (megasiemens per metre) or "%IACS" (International Annealed Copper Standard).

### Connect with the "PCE-COM 20"

After making the desired settings and closing the settings dialogue by clicking on the "Apply" button, you can establish a connection to the "PCE-COM 20" by clicking on the corresponding icon ("Connect with the "PCE-COM 20"").

If the connection was established successfully, the word "Connected" in the status bar for the dynamic data will be displayed in **green**.

If no connection was established, the word "Disconnected" will be shown in **red**.

### Possible scenarios

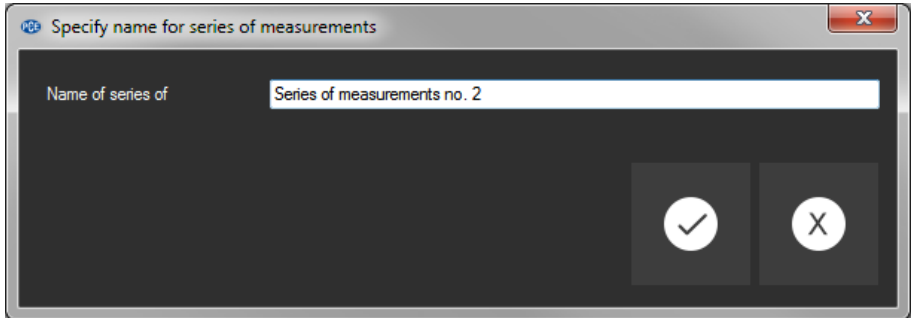
<p><b>Verbunden</b>  </p> <p>COM4   05.05.2017 (dd.mm.yyyy)   MS/m</p> <p>The connection to the "PCE-COM 20" was established successfully.</p>
<p><b>Getrennt</b>  </p> <p>COM4   05.05.2017 (dd.mm.yyyy)   MS/m</p> <p>There is no connection to the selected COM port.</p> <p>Disconnect from the "PCE-COM 20"</p> <p>You can click on the corresponding icon ("Disconnect from the "PCE-COM 20"") to disconnect an active connection to the "PCE-COM 20".</p> <p>Closing the software while the connection is active will also terminate the connection.</p>
<p><b>Getrennt</b>  </p> <p>COM4   05.05.2017 (dd.mm.yyyy)   MS/m</p> <p>The connection to the "PCE-COM 20" was terminated.</p>



### Import a series of measurements

When the connection has been established successfully, all measurement values saved to the "PCE-COM 20" can be imported to the software as a cohesive series of measurements.

After clicking on the corresponding icon on the toolbar ("Load a series of measurements from a file"), a new dialogue will appear (*Fig. 3*) where you can choose a name for the series of measurements you would like to import. You can use up to 80 digits.

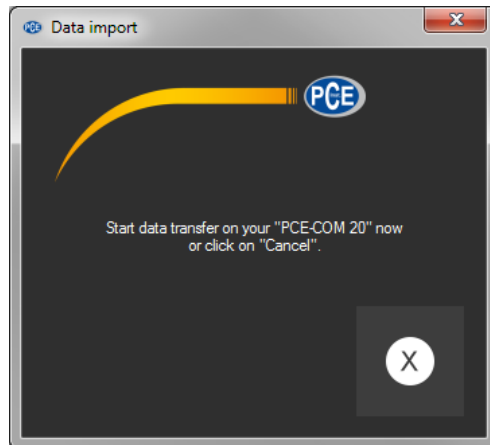


*Fig. 3: Choosing a name*

When you have clicked on the „Apply“ button, the software will wait for the data transfer (upload) in the "PCE-COM 20" to start (*Fig. 4*).

The import of the series of measurements will then start immediately.

You can discard this process at any time by clicking on the „Cancel“ button.



*Fig. 4: Wait for data transfer*



## After the import

After completion of the data import, all values measured by the "PCE-COM 20" will be available in the software.

## Numerical display

	No.	▲ Date	Temperature [°C]	Compensation [°C]	Coefficient	Measurement value	Unit
▶	1	05.05.2017	21.7	20	0.0038	5.69	MS/m
	2	05.05.2017	21.7	20	0.0038	5.68	MS/m
	3	05.05.2017	21.7	20	0.0038	5.67	MS/m
	4	05.05.2017	21.7	20	0.0038	5.67	MS/m
	5	05.05.2017	21.7	20	0.0038	5.67	MS/m
	6	05.05.2017	21.7	20	0.0038	5.67	MS/m
	7	05.05.2017	21.7	20	0.0038	5.66	MS/m
	8	05.05.2017	21.8	20	0.0038	5.67	MS/m
	9	05.05.2017	21.8	20	0.0038	5.67	MS/m
	10	05.05.2017	21.8	20	0.0038	5.67	MS/m
	11	05.05.2017	21.8	20	0.0038	5.67	MS/m
	12	05.05.2017	21.8	20	0.0038	5.67	MS/m
	13	05.05.2017	21.8	20	0.0038	5.67	MS/m
	14	05.05.2017	21.8	20	0.0038	5.67	MS/m
	15	05.05.2017	21.8	20	0.0038	5.67	MS/m
	16	05.05.2017	21.8	20	0.0038	5.67	MS/m
	17	05.05.2017	21.8	20	0.0038	5.66	MS/m
	18	05.05.2017	21.8	20	0.0038	5.67	MS/m
	19	05.05.2017	21.8	20	0.0038	5.67	MS/m
	20	05.05.2017	21.8	20	0.0038	5.66	MS/m

*Fig. 5: Numerical display*

In the upper right-hand part of the main window (*Fig. 5*), all measurement values are shown in a chart. Each measurement value is shown along with 7 more attributes. The columns show:

Consecutive number, date, temperature at the time of measurement, selected compensation, selected coefficient, numerical measurement value and unit of measurement.

The chart can be arranged by columns by clicking on a column heading.

Quantity:	20	Median:	5,67 MS/m	Modal values:	5,67 MS/m [15]
Minimum:	5,66 MS/m	Average:	5,67 MS/m		
Maximum:	5,69 MS/m	Standard deviation:	1,02 MS/m		
Span:	0,03 MS/m	Standard error:	0,23 MS/m		

*Fig. 6: Statistical data*

Below the chart, there is an area (*Fig. 6*) showing statistical data:

Number of measured values belonging to a series of measurements, minimum and maximum values, span (maximum - minimum), median, arithmetic average, standard deviation, standard error and modal value.

Since there can be several modal values, these are shown in a dropdown menu which can be unfolded with your mouse. The number within square brackets shows how often the modal value occurs in the series of measurements.

The unit for the statistical data can be selected via the settings dialogue (*Fig. 2*).

You can select "MS/m" (megasiemens per metre) or "%IACS" (International Annealed Copper Standard).

Series of measurements

On the left-hand side of the main window, there is an overview (*Fig. 7*) of all series of measurements currently available in the software. The number of series of measurements is limited to 500.

Datum	Name
05.05.2017	series of measurements no. 1
28.04.2017	series of measurements no. 2
28.04.2017	series of measurements no. 3
28.04.2017	series of measurements no. 4
28.04.2017	series of measurements no. 5
28.04.2017	series of measurements no. 6

*Fig. 7: List of series of measurements*

By selecting a series of measurements with a mouse click, the values of the series of measurements are shown in a chart and the statistical values are re-calculated.

The identifiers of the series of measurements can be changed either with a double click or a right click and selection of "Rename" (*Fig. 8*).

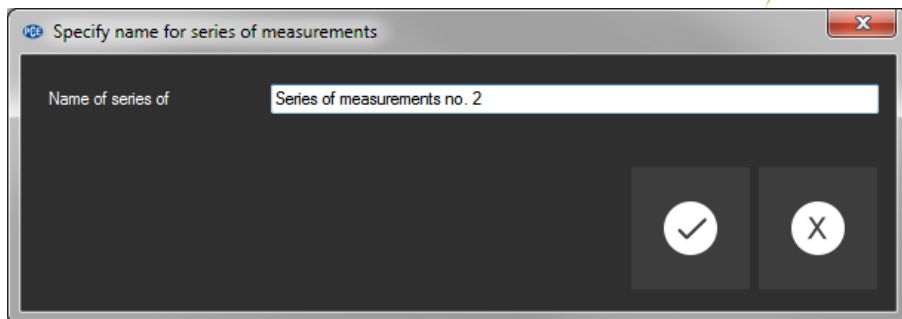


Fig. 8: Renaming series of measurements

If you would like to remove series of measurements from the software, you can highlight one or more identifiers in the list of series of measurements and delete them by pressing the "Del" key on your keyboard.

You can also do a right click and select "Delete".

#### Note:

Between the list of series of measurements on the left-hand side and the chart and statistics on the right-hand side, there is a small area with a displacement line which is normally not visible. This line can be used to change the allocation of the two areas, using your mouse.

To do so, place the cursor between the two areas until it changes. Then press and hold the left mouse key. The vertical dividing line will become visible and can be moved left or right.

#### Export of series of measurements

A series of measurements can be exported. By clicking on the icon "Export measurement data" in the toolbar, the complete content of the series of measurements can be exported in CSV format. This export saves all measurement values line by line, along with some comment lines and the seven attributes, separated by a semicolon ";".

These seven attributes are the same as the attributes shown in the chart (Fig. 5).

#### Loading and saving series of measurements

You can load and save a series of measurements by clicking on the "Load a series of measurements from a file" or "Save a series of measurements in a file" icon on the toolbar.

When you want to save a series of measurements, the typical Windows dialogue for saving data will appear first. This dialogue can be used to select a folder and a create a file name. The file format cannot be changed.



**Note:**

After at least one completed import, the series of measurements will be kept within the memory of the computer until it is deleted or the software is closed.

In the latter case, the software will show a hint that the current series of measurements has not been saved yet, which means that its complete content will be lost if you close the software (Fig. 9).

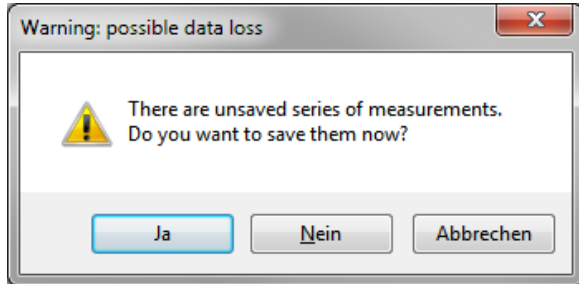


Fig. 9: Saving data

If you select "Yes", the series of measurements will be saved, just like when you click on the "Save a series of measurements in a file" in the toolbar.

## 6 Calibration

### **QUICK CALIBRATION PROCEDURE:**

**Step 1-** Press Menu button, Press Calibration Block, Enter the Password by pressing Save 4 times then pressing OK.

**Step 2-** You will need to select 2 calibration points/samples - One High/One Low. Enter the IACS and Temp Coefficient for each calibration point/sample (Refer to Fig. 17, pg.28) Press Menu to proceed.

**Step 3-** Press the CAL button, you will see the High calibration point in parenthesis at the top of the screen. Measure the high calibration sample with the sensor. If the value is not matching the calibration point, leave the sensor on the sample and press OK. The value should change to the correct value. Once the value is correct, lift the sensor and press OK. Now, do the same thing with the low calibration point. After that, your meter should be calibrated and ready to measure. Unit returns to Measure Mode.

When you are in measurement or settings mode, you have to press the "CAL" key to calibrate the meter. You will see the following calibration window (Fig. 16):

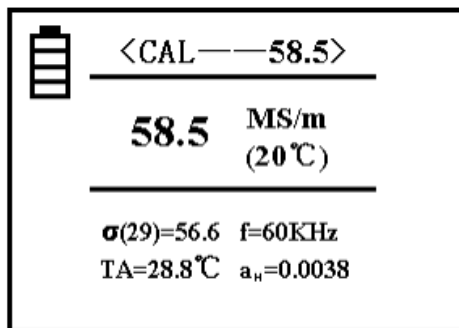


Fig. 16

### Notes

- The upper area will now show “CAL“, which stands for the function of the current mode. The number next to it shows the conductivity of the calibration block at +20 °C. This should be the value of the calibration block currently used. Further information on how to set this value can be found in chapter 5.4.5.
- In the middle of the display, you can see the conductivity value of the tested calibration block.
- In the left, lower part of the display, an H (high) or L (low) will appear instead of the temperature coefficient.

Table of conductivity for the common metals with temperature coefficient

metal	% IACS	conductivity	
		MS / m	temperature coefficient
copper	100	58	0.0038
aluminum	29 ... 61	17 ... 35.4	0.0040
gold	70.7	41	0.0034
silver	108	62.5	0.0038
Brass	25	14.5	0.0018
Aluminum bronze	9	5.2	0.0008
titanium	3.6	2.08	0.0040
lead	7.8	4.5	0.0039
zinc	30	17.4	0.0037
nickel	22	12.8	0.0060
magnesium	38	22	0.0040
nickel silver	8.6	5	0.00068
titanium alloy	1.02	0.59	0.0002
tungsten	31.46	18.25	0.0052
platinum	17.24	10	0.00374
constantan	3.92	2.27	0.000005

Fig. 17

## 1. Calibration of the high value $a_H$

When you are in the calibration menu, a calibration of the block with the high value will be required first. The set value of this block is marked with  $a_H$ , in the upper part of the display. On the lower, left-hand side of the display, the corresponding temperature coefficient will be shown. To calibrate the device, place the probe on the block's surface vertically and evenly to measure its conductivity.

If the measured value  $a_H$  corresponds to the set value, the high value does not have to be calibrated.

If you press the "OK" key while holding the probe up (distance to the block >5 cm), the device will automatically switch to the calibration of the low value  $a_L$ .

If the measured value  $a_H$  is not the same as the set value, keep the probe placed on the calibration block and press "OK". The device will finish the calibration automatically and emit a sound when the calibration is finished.

Measure this calibration block again. If the displayed value deviates by more than 0.3 %, the calibration must be repeated until the value is as required. Then hold the probe up (distance to the block >5 cm) and press "OK" to calibrate the low value.

## 2. Calibration of the low value $a_L$

Now the low value is calibrated. Again, you will find the set value of the block next to "CAL". Of course, the value will be lower this time. On the lower left-hand side, you can find the temperature coefficient for the block.

When the measured value  $a_L$  is the same as the set value, you do not have to calibrate the low value.

When the measured value  $a_L$  is not the same as the set value, keep the probe placed on the calibration block and press "OK". The device will complete the calibration automatically and emits a sound when it is finished.

Measure this calibration block again. If the displayed value deviates by more than 0.3 %, the calibration must be repeated until the value is as required. Then hold the probe up (distance to the block >5 cm) and press "OK".

### 3. Cancel calibration

To cancel the calibration during the process, press "MEAS" or "SET". The calibration window will be closed, all steps taken by then will be deleted and the device will return to the start screen.

### 4. Additional notes on the calibration

The calibration type for this device is a two-point calibration. This means that a calibration block with a high value  $\sigma_H$  and one with a low value  $\sigma_L$  is used.

#### **Selection of the calibration block:**

The value of the block with the high value  $\sigma_H(20)$  should normally be higher than the value of the tested material. The value of the other block  $\sigma_L(20)$  should be lower than the value of the material.



## 7 Maintenance

### 7.1 Storage

The device with all accessories should be stored in the carrying case included and at normal ambient temperature. The environment should be dry and constant. Avoid shocks and drops.

## 8 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.

## 9 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.









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