



User Manual

Moisture Balance PCE-MA Series



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

Last change: 3 July 2023
v1.0

Contents

1	Safety notes.....	1
1.1	Safety symbols	2
2	Specifications.....	2
2.1	Technical data	2
2.2	Delivery scope	2
2.3	Optional accessories	2
3	Device description	3
3.1	Device overview.....	3
3.2	Display	4
3.3	Overview control panel	4
3.4	Key description	5
4	Preparing the measurement.....	6
4.1	First steps	6
4.2	Preparing the sample.....	6
4.3	Tools for sample preparation	7
4.4	Sample distribution	7
5	Settings.....	8
5.1	Selection of the heating programme.....	8
5.2	Setting the drying parameters.....	9
6	Operation	12
6.1	Notes on the selection of settings.....	12
6.2	Measurement.....	13
7	Advanced settings	14
7.1	Setting the baud rate	14
7.2	Print measured values	14
7.3	Setting continuous data transfer	15
8	Adjustment (calibration)	15
9	Data transfer to the PC	17
10	Printer connection	17
11	Troubleshooting.....	18
12	Contact	19
13	Disposal	19

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.
- The measuring device should be transported as horizontally as possible, with the bottom side down and well padded. Make sure that the loose attachments are removed from the measuring chamber to avoid damage. It is recommended to keep the original packaging for transport.
- Only use cold-device plugs with a PE contact.
- Do not touch the halogen bulbs or the lid during or after the measuring process as this can cause severe burns.
- After measuring, let the sample cool down before touching it.
- Never operate the device with the lid open.
- 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.

1.1 Safety symbols

Safety-relevant instructions the non-observance of which may cause damage to the instrument or to injuries are additionally marked with a safety symbol.

Symbol	Designation / description
	General warning sign Non-observance can cause damage to the device and injuries to the user.
	Warning: hot surface Non-observance can cause burns.

2 Specifications

2.1 Technical data

Model	PCE-MA 100	PCE-MA 110	PCE-MA 200	PCE-MA 202
Weighing range*	110 g	110 g	200 g	200 g
Readability [g]	1 mg / 0.001 g	10 mg / 0.01 g	1 mg / 0.001 g	10 mg / 0.01 g
Repeatability	±0.003 g	±0.03 g	±0.003 g	±0.03 g
Linearity	±0.003 g	±0.03 g	±0.003 g	±0.03 g
Heating element	halogen lamp / round / approx. Ø 90 mm			
Moisture measurement range	0...100 %			
Readability [%]	0.01 %	0.1 %	0.01 %	0.1 %
Drying temperature	+40...+199°C; adjustable			
Drying time	1...199 minutes; adjustable (timing mode)			
Settling time	<4 seconds	<3 seconds	<4 seconds	<3 seconds
Memory	15 drying programmes (parameters)			
Display	LCD, 17 mm digit size (white on black)			
Power supply	220 V / 50 Hz			
Dimensions	200 x 180 x 380 mm			
Weight	approx. 4.4 kg			
Shipping dimensions	500 x 350 x 360 mm / approx. 7 kg			

2.2 Delivery scope

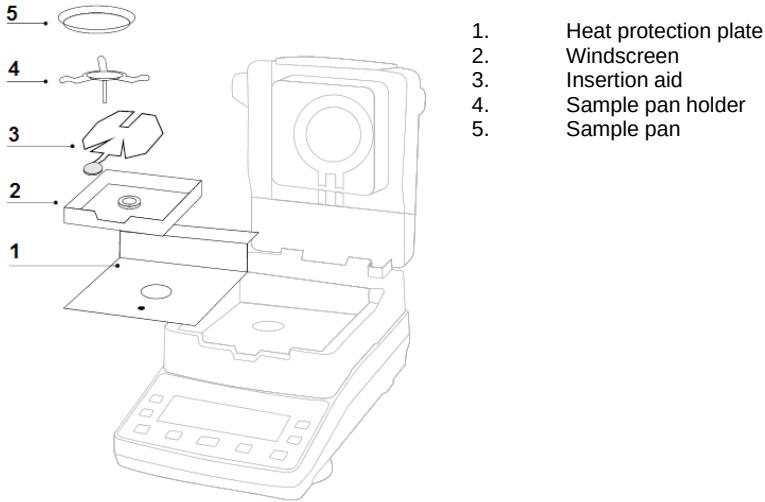
- 1 x moisture balance
- 1 x windscreen
- 1 x sample pan holder/handle
- 1 x sample pans
- 1 x mains cable
- 1 x user manual

2.3 Optional accessories

- PCE-MA-PS Spare sample pans (50 pieces)
- PCE-MA-SL1 Replacement lamp for PCE-MA 110/202 (for 220 V version)
- PCE-MA-SL2 Replacement lamp for PCE-MA 100/200 (for 220 V version)
- PCE-BP1 Thermal printer
- PCE-BP1-EP Spare paper rolls for PCE-BP1 (10 pieces)

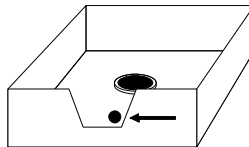
3 Device description

3.1 Device overview

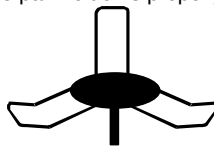


Assemble the individual parts as shown in the picture above:

1. Start with the heat protection plate (1).
2. The cut-out in the side wall of the windscreen (2) points in the direction of the control panel.

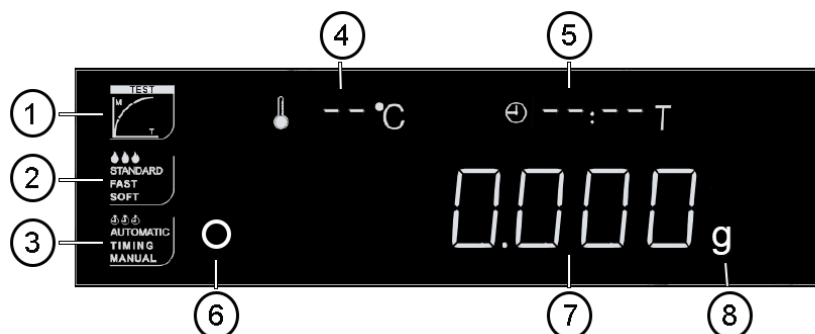


3. The handle of the insertion aid (3) is inserted into this cut-out.
4. Place the sample pan holder (4) in the centre of the measuring chamber. Make sure that the cone of the sample pan holder is properly seated in the guide.



5. The sample pan (5) is inserted last.

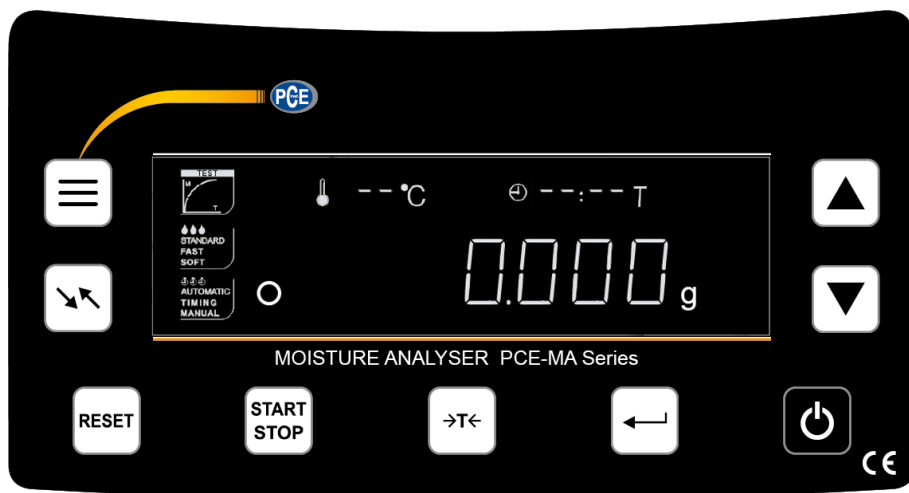
3.2 Display



1. Status display
2. Heating mode
3. Termination criterion
4. Temperature display

5. Time display
6. Stability indicator
7. Measured value
8. Unit

3.3 Overview control panel



3.4 Key description

Key	Function
	Switching the moisture meter on and off
	Start/stop measurement
	Tare / exit settings
	Menu / open settings
	Unit / switch between measurement results (%MC / g / %)
	Confirm current settings / switch to the next setting
	Return to weighing mode (short key press) / calibration (long keystroke)
	Change the settings (in the menu) / switch on the backlight (only in weighing mode)
	Change the settings (in the menu) / switch off the backlight (only in weighing mode)

4 Preparing the measurement

4.1 First steps



Allow the instrument to acclimatise to the new environment for at least 30 minutes after unpacking.



Adjust the height of the feet at the front of the meter so that the scales are plane. There is a spirit level on the back; you can use this for orientation.



Connect the scales to mains power by connecting the power cable to the scales* power connector on one side and to a wall socket on the other side.



ATTENTION!

The location of the scales should be chosen so that disturbing influences are reduced to a minimum. There should be enough space to work and the scales should be placed on a stable desk the material of which cannot have any magnetic effect on the scales. Strong wind, vibration, dust, strongly fluctuating temperatures or a humidity of more than 75 % should be avoided when using the scales. The same applies to strong heat sources and devices that generate a strong electromagnetic or magnetic field.

4.2 Preparing the sample

Always prepare only one sample for measurement. This avoids that the sample can exchange moisture with the environment. If several samples have to be taken at the same time, they should be packed in airtight containers so that their properties do not change during storage. The containers should not be exposed to high temperature fluctuations as this may lead to condensation and can affect the sample. Before starting the measurement, place the sample pan and, if applicable, the glass fibre round filter on the pan stand and tare so that only the weight of your sample is evaluated. Spread a thin layer of the sample evenly on the sample pan to obtain reproducible results. Uneven application will cause inhomogeneous heat distribution in the sample to be dried, resulting in incomplete drying or an increased drying time. Due to an accumulation of the sample, the upper layers are heated up more strongly, which consequently leads to burns or incrustations. An excessive layer thickness or possible incrustation prevents the moisture from escaping from the sample. This residual moisture has the consequence that measurement results determined in this way are not comprehensible and reproducible. In addition, a change in the state of aggregation can lead to a change in weight, which can falsify the result. Never re-use the aluminium sample pans. If you use the warm/hot sample pan for the next measurement, the heat of the pan can influence the sample even before drying. When you take several measurements in a row, bear in mind that some heat from the previous measurement still exists and evaporation already takes place when closing the lid, which can lead to a measurement deviation. If you do not let the drying chamber cool down, you will have to accept a measurement deviation.

4.3 Tools for sample preparation

The tools and instruments used for sample preparation are crucial for the accuracy and reliability of the measurement. Tools that are thermally conductive in their properties, i. e. they can transfer heat to the sample, should be avoided. Improper handling and preparation of the sample will falsify the final result of the measurement.

4.4 Sample distribution



ATTENTION!

- The samples should not exceed the 8 mm height and 85 mm diameter of the sample pan.
- Exceeding the prescribed max. height of the sample can cause the sample to burn or encrust.
- The sample should be applied as evenly as possible to the sample pan.
- Make sure that the temperature sensor, which is located in the lid, does not touch the sample, as this could falsify the result.

Solids:

- Distribute powdery and granular samples evenly on the sample pan.
- Grind coarse-grained samples with a mortar, chopping knife or similar. Avoid applying heat to the sample when crushing it as this will lead to moisture loss.



Liquids:

Glass fibre round filters should preferably be used for samples with a very high moisture content. They ensure an even distribution of liquids on the sample pan and in the case of solids they prevent their combustion.



The glass fibre round filter has the following advantages:

- Even distribution due to capillary effect
- no drop formation
- faster evaporation due to larger surface area

Note:

For the PCE-MA series, glass fibre round filters are not available from PCE Instruments. Filters with a diameter of approx. 80 mm are required.

5 Settings

After switching it off and back on, the moisture analyser has saved the last drying parameters used. These flash in the display.

5.1 Selection of the heating programme

Press the menu key to access the settings. Here you can call up existing modes as well as create and save new modes.

A flashing number appears on the left of the display to represent the memory location. Here you can retrieve up to 15 different memory locations using the arrow keys.

[The numbers 1 ... 9 and the letters A ... F are available].



Attention! "0" cannot be selected. When confirming this, two signal tones sound in quick succession and the scales automatically exit the menu.

The saved drying parameters of the individual memory locations flash in the display together with the memory location. If you want to save the memory location with its settings, confirm this with the tare key. The scales beep twice and switch to drying mode.

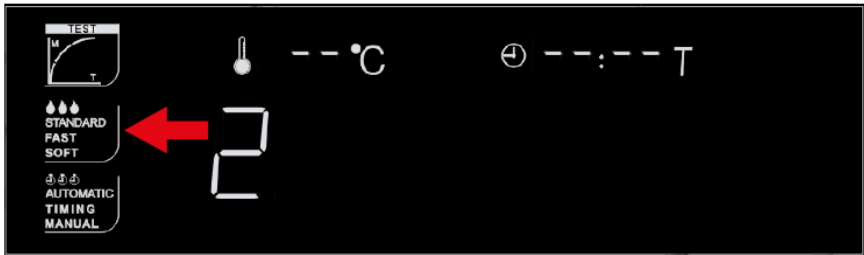
If you want to change the settings, confirm the memory location with the enter key and you can change the parameters. The settings are described in the next chapter of the instructions.

5.2 Setting the drying parameters

After you have selected a memory location in the selection menu and confirmed it with the enter key, you can now set the individual parameters one after the other.

5.2.1 Heating mode selection

Here you can choose between three heating speeds with the arrow keys. The current mode flashes.



STANDARD

This mode is the factory setting and is suitable for most samples.

FAST

Within the first few seconds, the instrument heats beyond the set temperature to generate a base heat in the heating chamber. With the help of this, the set temperature can be reached more quickly.

Note: This mode should only be used for samples with a very high moisture content.

SLOW

In this mode, the temperature is increased slowly to protect the sample. Thus, this mode is particularly suitable for relatively dry materials.

To confirm the selected heating mode, press the **enter key** and the scales switch to the next parameter.

5.2.2 Termination criterion / stop mode

The arrow keys can be used to select between three abort criteria for the measurement. The current mode flashes.



AUTOMATIC

This mode ends the measurement automatically when the measured value is constant over a certain period of time.

The following chart shows the conditions that must be met to end the measurement:

Stop conditions <period (weight change)>			
	Fast heating mode	Standard heating mode	Slow heating mode
PCE-MA 110	36 s (<20 mg)	45 s (<20 mg)	60 s (<20 mg)
PCE-MA 202	36 s (<20 mg)	45 s (<20 mg)	60 s (<20 mg)
PCE-MA 100	36 s (<3 mg)	45 s (<2 mg)	60 s (<2 mg)
PCE-MA 200	36 s (<3 mg)	45 s (<2 mg)	60 s (<2 mg)

ATTENTION: In this mode, no time setting for the measurement is possible. The stop conditions cannot be changed.

TIMING

This mode ends the measurement as soon as the set time has elapsed.

ATTENTION: The maximum measuring / drying time that can be set is 199 minutes.

MANUAL

In this mode, the measurement can be stopped by the user.

All you have to do is press the START/STOP key at the desired time.

ATTENTION: Depending on the selected temperature, combustion of the sample is very likely to occur. **This mode should only be used under constant observation.** The advantage of this measurement is that the sample can be left to dry for longer in order to be able to remove trapped moisture from the sample.

To confirm the selected heating mode, press the **enter key** and the scales switch to the next parameter.

5.2.3 Setting the drying temperature

The drying temperature can be entered here using the arrow keys.



First, the placeholder for the tens digit will flash. This can be set from 0 to 19 and it also covers the hundreds digit. Press the enter key to confirm the entry and the device switches to the units digit. This can be set from 0 to 9 and is confirmed again by pressing the enter key.

ATTENTION: Set temperatures below +40 °C will cause an error message "LOtEMP" when the device starts drying. When you return to the setting mode to change the temperature, the instrument will show you the temperature +40 °C as an indication of the minimum temperature.

5.2.4 Setting the drying time

This item can only be set if you have selected the TIMING termination criterion in advance.



Again, the setting is made here by using the arrow keys. First, the placeholder for the tens digit will flash. This can be set from 0 to 19 and it also covers the hundreds digit. Press the enter key to confirm the entry and the device switches to the tens step of the seconds. The seconds can only be set in steps of ten up to 50. Thus, the maximum time that can be set is 199 min and 50 s. By pressing the enter key, the meter now enters the measuring mode.

6 Operation

6.1 Notes on the selection of settings

If you are working with a moisture analyser for the first time, it is advisable to familiarise yourself with the measuring procedure by carrying out some test measurements. You can use a moistened piece of paper for this purpose, for example.

Since the moisture analysers do not work with characteristic curves, almost all materials can be dried in the device. However, the properties of the sample must be taken into account. For the correct settings, you must therefore think about the properties of the sample to be measured.

- How does the sample react to the effects of heat?
- Can the material ash, burn or melt?
- Does the material have a specific ignition / flash point?
- What is the grain size / sample size?

The settings should also be chosen depending on the material properties. It is advisable to make some test measurements with different settings, if necessary, to specify the appropriate ones for the different materials. This means, for example, starting with a low temperature to test how the sample reacts and then slowly increasing to minimise the drying time, for example.

Furthermore, it may also be necessary to take additional measures. If the sample can evaporate substances that may be toxic to humans, an appropriate exhaust air system should be available.

For comparability of measurements, care should be taken to always use the same sample quantity and settings and to follow the same sample preparation procedure. The environmental conditions can already influence the sample during sample preparation, which can lead to deviations in the measurement results. Please observe the specifications for sample preparation in chapter 4.

6.2 Measurement

Preparation of a measurement:

- Place the sample pan on the sample pan holder with the insertion aid. Make sure that the sample pan lies flat on the sample pan holder.
- Tare the sample pan with the tare key.
- Now put the desired amount of your sample into the sample pan.
- Make sure that the sample does not weigh less than 1 g. Depending on the material, a sample weight of 5 to 10 g is advisable.
- Do not close the lid again until the "o" icon disappears.
- Start the drying process by pressing the START/STOP key. The ongoing drying process is indicated by the flashing of the status indicator "TEST".
- Depending on the set stop criterion, an audible signal sounds when the drying process is completed.
- The display shows you the moisture content of the sample in %.
- Open the lid and make sure to remove the sample with the insertion aid to avoid burns.
- If you want to make the next measurement directly, press the RESET key to remove the last measured values and prepare a new measurement.

You have the option of switching back and forth between the units during and after the measurement with the unit key. If you do this during the measurement, the current values at the time of the measurement are displayed.

% MC = moisture content in %

g = weight of the sample in g

% = dry matter in %



Attention!

Do not touch the lid during the measurement to avoid burns and scalds!
The hot water vapour escapes through the ventilation slots at the top and the lid heats up during the measurement.

7 Advanced settings

7.1 Setting the baud rate

Switch on the scales with the on/off key and immediately press the tare key while the entire display is still lit up. The baud rate stored is now displayed.



You can now change this with the arrow keys. You can choose between 1200 / 2400 / 4800 / 9600.

To accept the desired selection, press the RESET key and the meter switches to measuring mode.

7.2 Print measured values

You can print out the measured values with the optional printer PCE-BP1. To do this, proceed as follows:

1. Check that the printer is correctly set and connected to the scales via the cable.
2. After successfully completing the measurement, keep the menu key pressed until "Print" appears on the display.
3. Then the option "L-C" (printed in Chinese) and "L-E" (printed in English) appears in the display. Use the arrow keys to select the option "L-E" and confirm it with the enter key.
4. Now the numbers 1 to 5 appear on the display, representing the last 5 measurements. Use the arrow keys to select the desired measurement and confirm it with the enter key.
5. The data is now sent to the printer via the RS-232 interface.

Example of a printout:

```

MOISTURE DETERMINATION (3)

Machine Type:  PCE-MA100
Heating Mode:  STANDARD
Stop Mode:     AUTOMATIC
Heating Temp:  120 degree(C)
Time elapsed:  12:00
Wet W:         10.620 g
Dry W:         8.013 g
Moisture:      24.08 % M
  
```

7.3 Setting continuous data transfer

Press and hold the menu key until you see a "t" in the display.

Please note that "Print" is displayed before this. However, you must continue to hold down the key until "t" appears in the display. When you then release the menu key, continuous data transfer is set.



ATTENTION!

This setting is necessary for the connection to the software.

8 Adjustment (calibration)

In the event that the internal balance does not work correctly and / or noticeable deviations in the measured values occur, you can carry out an adjustment with appropriate weights. In order to maintain the accuracy of the balance, it is necessary to use a weight of accuracy class F1 for the adjustment. A 100 g weight is required for the PCE-MA 110 / 100 and a 200 g weight for the PCE-MA 202 / 200.

ATTENTION: It is not possible to change the adjustment weight in the programme!

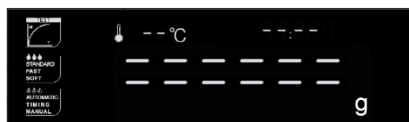
NOTE! The weight readings in the following illustrations belong to the calibration of a balance of the model PCE-MA 100.



Press and hold the "RESET" key in weighing mode until - CAL - appears in the display.



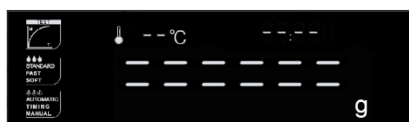
The display now changes to show the weight to be used. It flashes until you have put the weight on.



While the display is showing the lines, the scales must not be touched or exposed to vibration as the weight must stabilise internally.



After successful adjustment, the display shows the weight again.



When you lift the calibration weight, the scales still perform a zero setting. Again, do not touch the scales or expose them to vibration as the weight must stabilise internally.



After the zero point setting has also been successfully completed, the display switches to the weighing mode and shows 0.000 g. This completes the adjustment.

9 Data transfer to the PC

The drying data can also be transferred live to the optionally available **PCE-SOFT-MA** software via the RS-232 interface. For this purpose, the scales must be set to continuous data transfer (see item 7.3).

The following optionally available cables are required for this: **PCE-CK-RS232 + RS232-USB**

The necessary system requirements for the PC are:

- Operating system Windows 10 or higher
- USB port (2.0 or higher)
- An installed .NET Framework 4.6
- A minimum resolution of 1200x600 pixels
- Processor with 2 GHz
- 4 GB RAM memory recommended



NOTE!

The exact description for the correct set-up of the data transfer can be found in the software manual.

10 Printer connection

The RS-232 interface can be used to connect the optional PCE-BP1 printer. To do this, the baud rate of the scales must be adjusted on the printer:



Baud rate 1200



Baud rate 9600

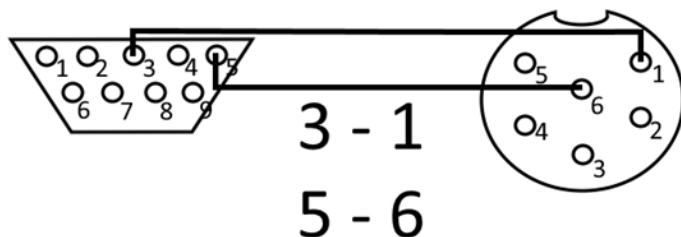


	1200	-	2400	-	4800	-	9600
SW 1	- ON	- OFF	- ON	- OFF			
SW 2	- ON	- ON	- OFF	- OFF			
SW 3	- ON	- 8 bit data (no parity)					
	- OFF	- 7 bit data					
SW 4	- ON	- parity checked					
	- OFF	- ignore parity					
SW 5	- ON	- even parity					
	- OFF	- odd parity					
SW 6	- ON	- 80 characters / line					
	- OFF	- 40 characters / line					
SW 7	- ON	- CR --> CR + LF					
	- OFF	- CR --> CR					
SW 8	- ON	- double parallel print					
	- OFF	- normal print					

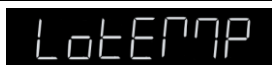
Pin assignment of the connection cable on the scales:

SUB-D 9 connector for RS-232 interface
on the PCE-MA series

MAS60 930 017-517 / DIN 45 322
connector for interface on printer



11 Troubleshooting

Error message	Cause	Possible solution
	Weight of the sample below 1 g	Use a sample quantity of approx. 5 ... 10 g
	Temperature setting below +40 °C	Change the settings
	Measuring time below 30 seconds	Change the settings / restart the scales
	Time setting for slow heating mode "SOFT" below 3 minutes	Change the settings / restart the scales
	Problem with the halogen lamp	Contact PCE Instruments
Black display	Power supply interrupted or down arrow key was pressed in measuring mode.	Check the power supply, press up arrow key in measuring mode

12 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.

13 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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