Manual
Multifunction Calibrator PCE-789

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Contents

1   Introduction

Thank you for purchasing a calibrator PCE-789 from PCE Instruments.

The multifunctional calibrator PCE-789 is a versatile instrument for measuring and simulating of the process signals. Both current and voltage signals can be simulated and measured with the multifunctional calibrator. The characteristics of many thermocouple types are stored in this
Multifunction calibrator and permit the entry and display of values in ° C. a special feature in this device is an integrated functional generator. Besides the waveforms sine, triangle, square and cut sine 10 further curve forms are stored in the multifunctional calibrator. In addition, due to the supplied software, also specific waveforms can be created and stored in the device. Furthermore, this device can output two superimposed frequencies. This functionality is combined with a robust plastic housing and allows applying this multifunctional calibrator in many areas. For maintenance engineer in industry, the engineer in the laboratory, as well as for the technicians in the service area this Multifunction Calibrator is a useful tool, with the help of which many tasks can be completed. For mobile use, in addition to the power supply via a power adapter the operation on battery is also possible.

1.1   Delivery

1 x Carrying case
1 x Manual
1 x AC Adapter
1 x USB cable
1 x Software CD
1 x Software Guide
1 x K-type thermocouples
2 x Alligator clip (red and black)
2 x Test leads (black and red)
1 x Rechargeable Lithium Battery (11,1V / 1600mAh)

2   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. There is no warranty of damages or injuries caused by non-observance of the manual.

2.1   Warning Symbols

	General warning
	Warning about dangerous electrical voltage

2.2 Warning Notes

- This instrument must only be used in the manner, described in this manual. If the instrument is used otherwise, dangerous situations may occur.
- Do not expose the device to extreme temperatures, direct sunlight, extreme humidity or wetness.
- The opening of the case should only be done by the qualified personnel of the PCE Instruments.
- The instrument should never be placed with the user interface (e.g. keyboard side on a table)
- Never use the device with wet hands.
- You should not make technical changes on the device.
- The appliance should only be cleaned with a damp cloth. Do not use abrasives or solvent-based cleaners.
- The device may only be used with accessories offered by PCE or equivalent replacement.
- Before each use of this instrument, please, check the housing and test leads for visible damage. If the visible damage occurs, the device may not be used.
- Further, this instrument must not be used when the environmental conditions (temperature, humidity ...) are not within the limits mentioned in the specifications.
- The instrument must not be used in an explosive atmosphere.
- If the battery is empty, (e.g., it may be indicated by the battery indicator) the device should not be used any more, as dangerous situations may arise because of false readings. Only after the battery is replaced or the accumulator is charged, the meter may be used again.
- Before each use, please check the meter by measuring a known parameter.
- The limit values for the measurement parameters given in the specification may not be exceeded under any circumstances.
- Before starting the measurement, always check, whether the correct measuring range is set, and whether the test leads are plugged into the sockets provided for the respective measurement.
- The measurement tips should never be touched on the bare ends, since there is a risk of electric shock.
- The device is designed for indoor use.
- Carry out the measurements of high voltages (> 30 V AC) with extra caution.
- Before opening the housing for the replacement of battery or fuse, please remove all test leads, as otherwise there is a risk of electric shock.
- Non-observance of the safety notes may bring to the damage of the device and injury of the operator.

This user's handbook is published from PCE Instruments without any guarantee.

We expressly point to our general guarantee terms, they can be found in our general terms of business.

If you have any questions please contact PCE Instruments.

3 Specification
(23+/- 5 ° C, 10 minutes after switching on)

mA (source function) (Vopen> 15V)

Measuring range	Resolution	Reading accuracy
-4mA to -0,005mA	1µA	±0.1% / ± 5dgts
0,005mA to 4mA	1µA	±0.1% / ± 5dgts
4mA to 20mA	1µA	±0.1% / ± 5dgts
20mA to 24mA	1µA	±0.1% / ± 5dgts

V (source function) (max. load 1mA, short circuit protection < 100mA)

Measuring range	Resolution	Reading accuracy
-3V to -0,005V	0.001V	±0.1% / ± 5dgts
0,005V to 10V	0.001V	±0.1% / ± 5dgts
10V to 15V	0.001V	±0.1% / ± 5dgts

mA (measuring function)

Measuring range	Resolution	Reading accuracy
-4mA to -0,005mA	1µA	±0.1% / ± 5dgts
0,005mA to 4mA	1µA	±0.1% / ± 5dgts
4mA to 20mA	1µA	±0.1% / ± 5dgts
20mA to 24mA	1µA	±0.1% / ± 5dgts

When the measured value is smaller than 5, 0 is displayed.

V (measuring function)

Measuring range	Resolution	Reading accuracy
-3V to -0,005V	0.001V	±0.1% / ± 5dgts
0,005V to 10V	0.001V	±0.1% / ± 5dgts
10V to 15V	0.001V	±0.1% / ± 5dgts

When the measured value is smaller than 5, 0 is displayed.

Frequency (source, 10 Vpp, OV offset, square wave, duty cycle 50%)

Measuring range	Resolution	Reading accuracy
0,3 to 99,999	0.1 Hz	0.002 Hz
10,00 to 999,99	0.1 Hz	0.02 Hz
1000,0 to 9999,9	0.1 Hz	0.2 Hz
10000 to 20000	1 Hz	2 Hz

Temperature, Thermocouples (sources and measuring function, 0.1 °C & 0.1 °F resolution, internal cold junction compensation (CJC), accuracy of the thermocouple not included, 3 minutes after inserting the thermocouples)

	°C		°F	
	Measuring range	Accuracy	Measuring range	Accuracy
K	-200 to -150	2.0	-382 to -238	3.6
	-150 to 0	1.2	-238 to 32	2.1
	0 to 1000	0.8	32 to 1832	1.4
	1000 to 1370	1.2	1832 to 2498	2.1
J	-200 to -150	2.0	-382 to -238	3.6
	-150 to 0	1.0	-238 to 32	1.8
	0 to 1050	0.7	32 to 238	1.2
E	-200 to -150	0.9	-382 to -238	2.7
	-150 to 0	0.7	-238 to 32	1.6
	0 to 850	1.5	32 to 1562	1.2
T	-200 to -150	1.5	-382 to -238	2.7
	-150 to 0	1.2	-238 to 32	2.1
	0 to 400	0.8	32 to 752	1.4
R	0 to 500	1.8	32 to 932	3.2
	500 to 1760	1.5	932 to 3200	2.7
S	0 to 500	1.8	32 to 932	3.2
	500 to 1760	1.5	932 to 3200	2.7
N	-200 to 0	1.5	-328 to 32	2.7
	0 to 1300	0.9	32 to 2372	1.6
L	-200 to 0	0.9	-328 to 32	1.6
	0 to 900	0.7	32 to 1652	1.2
U	-200 to 0	1.1	-328 to 32	1.9
	0 to 600	0.7	32 to 1652	1.2
B	600 to 800	2.2	1112 to 1472	3.9
	800 to 1000	1.8	1472 to 1832	3.2
	1000 to 1820	1.4	1832 to 3308	2.5
C	0 to 1800	1.0	32 to 3272	1.8
	1800 to 2310	1.5	3272 to 3308	2.7
mV	-10mV to 70mV	0.05mV	-10mV to 70mV	0.05mV

Voltage (peak-peak for sinusoidal waves)
(Vpp, 0.3 ~ 20kHz, 50% duty cycle, sine wave, 0V offset)

Measuring range	Resolution	Reading accuracy
0.1 to 20V	0.001V	5% ±0.3V

Voltage (peak-peak for non-sinusoidal waves) (Vpp, 0.3 ~ 20kHz, 0V offset)

Measuring range	Resolution	Reading accuracy
0.1 to 20V	0.001V	6% ±0,4V

Voltage (peak-peak) (Vpp, 0.3 ~ 20kHz, 50% duty cycle, square wave, 0V offset)

Measuring range	Resolution	Reading accuracy
0.1 to 20V	0.001V	6% ±0,4V

Offset voltage (max. Vpp < 20V)

Measuring range	Resolution	Reading accuracy
-5 to 5V	0.001V	5% ±0,5V ±5%xVss

Duty cycle (%, square wave, 10 Vpp, 0.3 ~ 20kHz)

Measuring range	Resolution	Rise time of Vpp	Fall time of Vpp
0 to 100%	1%	10µs maximum 5µs typical	15µs maximum, 7.5µs typical

DTMF (Hz)

Measuring range	Resolution	Reading accuracy
0.3 to 99.999	0.1 Hz	0.002 Hz
10.00 to 999.99	0.1 Hz	0.02 Hz
1000.0 to 9999.9	0.1 Hz	0.2 Hz
10000 to 20000	1 Hz	2 Hz

DTMF (%)

Measuring range	Resolution	Reading accuracy
0% ~ 100%	1 %	5%

DTMF (phase angle)

Measuring range	Resolution	Reading accuracy
0° ~ 360°	1°	100µs + 1°

DTMF (Vpp, f1 = f2, < 1kHz, %1 = %2, Phase1 = Phase 2)

Measuring range	Resolution	Reading accuracy
5V ~ 20V	0.001 V	10% ±0.6V ±5%xVss

General specifications

AC Adapter	AC 110V, 60Hz (input), or AC 220V, 50/60Hz (input), DC 15V / 0.5A (output)
Operating conditions	0°C ~ 50°C, 85% RH
Storage conditions	-20°C ~ 60°C, 75% RH
Dimensions	214 x 98.7 x 56 mm
Weight	approx. 650 g

4 Device Description

Device
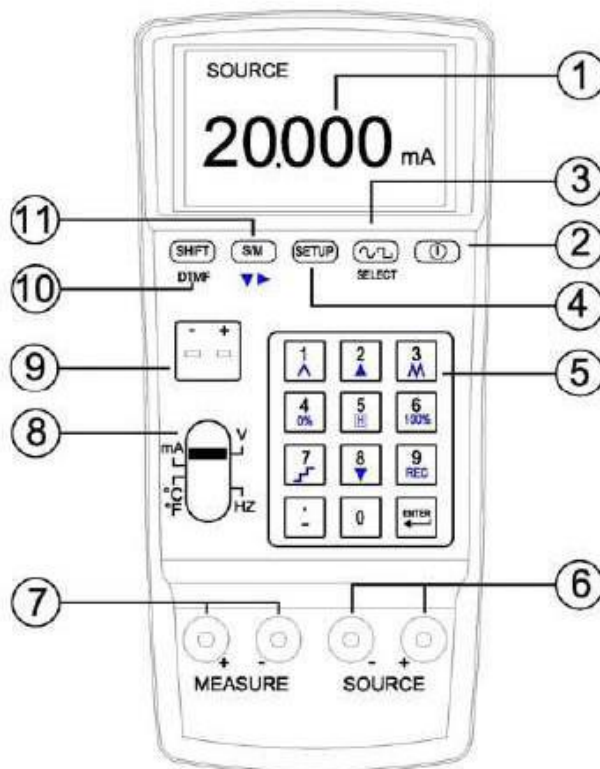
(1) LCM Display
(2) ON / OFF button
(3) SELECT button to select the waveform in a frequency mode
(4) Setup button
(5) Numeric keypad / buttons for special functions (e.g., REC, 0 %, 100%)
(6) Output jack (for source function)
(7) Input jack (for measuring functions)
(8) Slide switch (for various functions)
(9) Temperature input / output jack
(10) SHIFT button to use the second functions of the numerical keypad: DTMF and frequency change
(11) S / M button (for switching between source and measuring mode)

5 Operating Manual

5.1 Voltage source

a) 3V ~ 15V

(1) Turn on the device and push the slide switch to "V"
(2) Press the S / M button to select the SOURCE (output) mode.
(Press SETUP once to save this as the initial setting.)
(3) Enter a voltage value (incl. digits after the decimal point) and press ENTER.
(4) Connect the test leads or the crocodile clamps to the SOURCE jacks (red to red, black to black)
(5) Then connect the test leads or the crocodile clamps to the calibrated object.
(6) To perform a voltage ramp measurement, read the chapter "Ramp function".
(7) In order to use the data logger function, read the chapter "Data Logging".

Note:

1. The users may enter maximum 5 digits.
2. If you enter a voltage value (incl. digits after the decimal point), and then press ENTER, the PCE-789 outputs this voltage value.
3. If the output value is < 0, please, enter the minus first.
4. If the output value is < 1 and > 0, please, enter "0" first.

> ⚠️ **Warning:**

1. Do not connect any voltage potential or a live circuit to the SOURCE jacks in order to avoid the damage of PCE-789.
2. If there is short circuit or an overvoltage at the output jacks, the PCE-789 cannot show any correct voltage value. Disconnect the device and check, whether an OUTPUT ERROR symbol is displayed.
3. Always make only one measurement at the same time and connect only the sockets required for this. Disconnect all the unused sockets. Connect the measuring cable always only to one socket type (SOURCE or MEASURE or TC).

b) Setup Instructions
   (1) Press SETUP to enter the setup menu.
   (2) V 0%: Sets the voltage starting value of the voltage ramp function. (Details in the chapter "Ramp function")
   (3) V 100%: Sets the voltage end value of the voltage ramp function. (Details in the chapter "Ramp function")
   (4) SAMPLE: Sets the sample time for data logging. (Details in the chapter "Data Logging")
   (5) FILE NAME: data can be stored under different file names. Here, the
Filename can be set. (Details in the chapter "Data Logging")
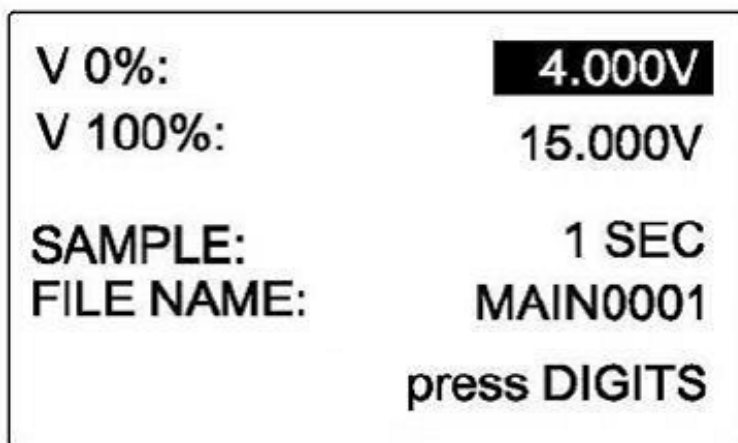
c) Setup Details

   (1) Press S/M to select the desired option.
   (2) The desired value can be entered when an appropriate option is in a reverse black / white mode.
   (3) FILE NAME: The file name must be entered with the help of the ASCII code. (See table Annex 1), e.g., the code "65" must be entered for the letter "A".
   (4) The data stored under the same file names are automatically joined together.

5.2 Current Source

   a) -4mA ~ 24mA
   (1) Turn on the device and push the slide switch to the "mA".
   (2) Press the S / M button to select the SOURCE (output) mode.
      (Press SETUP once to save this as an initial setting.)
   (3) Enter a power value (incl. digits after the decimal point) and press ENTER.
   (4) Connect the test leads or the crocodile clamps to the SOURCE jacks (red to red, black to black)
   (5) Then connect the test leads or the crocodile clamps to the calibrated object.
   (6) To perform a power ramp measurement, read the chapter "Ramp function".
   (7) To use the data logger function, read the chapter "Data Logging".
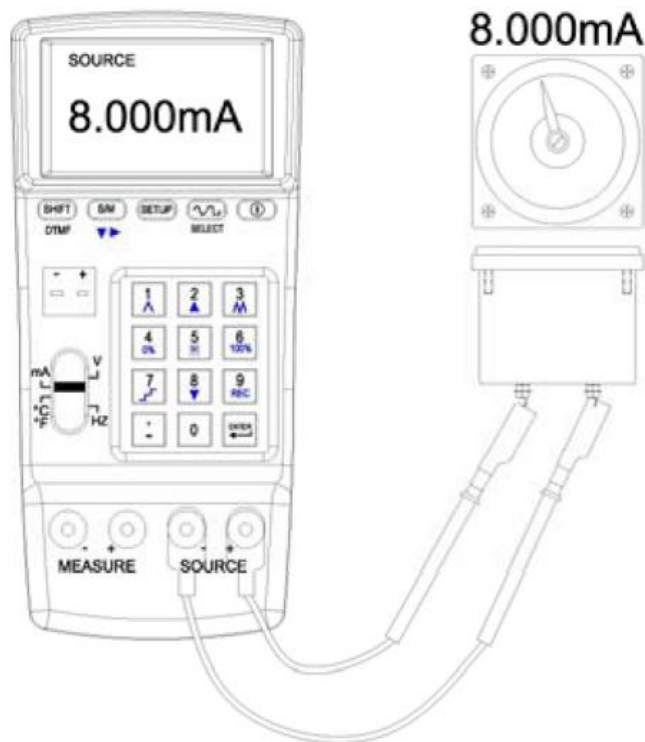
Note:

1. The users may enter maximum 5 digits.
2. If you enter a current value (incl. digits after the decimal point), and then press ENTER, the PCE-789 outputs this current value.
3. If the output value is < 0, please, enter the minus first.
4. If the output value is < 1 and > 0, please, enter "0" first.

Warning:

1. Do not connect any current carrying conductor or a loaded circuit to the SOURCE jacks in order to avoid the damage of PCE-789.
2. If there is short circuit or an overload at the output jacks, the PCE-789 cannot show any correct current value. Disconnect the device and check, whether an OUTPUT ERROR symbol is displayed.
3. Always make only one measurement at the same time and connect only the sockets required for this. Disconnect all the unused sockets. Connect the measuring cable always only to one socket type (SOURCE or MEASURE or TC).

b) Setup Instructions

(1) Press SETUP to enter the setup menu.
(2) mA 0%: sets the current starting value of the ramp function. (Details in the chapter "Ramp function")
(3) mA 100%: sets the current end value of the ramp function. (Details in the chapter "Ramp function")
(4) 4mA ->: sets the mapping unit for 4mA.
(5) 20mA->: sets the mapping unit for 20mA.
(6) MAPPING: here the "MAPPING" function can be activated.

```
mA 0%:              4.000mA
mA 100%:            20.000mA

4mA  →              0.0000KW
20mA →              100.00KW
MAPPING                  YES
         press DIGITS
```
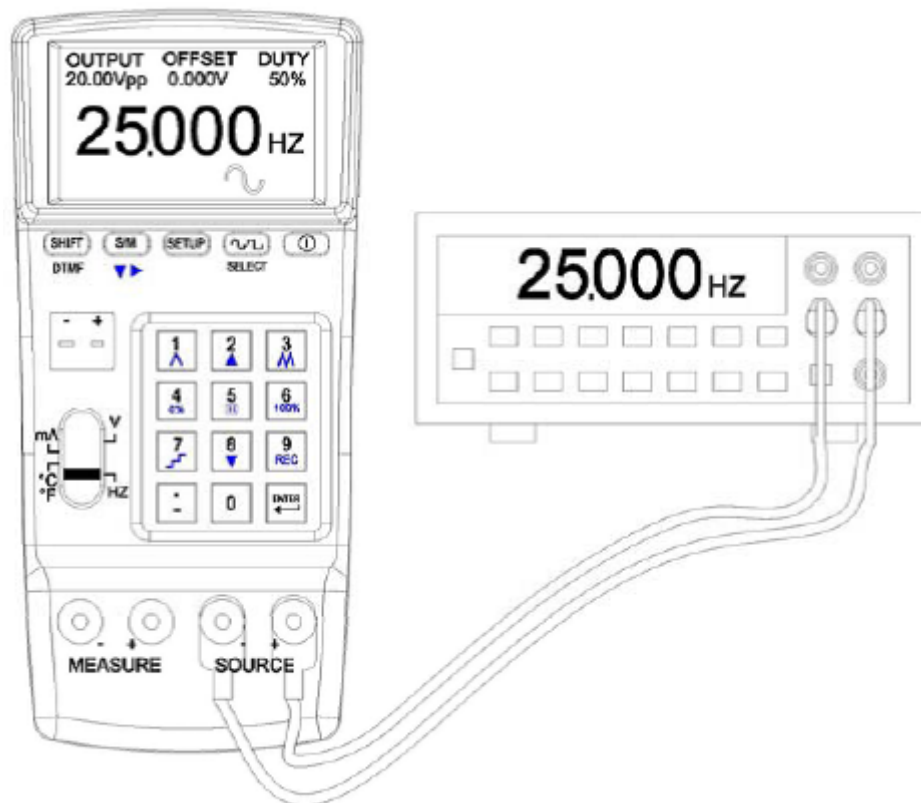
c) Setup Details
(1) Press S/M to select the desired option.
(2) The desired value can be entered when an appropriate option is in a reverse black / white mode.
(3) The Mapping unit for 4mA and 20mA must be entered with the help of the ASCII code. (See table Annex 1), e.g., the codes "75" and "87" must be entered for "KW".
(4) MAPPING: "YES" mapping function activated
                      "NO" mapping function deactivated

d) MAPPING Function
(1) The mapping function is activated when the user has selected "YES" in MAPPING in the SETUP Menu.
(2) The display unit then corresponds to the unit set by the user in the SETUP menu (if "0KW" for 4mA and "100KW" for 20mA were set in the SETUP menu).
(3) If 100 has been typed by the user and ENTER pressed, the display shows the following values: 100.00KW (on the main display) and 20.000mA (the current value output by the PCE-789).
(4) If the ramp function is used, the display shows 0 ~ 100KW instead of 4 ~ 20mA.

5.3 Temperature Source

a) Simulation of the Output Signals of the Thermocouples
(for the types K, J, E, T, R, S, N, L, U, B, C, and mV output)
(1) Turn on the device and push the slide switch to the "°C ° F mV".
(2) Select a thermocouple type in the Setup menu.
(3) Enter a temperature value (incl. digits after the decimal point) and then press ENTER.
(4) Connect the thermocouple cable to the TC/mV jack.
(5) Finally, connect the thermocouple cable to the calibrated object.
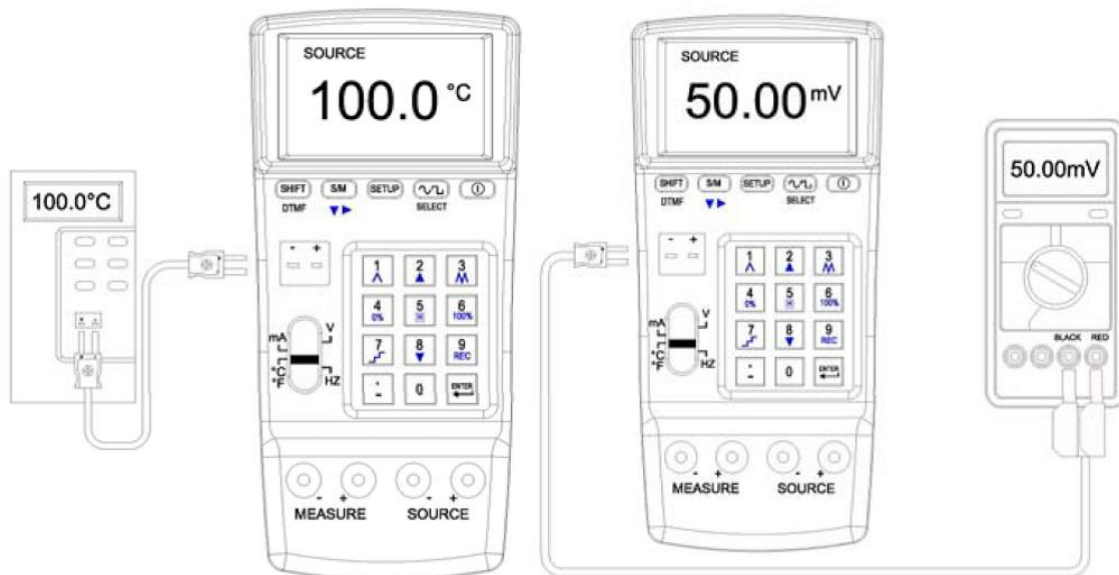
Note:

1. The users may enter maximum 5 digits.
2. If you enter a temperature value (incl. digits after the decimal point), and then press ENTER, the PCE-789 outputs this temperature value.
3. If the output value is < 0, please, enter the minus first.
4. If the output value is < 1 and > 0, please, enter "0" first.

⚠ **Warning**:

1. Do not connect any current carrying conductor or a loaded circuit to the TC jacks in order to avoid the damage of PCE-789.
2. If there is a short circuit or an overload at the output jacks, the PCE-789 cannot show any correct voltage value. Disconnect the device and check, whether an OUTPUT ERROR symbol is displayed.
3. Always make only one measurement at the same time and connect only the sockets required for this. Disconnect all the unused sockets. Connect the measuring cable always only to one socket type (SOURCE or MEASURE or TC).

b) Setup Instructions

(1) Press SETUP to enter the SETUP menu.
(2) TC 0%: sets the temperature starting value of the ramp function (details in the chapter "Ramp function")
(3) TC 100%: sets the temperature end value of the ramp function (details in the chapter "Ramp function")
(4) C. J. COMP.: sets the CJC.
(5) TC TYPE: sets the thermocouple types.
(6) UNIT: here you can choose between °C and °F.

c) Setup Details

1. Press S/M to select the desired option.
2. The desired value can be entered when the appropriate option is in a reverse black / white mode.
3. C.J.COMP.: here a value for CJC can be set (the standard value is 0.0°C. Compensation between -5°c and +5°C corresponding to the ideal output values can be set).
4. If the option "TC TYPE" has been selected, the desired thermocouple can be selected with the button SELECT
5. If the option "UNIT" has been selected, °C or ° F can be selected with the help of the button SELECT

5.4 Frequency Output (Hz)

a) 0.1Vpp ~ 20Vpp, 0.3Hz ~ 20kHz, offset: -5V ~ +5V

(1) Turn on the device and push the slide switch to the "Hz" (press the SETUP key once, to save this as an initial setting).
(2) Press the SELECT button to select the waveform (sine signal, rectangular signal, triangular signal, clipped sine signal, custom signal).
(3) Press the S/M button to select between "voltage peak-to-peak" (Vpp), "OFFSET", "DUTY" and "Hz".
(4) Enter a value (incl. digits after the decimal point) and press "ENTER".
(5) Connect the test leads or the crocodile clamps with the SOURCE jacks (red to red, black to black).
(6) Finally, connect the test leads or the crocodile clamps with the object to be calibrated.

Note:

1. The users may enter maximum 5 digits.
2. If you enter a parameter value (incl. digits after the decimal point), and then press ENTER, the PCE-789 outputs this parameter value.
3. If the output value is < 0, please, enter the minus first.
4. If the output value is < 1 and > 0, please, enter "0" first.

Warning:

1. Do not connect any current carrying conductor or a loaded circuit to the SOURCE jacks in order to avoid the damage of PCE-789.
2. If there is a short circuit or an overload at the output jacks, the PCE-789 cannot show any correct voltage value. Disconnect the device and check, whether an OUTPUT ERROR symbol is displayed.
3. Always make only one measurement at the same time and connect only the sockets required for this. Disconnect all the unused sockets. Connect the measuring cable always only to one socket type (SOURCE or MEASURE or TC).

b) Setup Instructions

(1) Press SETUP to enter the SETUP menu.
(2) Waveform index: enter a number for the custom signal.
(3) Press SETUP again in order to enter the Hz range in the main display.
(4) Press the SELECT button to select the custom signal. The PCE-789 then outputs the custom signal at the output (e.g., number 7 – sine wave named SINONE60 with 60 Hz).
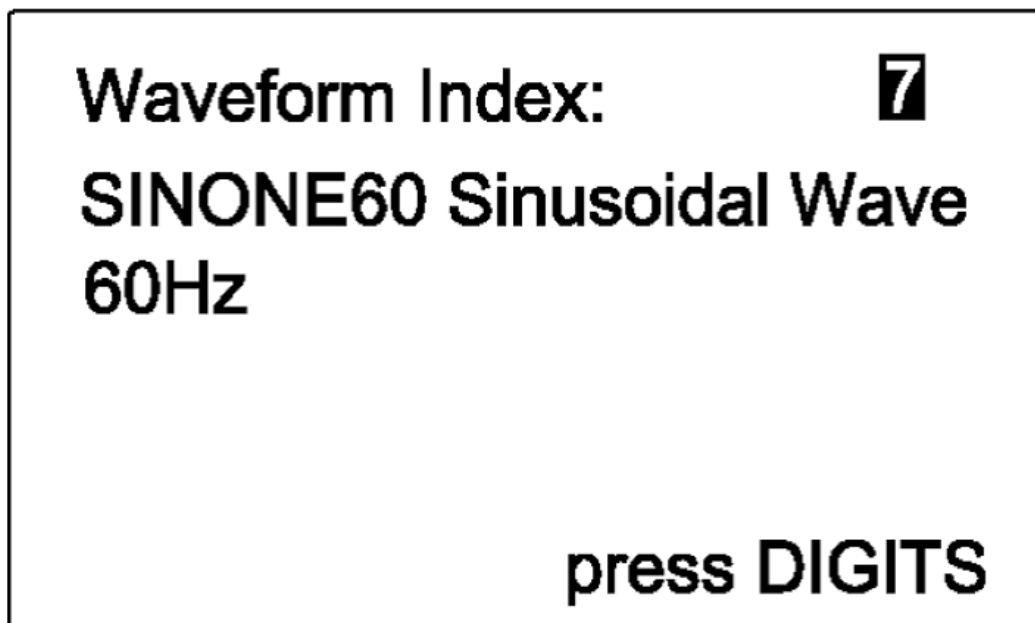
c) Fine Adjustment Details

(1) Hz: sets the output frequency.
(2) OUTPUT: sets the output voltage (peak-peak).
(3) OFFSET: sets the DC-Offset at the output. Through the fine adjustment of this option, you can output TTL or PWM-signals.
(4) DUTY: for the rectangular signal here, the bandwidth of the positive waves can be set. For the triangular signal, the saw tooth signals can be set.
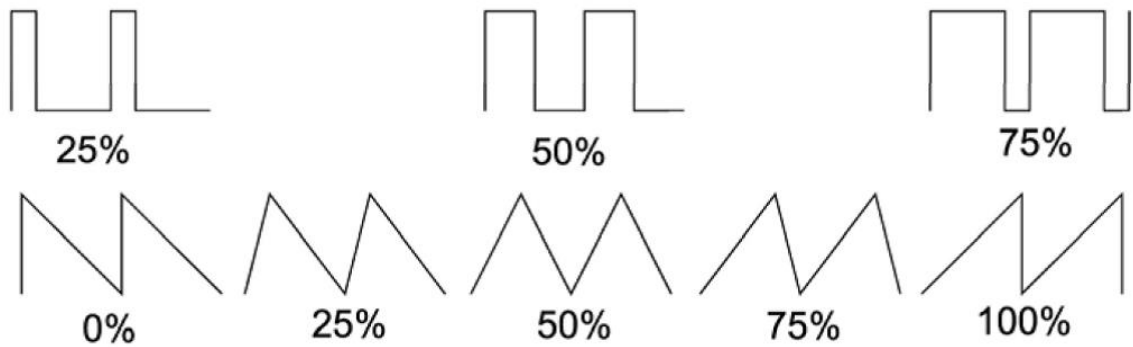
(5) Waveform selection: here you can select between sine signal, rectangular signal, triangular signal, clipped sine signal and custom signal.
(6) Custom signal: first, the user must compile a waveform in the PC und transfer this to the PCE-789 (details can be found in the software manual).
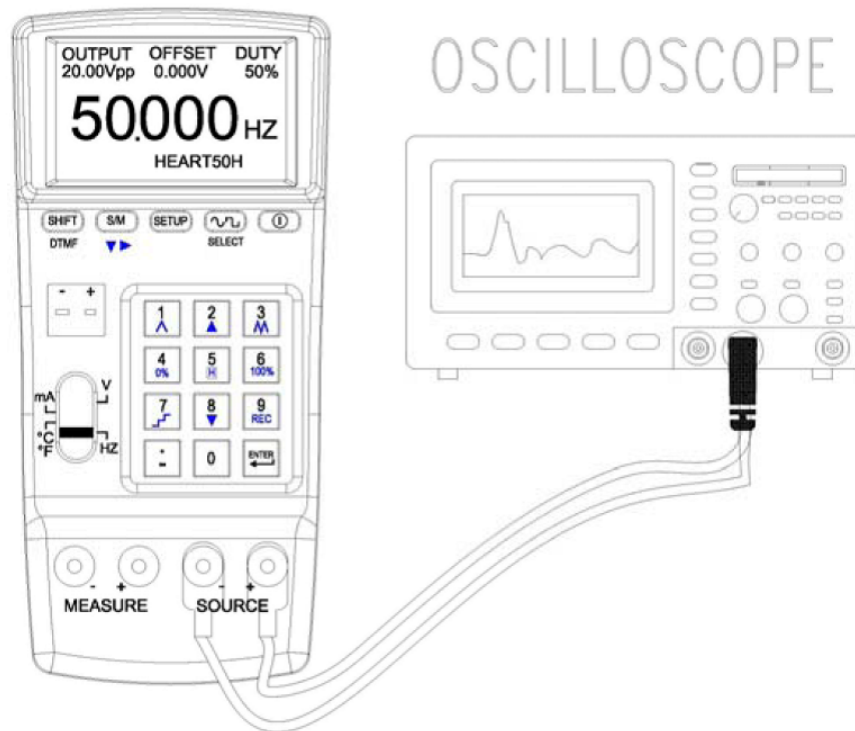
5.5   DTMF (Dual Tone Multi-Frequency)

a)   0.1Vpp ~ 20Vpp, 0.3Hz ~ 20kHz, offset: -5V ~ +5V, % 0~100%, Phase: 0~360°

(1) Turn on the device and push the slide switch to "Hz". (press SELECT once to save this as an initial setting).
(2) Press the SHIFT button to select the DTMF-mode.
(3) Press the S/M button to enter all the parameters for F1 and F2.
(4) Enter a value (incl. digits after the decimal point) and press ENTER.
(5) Connect the test leads or the crocodile clamps to the SOURCE jacks (red to red, black to black).
(6) Then connect the test leads or crocodile clamps to the object to be calibrated.

Note:
1. The users may enter maximum 5 digits.
2. If you enter a parameter value (incl. digits after the decimal point), and then press ENTER, the PCE-789 outputs this parameter value.
3. If the output value is < 0, please, enter the minus first.
4. If the output value is < 1 and > 0, please, enter "0" first.

⚠ **Warning:**

1. Do not connect any current carrying conductor or a loaded circuit to the SOURCE jacks in order to avoid the damage of PCE-789.
2. If there is a short circuit or an overload at the output jacks, the PCE-789 cannot show any correct voltage value. Disconnect the device and check, whether an OUTPUT ERROR symbol is displayed.
3. Always make only one measurement at the same time and connect only the sockets required for this. Disconnect all the unused sockets. Connect the measuring cable always only to one socket type (SOURCE or MEASURE or TC).

b) Setup instructions

(1) Hz: sets the output frequency for F1 and F2.
(2) %: sets the output power in % for F1 and F2.
(3) Phase: adjusts the output angle for F1 and F2.
(4) Vpp: sets the peak-peak voltage.
(5) Offset: sets the DC-Offset.

5.6 Voltage measurement

a) -3V ~ 24V

(1) Turn on the device and push the slide switch to "V".
(2) Press the S/M button to select the MEASURE (input) mode.
(3) Connect the test leads or the crocodile clamps to the MEASURE jacks (red to red, black to black)
(4) Then connect the test leads or the crocodile clamps to the object to me measured.
(5) The display of the PCE-789 shows the measured voltage value.
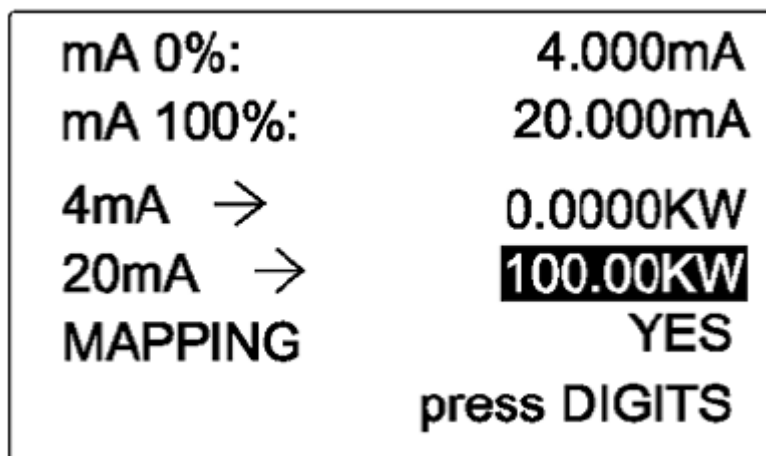(6) In order to use the data logger function, read the chapter "Data Logging".

Note:

1. The measurement result is displayed with 5 digits (incl. decimal place)

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⚠ **Warning:**

1. Do no measure voltage over 30V at the MEASURE jacks to avoid the damage of the PCE-789.
2. Always make only one measurement at the same time and connect only the sockets required for this. Disconnect all the unused sockets. Connect the measuring cable only with one socket type (SOURCE or MEASURE or TC).
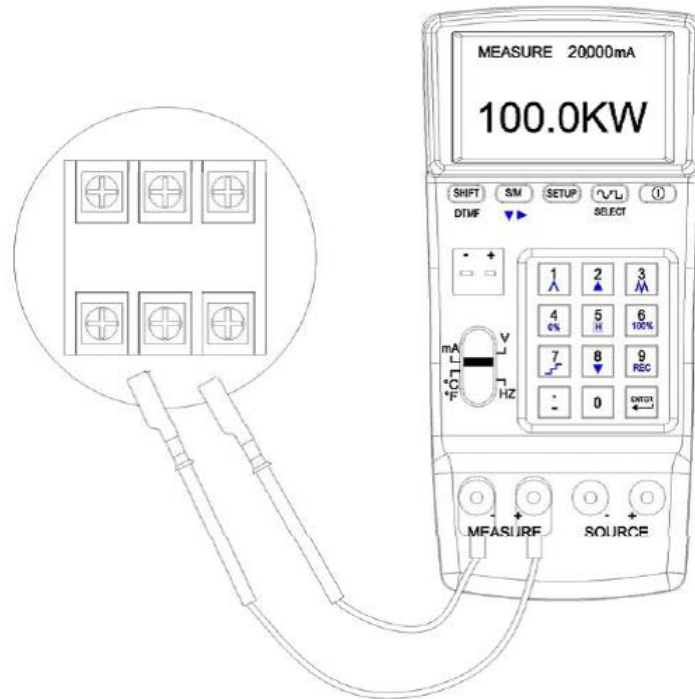
5.7   Current measurement

a)   -4mA ~ 24mA

(1) Turn on the device and push the slide switch to "mA".
(2) Press the button S/M to select the MEASURE (Input) mode.
(3) Connect the test leads or the crocodile clamps to the MEASURE jacks
     (red to red, black to black)
(4) Then connect the test leads or the crocodile clamps to the object to be measured.
(5) The display of the PCE-789 shows the measured voltage value.
(6) In order to use the data logger function, read the chapter "Data Logging"
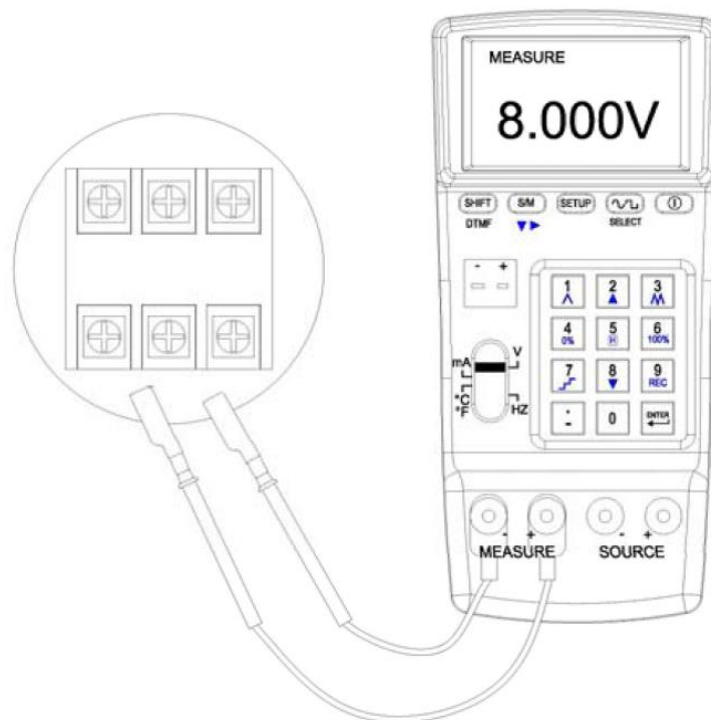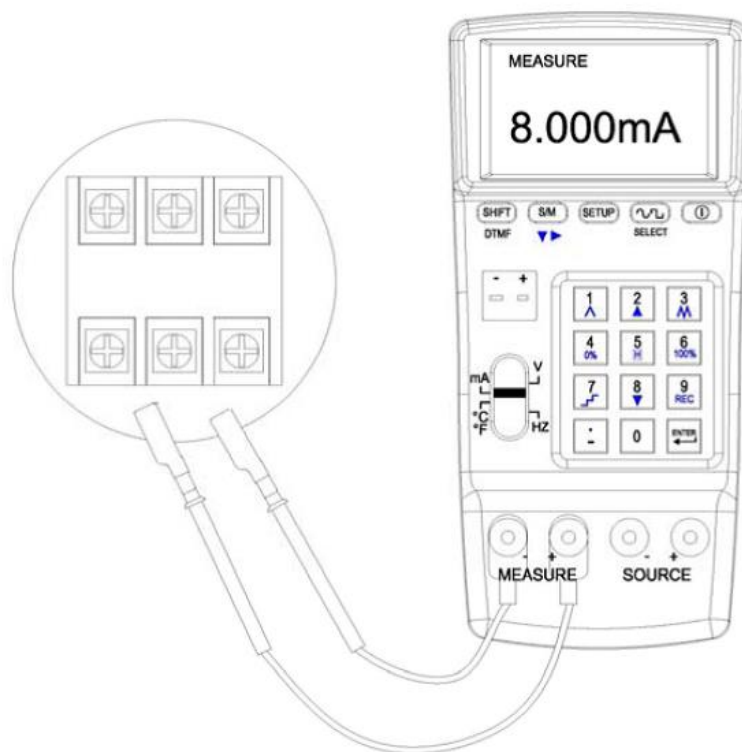
Note:

1. The measurement result is displayed with 5 digits (incl. decimal place)

⚠ **Warning:**
1. Always make only one measurement at the same time and connect only the sockets required for this. Disconnect all the unused sockets. Connect the measuring cable only with one socket type (SOURCE or MEASURE or TC).

b) Setup instructions
(1) Press SETUP to enter the SETUP menu.
(2) 4mA->: set the mapping unit for 4mA.
(3) 20mA->: set the mapping unit for 20mA.
(4) MAPPING: here the "MAPPING" function can be activated

```
mA 0%:              4.000mA
mA 100%:           20.000mA

4mA   →            0.0000KW
20mA  →            100.00KW
MAPPING               YES
press DIGITS
```

c) Setup details

(1) Press S/M to select the desired option.
(2) The desired value can be entered when an appropriate option is in a reverse black / white mode.
(3) The Mapping unit for 4mA and 20mA must be entered with the help of the ASCII code (see table Annex 1), e. g., the codes "75" and "87" must be entered for "KW".
(4) MAPPING: "YES" mapping function activated
                  "NO"   mapping function deactivated

d) MAPPING function

(1) The mapping function is activated when the user has selected "YES" in MAPPING in the SETUP Menu.
(2) The display unit then corresponds to the unit set by the user in the SETUP menu (if "0KW" for 4mA and "100KW" for 20mA were set in the SETUP menu).
(3) If 100 has been typed by the user and ENTER pressed, the display shows the following values: 100.00KW (on the main display) and 20.000mA (the current value output by the PCE-789).

5.8 Temperature Measurement

a) Simulation of the Output Signals of the Thermocouples

(for the types K, J, E, T, R, S, N, L, U, B, C, and mV input)

(1) Turn on the device and push the slide switch to "°C °F mV"
(2) Press the S/M button to select the MEASURE (input) mode.
(3) Select a thermocouple in the Setup menu.
(4) Connect the thermocouple to the TC/mV jack.
(5) Finally, connect the thermocouple cable to the measured object.
(6) The display of the PCE-789 shows now the temperature of the measure object.
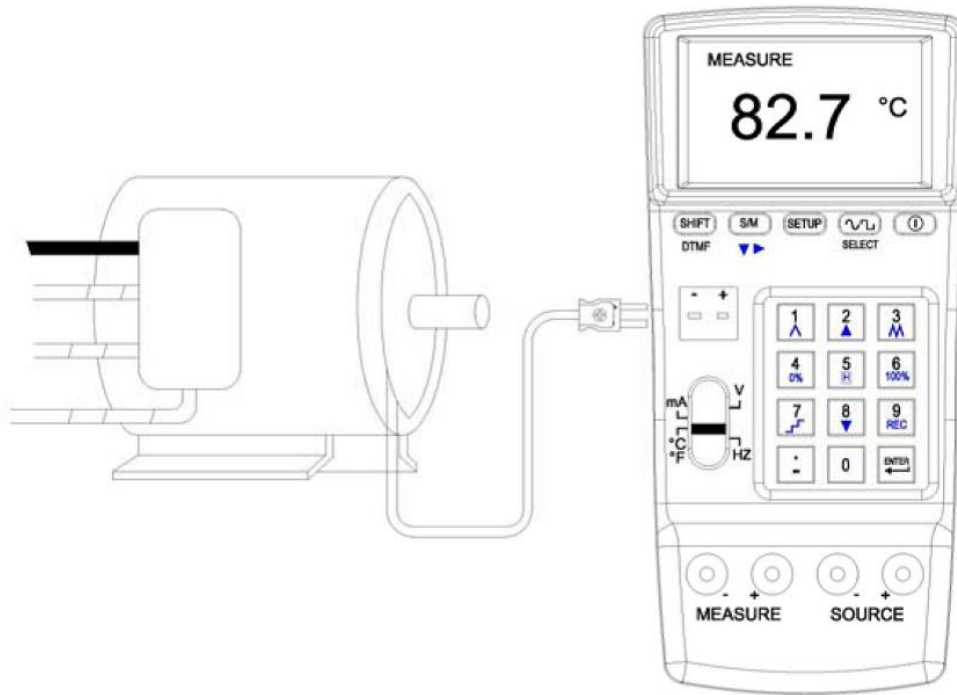
Note:

1. The measurement result is displayed with 5 digits (incl. digits after the decimal point).

Warning:

1. Do no measure voltage over 30V at the MEASURE jacks to avoid the damage of the PCE-789.
2. Always make only one measurement at the same time and connect only the sockets required for this. Disconnect all the unused sockets. Connect the measuring cable only with one socket type (SOURCE or MEASURE or TC).

b) Setup instructions

(1) Press SETUP to enter the SETUP menu.
(2) C.J.COMP.: set the RJC.
(3) TC TYPE: Set the thermocouples.
(4) UNIT: Here you can choose between °C and °F.

```
TC 0%:              100.0 °C
TC 100%:           1000.0 °C

C.J.COMP.:            0.0 °C
TC TYPE:                K
UNIT:                   °C
                press DIGITS
```

c) Setup Details
(1) Press S/M to select the desired option.
(2) The desired value can be entered when the appropriate option is in a reverse black / white mode.
(3) C.J.COMP.: here a value for CJC can be set (the standard value is 0.0°C. A compensation between -5°c and +5°C corresponding to the ideal output values can be set).
(4) If the option "TC TYPE" has been selected, the desired thermocouple can be selected with the button SELECT.
(5) If the option "UNIT" has been selected, °C or ° F can be selected with the help of the button SELECT.

6   Ramp Function

6.1   Ramp function for voltage sampling (as a source)

a) Setup instructions

(1) Press SETUP to enter the SETUP menu.
(2) V 0%: sets the voltage starting value.
(3) V 100%: sets the voltage end value.
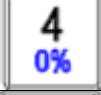
```
V 0%:               4.000V
V 100%:            15.000V

SAMPLE:              1 SEC
FILE NAME:        MAIN0001
                press DIGITS
```
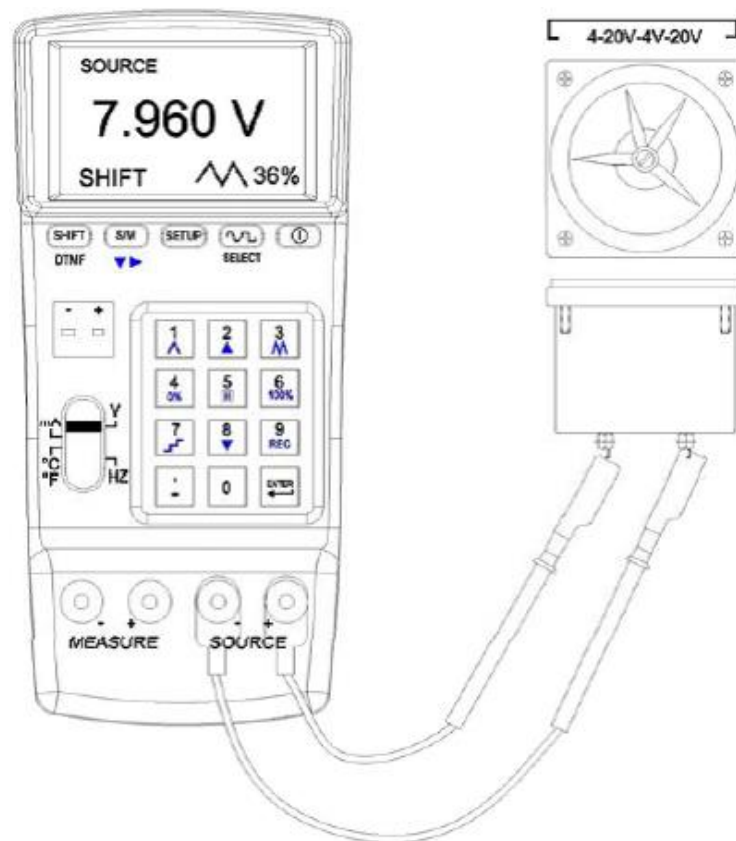
Note:

1. The users may enter maximum 5 digits.
2. If you enter a voltage value (incl. digits after the decimal point), and then press ENTER, the PCE-789 outputs this voltage value.
3. If the output value is < 0, please, enter the minus first.
4. If the output value is < 1 and > 0, please, enter "0" first.

b) Ramp Function

Press the SHIFT and the display shows you various functions in the lower left part. See the following table.

	Functions
1 ∧	Ramp sampling 1% 2% … 100% 99% … 2% 1%
2 ▲	Manual multi-stage sampling (gradual increase) One press of this button: +25% (up to 100%)
3 Ʌ/Ʌ	Fast ramp sampling 4% 8% … 100% 96% … 8% 4%
4 0%	Set to the start value 0%
5 H	Press this button to stop sampling (HOLD)
6 100%	Set to the end value 100%
7 ⌐_	Automatic multi-stage sampling (gradual increase and decrease) 0% 25% 50% 75% 100% …
8 ▼	Manual multi-stage sampling (gradual decrease) One press of this button: -25% (up to max. 0%)

Example of Connecting the Measuring Cable (for fast and multistage sampling)

Connection for fast ramp sampling
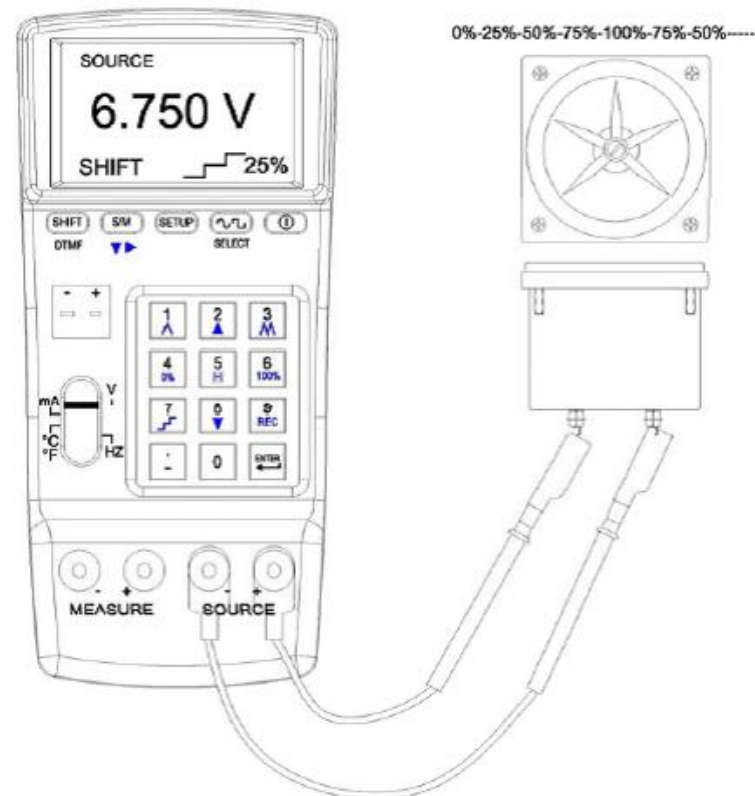
Connection for multistage sampling

6.2   Ramp Function for Current Sampling (as source)

a) Setup instructions
(1) Press SETUP to enter the SETUP menu.
(2) V 0%: sets the current starting value.
(3) V 100%: sets the current end value.

```
mA 0%:                 4.000mA
mA 100%:              20.000mA

4mA   →               0.0000KW
20mA  →               100.00KW
MAPPING                    YES
                    press DIGITS
```
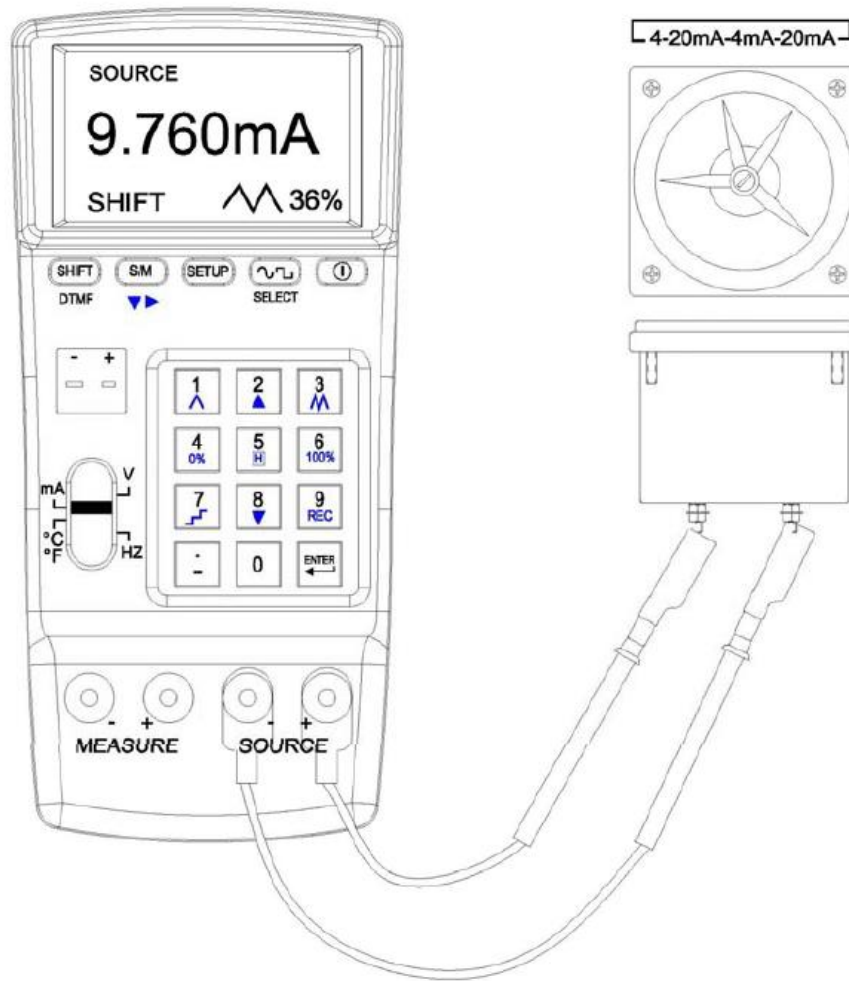
Note:
1. The users may enter maximum 5 digits.
2. If you enter a current value (incl. digits after the decimal point), and then press ENTER, the PCE-789 outputs this parameter value.
3. If the output value is < 0, please, enter the minus first.
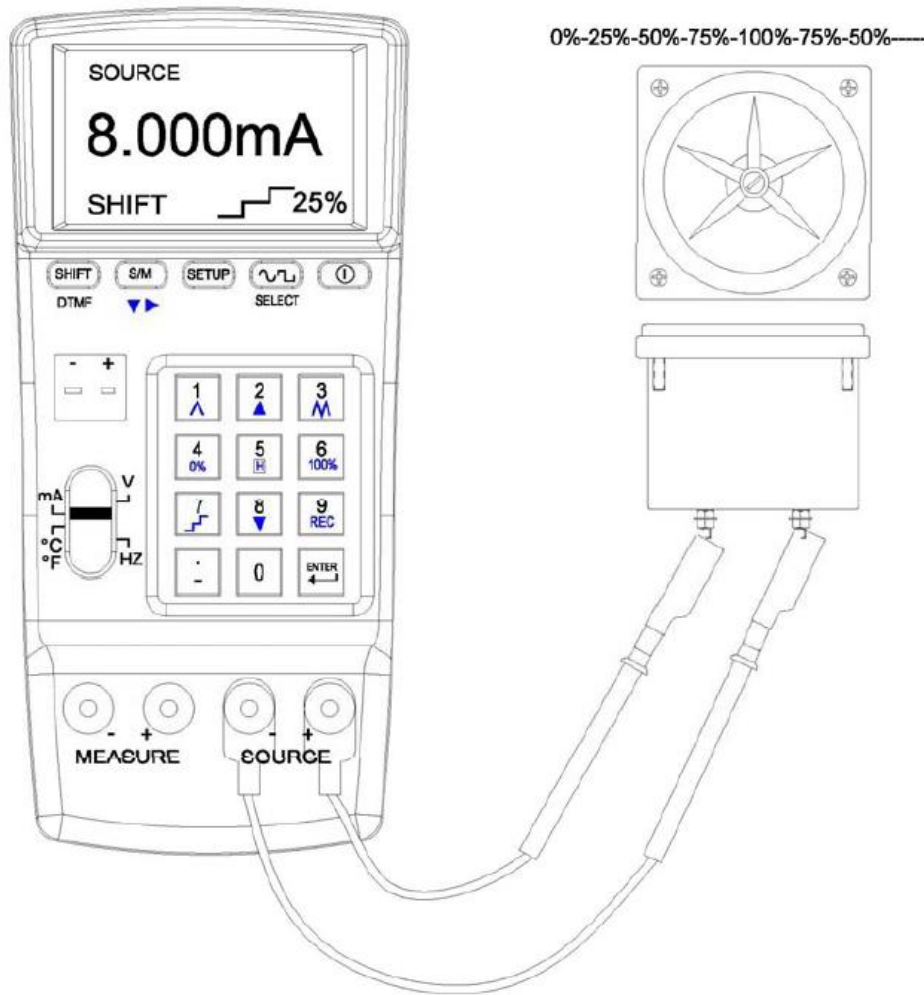4. If the output value is < 1 and > 0, please, enter "0" first.

b) Functions of the Ramp Function
Press the SHIFT key and the display shows you various functions in the lower left part. See the following table.

		Functions
1 ∧		Ramp sampling 1% 2% … 100% 99% … 2% 1%
2 ▲		Manual multi-stage sampling (gradual increase) One press of this button: +25% (up to 100%)
3 M		Fast ramp sampling 4% 8% … 100% 96% … 8% 4%
4 0%		Reset to the start value 0%
5 H		Press this button to stop sampling (HOLD)
6 100%		Reset to the end value 100%
7		Automatic multi-stage sampling (gradual increase and decrease) 0% 25% 50% 75% 100% …
8 ▼		Manual multi-stage sampling (gradual decrease) One press of this button: -25% (up to max. 0%)

c) Example of Connecting the Measuring Cable (for fast and multistage sampling)

Connection for fast ramp sampling

Connection for multistage sampling

6.3　Ramp Function for Temperature Values (as source)

a)　Setup Instructions
(1)　Press SETUP to enter the SETUP menu.
(2)　TC 0%: sets the temperature starting value.
(3)　TC 100%: sets the temperature end value.

```
┌─────────────────────────────────────────┐
│ TC 0%:              ▐100.0 °C▌           │
│ TC 100%:             1000.0°C            │
│                                          │
│ C.J.COMP.:              0.0°C            │
│ TC TYPE:                   K             │
│ UNIT:                     °C             │
│                    press DIGITS          │
└─────────────────────────────────────────┘
```
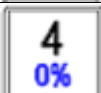
Note:
1. The users may enter maximum 5 digits.
2. If you enter a temperature value (incl. digits after the decimal point), and then press ENTER, the PCE-789 outputs this parameter value.
3. If the output value is < 0, please, enter the minus first.
4. If the output value is < 1 and > 0, please, enter "0" first.

b) **Functions of the Ramp Function**

Press the SHIFT key and the display shows you various functions in the lower left part. See the following table.

		Functions
1 ∧		Ramp sampling 1% 2% … 100% 99% … 2% 1%
2 ▲		Manual multi-stage sampling (gradual increase) One press of this button: +25% (up to 100%)
3 M		Fast ramp sampling 4% 8% … 100% 96% … 8% 4%
4 0%		Reset to the start value 0%
5 H		Press this button to stop sampling (HOLD)
6 100%		Reset to the end value 100%
7 ⌐		Automatic multi-stage sampling (gradual increase and decrease) 0% 25% 50% 75% 100% …
8 ▼		Manual multi-stage sampling (gradual decrease) One press of this button: -25% (up to max. 0%)

c) Example of Connecting the Measuring Cable (for fast and multistage sampling)

Connection for fast ramp sampling

Connection for multistage sampling

7 Data Logging

7.1 Use of the Data Logger

The data logger functions are available for all measuring ranges, except Hz.

a) Instructions

(1) The user can set the value for SAMPLE and FILE NAME only in V measuring ranges. These settings are automatically taken for the other measuring ranges (mA, …).
(2) Press SETUP to enter the setup menu.
(3) SAMPLE: set the sample time for the data logger.
(4) FILE NAME: data can be stored under different file names. Here the data name can be set. (however, this function is available only when the sample time is set to "0".)

```
V 0%:                    4.000V
V 100%:                 15.000V

SAMPLE:                   1 SEC
FILE NAME:            MAIN0001

                  press DIGITS
```
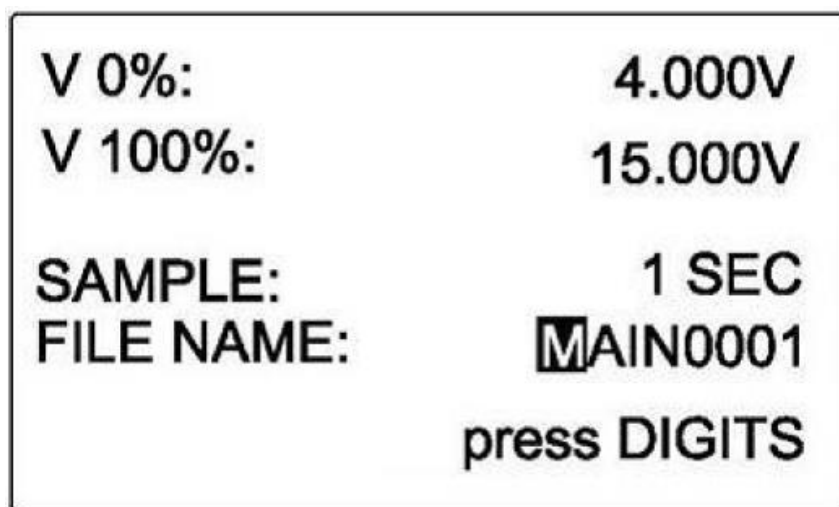
b) Data Logging for V, mA and Temperature (°C and °F)

(1) The data logger function can be used in both modes (SOURCE and MEASURE). However, the data cannot be stored in different measuring ranges or in different modes (when SAMPLE is set to "0", many single memory values can be stored in the same file).
(2) To use the data logger function, press SHIFT and "SHIFT" at the bottom left on the display. Press 9 REC to start the data storage.
(3) To end the data saving process, repeat step (2). To continue – repeat it again.
(4) If the user wants the data for a different mode, the memory must be cleared first (do not forget to save the data before deletion. More details you may find in the Software manual).

c) Storing the Data Under FILE NAME

This data saving can be carried out in all measuring ranges (V, mA, ° C and ° F) and in all modes (SOURCE and MEASURE). The logged data can be saved in the FILE NAME's (filename) set by the user.

(1) If the data should be saved in the FILENAME's (filename), the SAMPLE (-time) must be set to "0".
(2) To use the data logger function, SHIFT and "SHIFT" at the bottom left on the display. Press 9 REC to start the data saving process.
(3) The data saving can be carried out for different data in all measuring ranges or modes
be performed. The users must follow the above-mentioned procedures to continue the data storing.

7.2   Storing Single Value

a)   Instructions for Data Logging

(1) The user can set the value for SAMPLE and FILE NAME only in V measuring range. These settings are automatically for the other measurement ranges (mA, ...).
(2) Press SETUP to enter the setup menu.
(3) SAMPLE: Set the sample time for the data log to "0".
(4) FILENAME: data can be stored under different file names. Here, the Filename can be set. (See ASCII codes)

```
V 0%:                    4.000V
V 100%:                 15.000V

SAMPLE:                  0 SEC
FILE NAME:            MAIN0001

                    press DIGITS
```
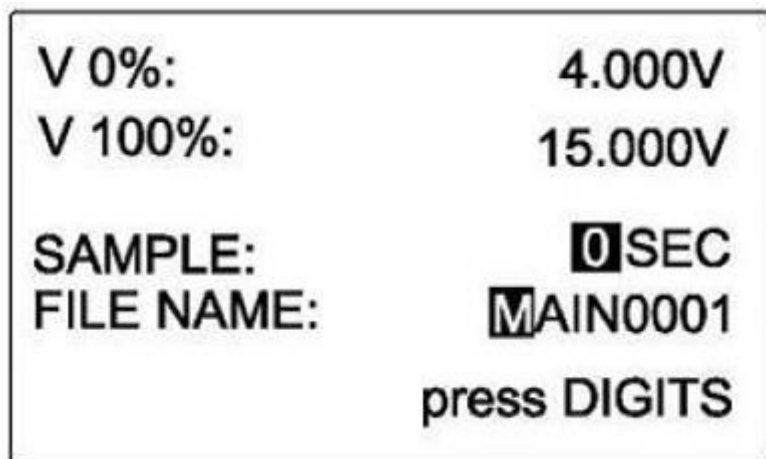
b)   Start of the Storing Process

(1) In all measuring ranges / modes except the Hz measuring range, "SHIFT" appears at the bottom left on the display when you press SHIFT. Then press (REC 9) to save the single reading under FILENAME.
(2) In all measuring ranges / modes the individual measurement values can be saved under the same FILENAME
(3) To continue the data logging in each measuring range, the step 1 described above must be repeated.

7.3   Ongoing Data Storage

a)   Instructions for Data Logging

(1) The user can set the value for SAMPLE and FILE NAME only in V ranges. These settings are automatically taken for the other measurement ranges (mA, ...)
(2) Press SETUP to enter the setup menu.
(3) SAMPLE: Set the sample time for data logging (between 1 ~ 255 sec.)
(4) FILE NAME: for the continuous data storage it is not possible to save the data under different file names (FILE NAME) to save. In this mode no FILE NAME must be entered.

```
V 0%:                    4.000V
V 100%:                  5.000V

SAMPLE:                  1SEC
FILE NAME:               MAIN0001

                         press DIGITS
```

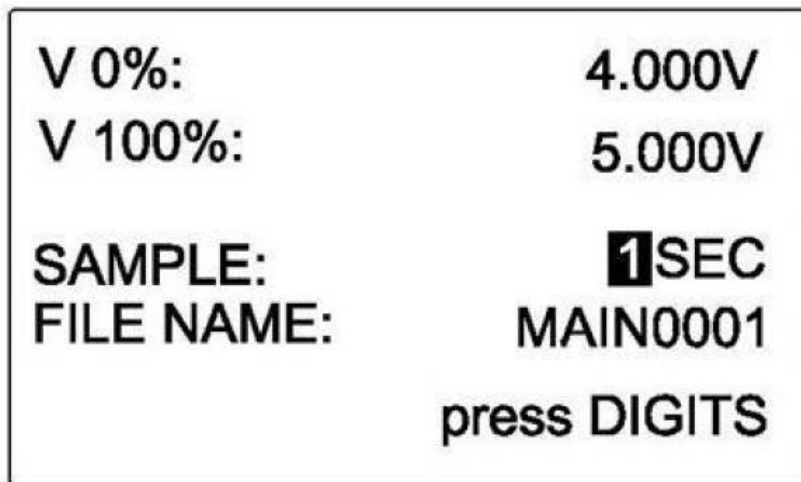**b) Start of the Storing Process**

(1) In all ranges / modes except the Hz range, "SHIFT" appears at the bottom left on the screen when you press SHIFT. Then press 9 REC to start the continuous data storing with the set sample time.
(2) To interrupt the storing process, repeat step 1.
(3) In this mode, no data can be logged in another measuring range or mode. To store the data for another measuring range, the existing data must be first downloaded or deleted.

7.4 Delete and Download Data

(1) Delete data: Turn off the device. Press 9 REC and POWER simultaneously, till the device has beeped twice. After that, the memory is cleared.
(2) Download data: first, install the supplied software on your PC and download the data from the PCE-789 (see the details in the software manual).

8 Remote Control via PC

1. The baud rate between PC and PCE-789 is 460800Bps.
2. The following table shows the PC-keys corresponding to the PCE-789.

9 Maintenance and Cleaning

9.1 Charging the battery pack

1. There is a rechargeable lithium battery pack in the PCE-789.
2. After turning the device on, you see the remaining battery charge displayed.
3. When the remaining battery charge is less than 10%, we recommend to charge the battery with the supplied PSU (adapter).
4. To charge the battery, you should follow the following steps:
    (1) Plug the adapter into the socket.
    (2) Connect the adapter to the PCE-789
    (3) Turn on the device PCE-789.

9.2 Cleaning

Clean the device with a damp cloth and possible gentle cleanser. Do not use any abrasives or solvents!

10 Disposal

For the disposal of batteries, 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.

If you have any questions, please contact PCE Instruments.

Annex 1 ASCII-Table

Decimal	ASCII	Decimal	ASCII	Decimal	ASCII	Decimal	ASCII
32		71	G	110	n	149	²
33	!	72	H	111	o	150	∞
34	„	73	I	112	p	151	€
35	#	74	J	113	q	152	∩
36	$	75	K	114	r	153	±
37	%	76	L	115	s	154	≧
38	&	77	M	116	t	155	≦
39	,	78	N	117	u	156	α
40	(	79	O	118	v	157	β
41	)	80	P	119	w	158	γ
42	*	81	Q	120	x	159	δ
43	+	82	R	121	y	160	ε
44	,	83	S	122	z	161	ζ
45	-	84	T	123	{	162	η
46	.	85	U	124	|	163	θ
47	/	86	V	125	}	164	ι
48	0	87	W	126	~	165	κ
49	1	88	X	127	°	166	λ
50	2	89	Y	128	⌁	167	μ
51	3	90	Z	129	μ	168	ν
52	4	91	[	130	🔔	169	ξ
53	5	92	\	131	⬆	170	o
54	6	93	]	132	⬇	171	π
55	7	94	^	133	⬅	172	ρ
56	8	95	_	134	➡	173	σ
57	9	96	`	135	▲	174	τ
58	:	97	a	136	▼	175	υ
59	;	98	b	137	◄	176	Φ
60	<	99	c	138	⬇	177	χ
61	=	100	d	139	Λ	178	ϕ

62	>	101	e	140	△	179	ω
63	?	102	f	141	千	180	Γ
64	@	103	g	142	万	181	Σ
65	A	104	h	143	元	182	Φ
66	B	105	i	144	丹	183	Ω
67	C	106	j	145	X		
68	D	107	k	146	$\mathcal{X}$		
69	E	108	l	147	$\mathcal{P}$		
70	F	109	m	148	$\mathcal{Z}$		

11 Contact

If you have any questions about our range of products or measuring instruments please contact PCE Instruments.

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