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Penetrometer PCE-PTR 200

MANUAL



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1 Introduction

The Penetrometer PCE-PTR 200 penetrometer is very useful for testing the maturity of fruits. This digital penetrometer offers higher accuracy and resolution than any other analogue device. With 20 kg it has a high capacity. The indication units can be selected from kg, lb and N. Thus it also offers the option of measuring compressive and tractive forces. The penetrometer supports saving not only the current measurements, but also the maximum value. In all modes the penetrometer can be set back to 0, whilst the tare function can be performed over the whole measurement range. The penetrometer PCE-PTR supports many features, amongst which is a key for quick and slow response times, whilst the display can be selected for forward or backwards- indication. The device can be also installed at a stand for a fixed measurement point. The battery consumption is very low, while it can also function on an adapter. The battery state is indicated by the device, so the operator is always informed about the power consumption of the device. The penetrometer features a microprocessor switch and an overload protection. Additionally the device can be purchased with an optional test stand.

2 Safety Precautions

Please read the following instruction manual before operating with the device. Damages caused by disregard of the instructions written in this manual, are excluded from any warranty or liability.

- This device is only designed for the applications mentioned in this manual. In case the device is used for any other application than these, it might lead to hazardous situations.
- Do not expose the device to extreme temperatures, direct sunlight, extreme air humidity or liquids.
- The device may be opened only by specialized personnel of PCE instruments
- Do not operate the device with wet hands.
- Technical alternations on the device are not allowed.
- The device should be only cleaned with a damp cloth. Do not use scrubbing agents or or detergents of any kind.
- The device may be only combined with the optional equipment provided by PCE instruments or comparable alternatives.
- Please check the prior to every operation the enclosure of the device on any visible damages. In case there appears any visible damage, refrain from any further application of the device.
- Furthermore the device may not be applied in any areas where the surrounding conditions (e.g. temperature, air humidity ...) deviate from the specifications and limits listed in this manual, any application of the device is prohibited.
- The device cannot be used in explosion-hazardous areas.
- A disregard of these instructions can lead to a damage of this device and serious injuries.

For any further information feel free to contact PCE Instruments.

3 Delivery Content

- PCE-PTR 200 penetrometer
- User manual
- Sensor with 6 mm diameter
- Sensor with 8 mm diameter
- Sensor with 11 mm diameter
- Two spacing washers
- Carrying case

4 Technical Specifications

Display:	5-digit, 10 mm LCD
Indication direction:	eligible with button on the front of the device
Function:	Measurement of tractive and compressive forces
Peak Hold:	saves the maximum value
ZERO:	Zero setting for standard mode and max-load mode
Measurement range:	20 kg / 44.10 lb / 196.10 N
Resolution:	1 g / 0.05 oz / 0.01 N
Minimum indication:	0.03 kg / 0.07 lb / 0.3 N
Accuracy:	±0.5 % of reading + 2 digit
Range selection:	kg, N, lb
Refreshing the measurement value:	every 0.2 s in quick mode / every 0.6 s in slow mode
Indication range:	Indicates “---“ if measurement range is trespassed
Overload:	max. 30 kg
Power Supply:	6 x 1.5 V batteries or DC 9 V adapter
Operation temperature:	0 ... 50 °C, <80 % rH
Dimensions:	227 x 83 x 39 mm
Function:	measurement of penetration force into fruits

5 Detailed description of device

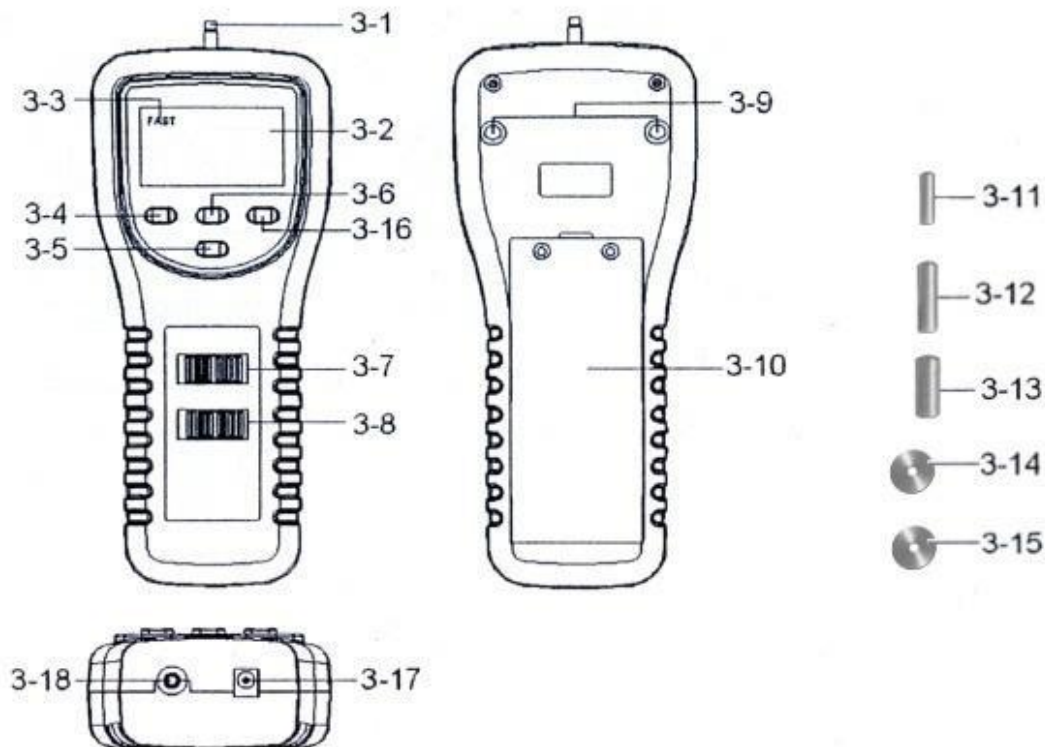


Fig.1

3-1	Load cell head	3-10	Cover for battery compartment
3-2	LCD display	3-11	Sensor with 6 mm diameter
3-3	Quick indicator	3-12	Sensor with 8 mm diameter
3-4	Key for quick / slow mode	3-13	Sensor with 11.3 mm diameter
3-5	Adjustment of LCD display direction	3-14	Arrestor ring
3-6	Key for zero setting	3-15	Arrestor ring
3-7	Button to select measurement unit	3-16	Display light
3-8	ON / OFF button (0= OFF / 1 = ON)	3-17	Adapter 9 V
3-9	Blind hole to attach the device to a test stand	3-18	PC interface (3.5 mm phone jack)

6 Measuring Procedure

6.1 Selecting the measuring samples

It is important to perform this process prior to the measurement in the right way in order to gain significant measurement values. Those will help determining the right harvest time. First make sure that the measurement samples represent a characteristic extract from the whole harvest (minimum number of samples, size, quality, etc...). It is advised to set up a separate protocol for the sampling, which will be valid for a maximum of one year, e.g.: 10 to 15 days prior to the usual harvest time, you should start collect every 3 to 4 days a sample of 10 – 15 fruits. These samples should be representative for the whole range of fruits from that harvest. It is important that the samples have a relatively comparable size, since the stiffness correlates with the size of the fruits (the bigger, the more rigid they are). It is also important that the samples are wholesome and undamaged and not

affected by any kind of plague or physical damages. Those samples can be also taken from transported or stored fruits.

6.2 Preparation of the measurement sample

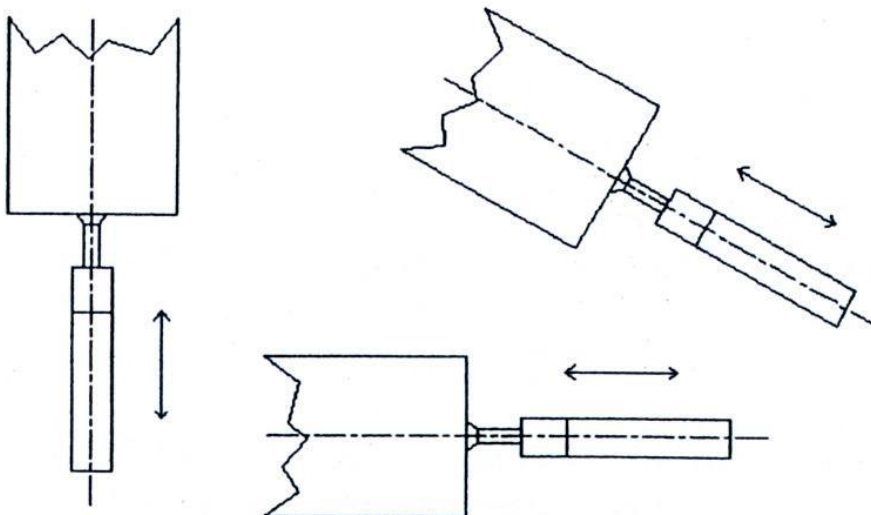
Perform two measurements at the middle of the fruit from opposite sides. Thus the device calculates the mean value of those two.

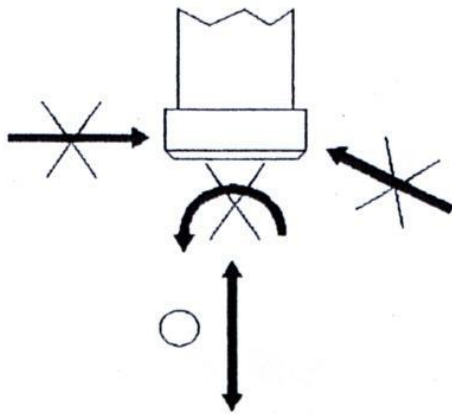
- Select the measurement points and remove the peel from these areas. The diameter of the peeled area should be a little more than the diameter of the probe.
- The selected measurement probe depends on the type of fruit and its mellowness.
- Usually the smaller probes are used for harder and smaller measurement objects, while the larger probes are used for soft and large fruits.
- It is important to gain repeatable and comparable measurement values.
- The fruits should all have the same temperature, since it determines the stiffness of the fruit as well (the higher the temperature, the less harder the fruit).

6.3 Important notes for measurement

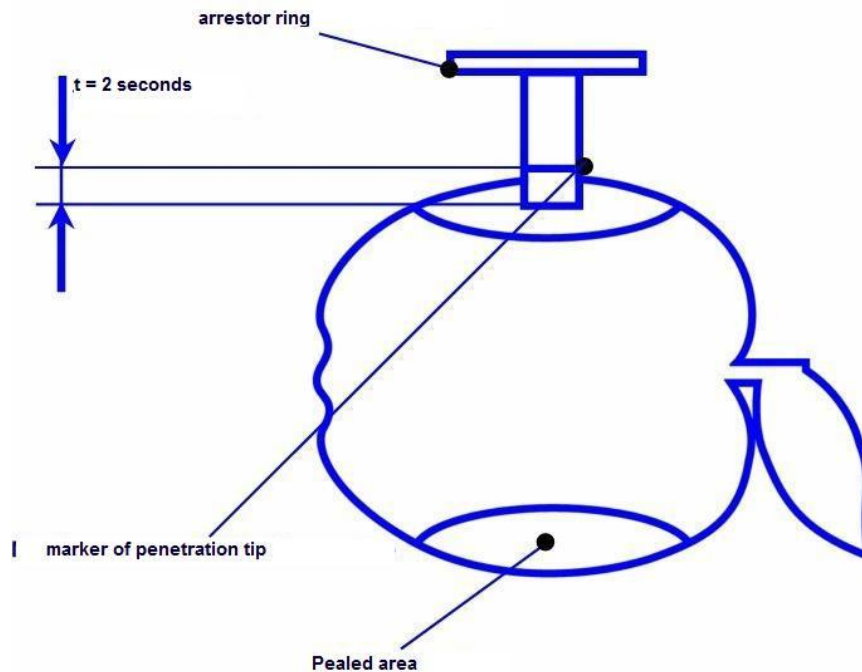
You can start measuring both measurement points with the digital penetrometer as soon as you have selected the accordant measuring probe and measurement samples (as described in the previous paragraphs). In order to gain accurate values for the measurement, it is important to follow the following notes:

- Fix the measurement object on a plane and hard surface (e.g. on a table or a plate), when you are performing the measurement. Thus you will be able to apply an even pressure by means of the penetrometer, when you have a rigid resistance.
- Pay attention to maintain the same direction of the head of the measurement device, as well as the probe tip and the measurement object during the measurement process. Apply the pressure always vertically. Other measurement angles are not allowed.





- Apply a slow and consistent pressure with the penetration tip until you reach the marked penetration slit on the penetration tip. An inconsistent pressure can falsify the measurement. The whole process should not take more than 2 seconds.



- Try repeating the measurements under the same conditions, so that you achieve repeatable values for comparisons and for statistical purposes.
- In order to maintain a higher accuracy, you should use a test stand. This test stand enables you to apply an even pressure with a constant penetration angle, and thus the repeatability can be increased.

6.4 Standard measurement

- Switch on the penetrometer by pressing the "Power on"-button [3-8] (0= OFF, 1 = ON)
- Insert the sensor head with the relevant penetration probe vertically into the measurement object.
- Start the measurement by applying a slow and consistent pressure on the device.
- Set the measuring unit (kg, lb or Newton) [3-7]
- Check the zero point of the device, and set it prior to the measurement on zero, if necessary. Therefore press the button "zero / TARE" [3-6].

- The measurement will start as soon as you apply pressure, or pull on it. The display will then indicate the mean value.

Note:

- ! In case you might need to change the indication order of the display, simply press the “reverse”- key [3-5]
- ! The sampling rate of the display can be set to either “fast” or “slow” by pressing the key “FAST / SLOW”. If the symbol ((°)) appears at the left upper corner of the display, the sampling rate is set on „fast“. If not, the device is set on “slow”.
- ! An overload of the device during tension, will be shown in in the display by “-----”.
- ! An overload of the device during pressure will be indicated on the display by “-----”.
- ! For more information feel free to call PCE instruments ►UK customers +44(0) 23 809 870 30 / ►US customers +1-410-387-7703

6.5 Peak Load measurement

- Switch on the device by pressing the “Power on” button [3-8] (0 = OFF, 1 = ON)
- Set unit (kg, lb or Newton) [3-7]
- Connect the sensor head with the relevant adapter in one line with the measured object. Do not apply any pressure at that time!
- Check the zero point of the device and set, if necessary, the device to “0” by pressing the “zero/tare” button.[3-6]
- Set the switch “Peak on / Peak off” into the “on” position [3-8].
- Start the measurement by applying pressure or by pulling the device. The LCD display will then indicate the highest value, that was reached.

7 Change battery

In case you need to change the batteries (battery voltage under approx.. 6.8 V), the display will indicate “LO”.

1. Remove the screws from the cover of the battery compartment [3-10], if necessary.
2. Open the battery compartment and remove all the old batteries and insert the new batteries accordingly.

Note:

- ! If the battery is not inserted with the right connection of the “+”- and “-“ -pole, it might lead to permanent damages of the device.

8 Computer Interface

The penetrometer features a computer interface, which allows transferring the measured data to a computer. The device’s data output is a 16 Bit data string, that can be connected to a serial input on the computer. To connect the device with the computer, you will need the following interface cable:

Device (3.5mm phone jack)	Computer (9W „D“ jack)
PIN 2.....	PIN 2
PIN 5.....	PIN 5

The 16 Digit data set has the following format:

D15 / D14 / D13 / D12 / D11 / D10 / D9 / D8 / D7 / D6 / D5 / D4 / D3 / D2 / D1 / D0

The Digits have the following state:

D0	End
D1 & D8	Value on display, e.g. the display indicates "1234" then D8 – D1 will be occupied as: "00001234"
D9	Position of decimal point (DP) (0 = no DP, 1= DP on 2, 3= DP on 3)
D10	Prefix (0= no prefix, 1= "-" prefix)
D11 & D12	set unit (g=57, Newton=59, oz=58)
D13	reserved with "1"
D14	reserved with "4"
D15	Start

9 Montage gadget

The penetrometer is a very precise and thus a very sensitive device. Thus it might be advised to attach the device to a test stand (optional) to perform a precise measurement. The montage gadget is at the backside of the device.

10 Table with reference values for the fruits mellowness

The following table is an overview of the reference values for the fruits' mellowness during harvest time. We recommend generating your own table for your fruits, since the values depend on the cultivation, surrounding conditions, climate etc.

The recommended mean values are listed in the following table in kg/cm² (applied tensile / compressive force) and must be seen with a tolerance of ±0.5 kg/cm². All values, which are within this range, are effective for the harvest of those fruits. We recommend to follow the values that are valid in the specific conditions, your harvest was cultivated, since the values shown in the table should be a general reference.

The measurement should be performed with a probe of Φ 11.3 mm diameter for apples and a probe of Φ 8 mm diameter for other fruits (e.g. peaches, pears, plum). The penetration tip of Φ 6 mm diameter is recommended for smaller fruits (e.g. cherries).

FRUIT	SORT	MELLOWNESS (*) [kg/cm ²]
Pear	William's / Guyot	6.5
	Conference	5.5
	Abate Fetel	5
	Comice	4.5
Apple	Staymanred	7.5
	Stark Delicious	6
	Golden Delicious / Granny Smith	5.5
Plum	Calita	2.5
	Golden Japan / Ozark Premier	3
Peach	Creasthaven, Suncrest, Flavor Top, Red Haven	6

(*) reference value

The penetrometer PCE-PTR 200 can indicate the applied force in gramm. If you wish to view the force applied on the fruit in kg/cm^2 , you will have to include the diameter of the measurement probe in your calculation.

In the following you can view the reference values and graphs showing the difference between the indicated force and actual force in kg/cm^2 , depending on the measuring probe. The DIN-tables are organized according to the recommended range for each sort of fruit:

- Range 0-1 kg (recommended for fruit sorts like grapes, cherries,...), measurement probe with Φ 6 mm diameter.
- Range 0-5 kg (recommended for plums, lemons and fruits with mediocre stiffness), for measurement probe of Φ 6mm to Φ 8 mm diameter.
- Range 0-13 kg (recommended for apples, pears, plums and kiwis), with measurement probe of Φ 8 mm or Φ 11.3 mm diameter.
- Range 0-20 kg (recommended for very hard fruits), measurement probe with Φ 11.3 mm diameter.

Range 0-1 kg – penetration probe with Φ 6mm (0.28 cm^2)

Indication on Penetrometer [g]	Applied pressure [kg/cm^2]
5	0.02
10	0.04
15	0.05
20	0.07
25	0.09
30	0.11
35	0.12
40	0.14
45	0.16
50	0.18
55	0.19
60	0.21
65	0.23
70	0.25
75	0.27
80	0.28
85	0.30
90	0.32
95	0.34
100	0.35
105	0.37
110	0.39
115	0.41
120	0.42
125	0.44
130	0.46
135	0.48
140	0.50
145	0.51

Indication on Penetrometer [g]	Applied pressure [kg/cm^2]
150	0.53
155	0.55
160	0.57
165	0.58
170	0.60
175	0.62
180	0.64
185	0.65
190	0.67
195	0.69
200	0.71
205	0.73
210	0.74
215	0.76
220	0.78
225	0.80
230	0.81
235	0.83
240	0.85
245	0.87
250	0.88
255	0.90
260	0.92
265	0.94
270	0.95
275	0.97
280	0.99
285	1.01
290	1.03

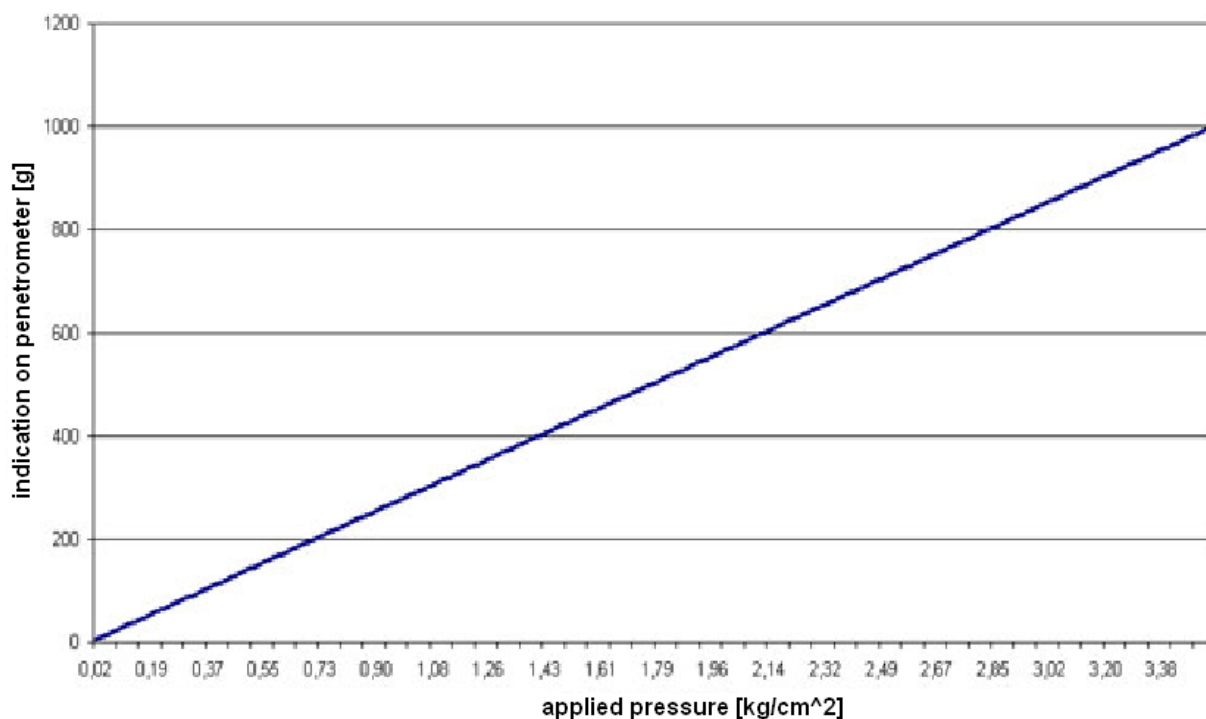
Indication on Penetrometer [g]	Applied pressure [kg/cm^2]
295	1.04
300	1.06
305	1.08
310	1.10
315	1.11
320	1.13
325	1.15
330	1.17
335	1.18
340	1.20
345	1.22
350	1.24
355	1.26
360	1.27
365	1.29
370	1.31
375	1.33
380	1.34
385	1.36
390	1.38
395	1.40
400	1.41
405	1.43
410	1.45
415	1.47
420	1.49
425	1.50
430	1.52
435	1.54

Indication on Penetrometer [g]	Applied pressure [kg/cm ²]
440	1.56
445	1.57
450	1.59
455	1.61
460	1.63
465	1.64
470	1.66
475	1.68
480	1.70
485	1.72
490	1.73
495	1.75
500	1.77
505	1.79
510	1.80
515	1.82
520	1.84
525	1.86
530	1.87
535	1.89
540	1.91
545	1.93
550	1.95
555	1.96
560	1.98
565	2.00
570	2.02
575	2.03
580	2.05
585	2.07
590	2.09
595	2.10
600	2.12
605	2.14
610	2.16
615	2.18
620	2.19
625	2.21

Indication on Penetrometer [g]	Applied pressure [kg/cm ²]
630	2.23
635	2.25
640	2.26
645	2.28
650	2.30
655	2.32
660	2.33
665	2.35
670	2.37
675	2.39
680	2.41
685	2.42
690	2.44
695	2.46
700	2.48
705	2.49
710	2.51
715	2.53
720	2.55
725	2.56
730	2.58
735	2.60
740	2.62
745	2.63
750	2.65
755	2.67
760	2.69
765	2.71
770	2.72
775	2.74
780	2.76
785	2.78
790	2.79
795	2.81
800	2.83
805	2.85
810	2.86
815	2.88

Indication on Penetrometer [g]	Applied pressure [kg/cm ²]
820	2.90
825	2.92
830	2.94
835	2.95
840	2.97
845	2.99
850	3.01
855	3.02
860	3.04
865	3.06
870	3.08
875	3.09
880	3.11
885	3.13
890	3.15
895	3.17
900	3.18
905	3.20
910	3.22
915	3.24
920	3.25
925	3.27
930	3.29
935	3.31
940	3.32
945	3.34
950	3.36
955	3.38
960	3.40
965	3.41
970	3.43
975	3.45
980	3.47
985	3.48
990	3.50
995	3.52
1000	3.54

applied pressure with penetration probe 6mm (range 0 - 1 kg)



Range 0-1 kg – penetration probe with Φ 6mm (0.28 cm²)

Indication on Penetrometer [g]	Applied pressure [kg/cm ²]
50	0.18
100	0.35
150	0.53
200	0.71
250	0.88
300	1.06
350	1.24
400	1.41
450	1.59
500	1.77
550	1.95
600	2.12
650	2.30
700	2.48
750	2.65
800	2.83
850	3.01
900	3.18
950	3.36
1000	3.54
1050	3.71

Indication on Penetrometer [g]	Applied pressure [kg/cm ²]
1100	3.89
1150	4.07
1200	4.24
1250	4.42
1300	4.60
1350	4.77
1400	4.95
1450	5.13
1500	5.31
1550	5.48
1600	5.66
1650	5.84
1700	6.01
1750	6.19
1800	6.37
1850	6.54
1900	6.72
1950	6.90
2000	7.07
2050	7.25
2100	7.43

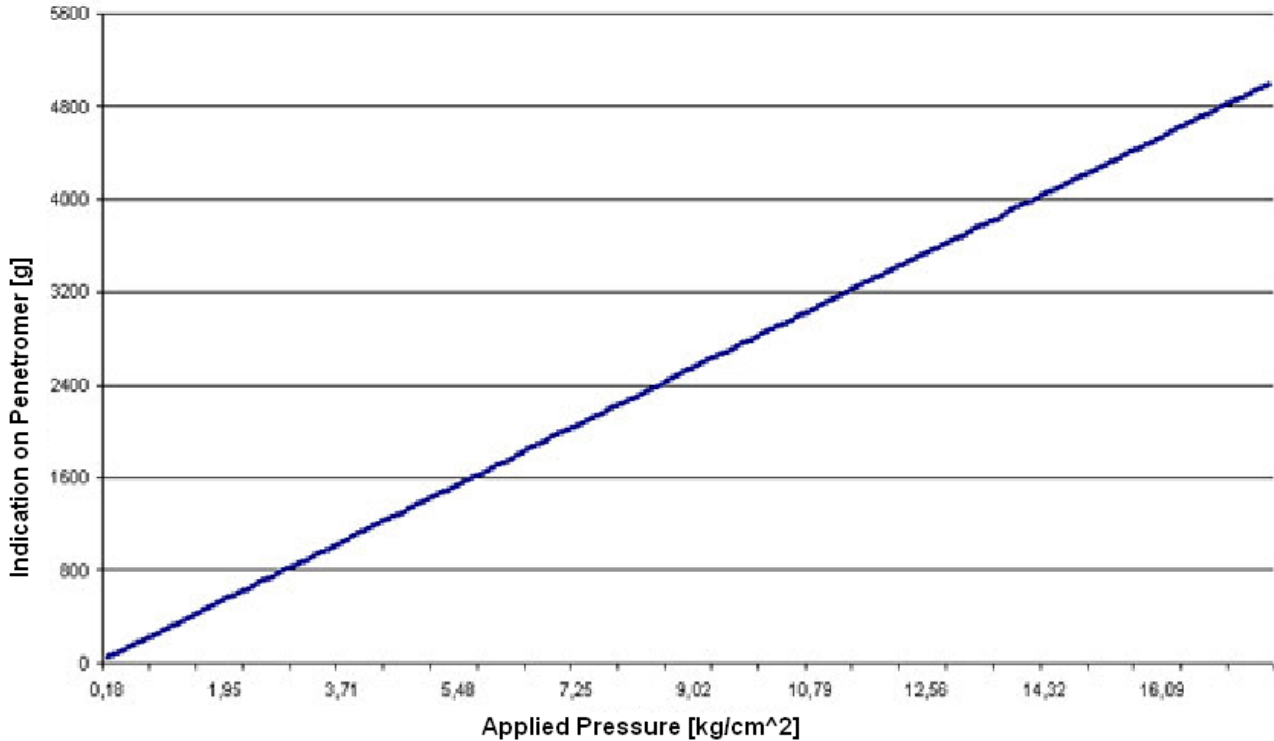
Indication on Penetrometer [g]	Applied pressure [kg/cm ²]
2150	7.60
2200	7.78
2250	7.96
2300	8.13
2350	8.31
2400	8.49
2450	8.67
2500	8.84
2550	9.02
2600	9.20
2650	9.37
2700	9.55
2750	9.73
2800	9.90
2850	10.08
2900	10.26
2950	10.43
3000	10.61
3050	10.79
3100	10.96
3150	11.14

Indication on Penetrometer [g]	Applied pressure [kg/cm ²]
3200	11.32
3250	11.49
3300	11.67
3350	11.85
3400	12.03
3450	12.20
3500	12.38
3550	12.56
3600	12.73
3650	12.91
3700	13.09
3750	13.26
3800	13.44
3850	13.62
3900	13.79
3950	13.97

Indication on Penetrometer [g]	Applied pressure [kg/cm ²]
4000	14.15
4050	14.32
4100	14.50
4150	14.68
4200	14.85
4250	15.03
4300	15.21
4350	15.38
4400	15.56
4450	15.74
4500	15.92
4550	16.09
4600	16.27
4650	16.45
4700	16.62
4750	16.80

Indication on Penetrometer [g]	Applied pressure [kg/cm ²]
4800	16.98
4850	17.15
4900	17.33
4950	17.51
5000	17.68

Applied pressure with penetration tip 6mm (range 0-5 kg)



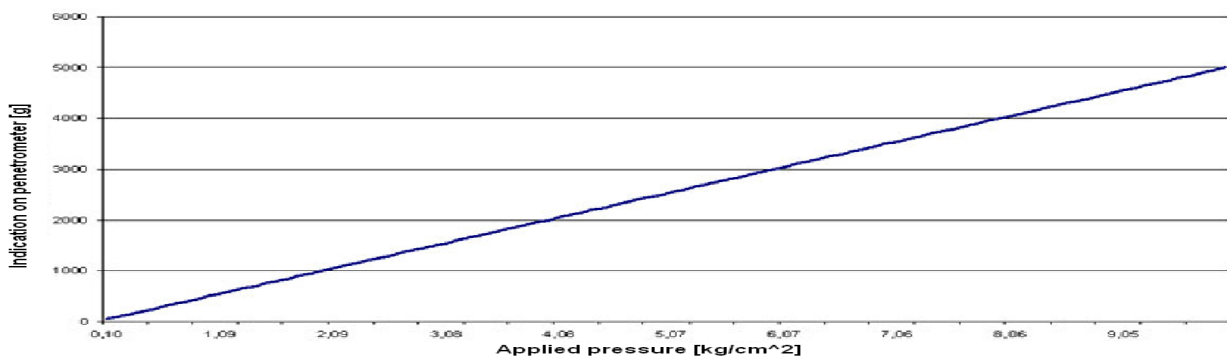
Range 0-5 kg – Penetration tip Ø 8 mm (0.5 cm²)

Indication on Penetrometer [g]	Applied pressure [kg/cm ²]
50	0.10
100	0.20
150	0.30
200	0.40
250	0.50
300	0.60
350	0.70
400	0.80
450	0.90
500	0.99
550	1.09
600	1.19
650	1.29
700	1.39
750	1.49
800	1.59
850	1.69
900	1.79
950	1.89
1000	1.99
1050	2.09
1100	2.19
1150	2.29
1200	2.39
1250	2.49
1300	2.59
1350	2.69
1400	2.79
1450	2.88
1500	2.98
1550	3.08
1600	3.18
1650	3.28
1700	3.38

Indication on Penetrometer [g]	Applied pressure [kg/cm ²]
1750	3.48
1800	3.58
1850	3.68
1900	3.78
1950	3.88
2000	3.98
2050	4.08
2100	4.18
2150	4.28
2200	4.38
2250	4.48
2300	4.58
2350	4.68
2400	4.77
2450	4.87
2500	4.97
2550	5.07
2600	5.17
2650	5.27
2700	5.37
2750	5.47
2800	5.57
2850	5.67
2900	5.77
2950	5.87
3000	5.97
3050	6.07
3100	6.17
3150	6.27
3200	6.37
3250	6.47
3300	6.57
3350	6.66
3400	6.76

Indication on Penetrometer [g]	Applied pressure [kg/cm ²]
3450	6.86
3500	6.96
3550	7.06
3600	7.16
3650	7.26
3700	7.36
3750	7.46
3800	7.56
3850	7.66
3900	7.76
3950	7.86
4000	7.96
4050	8.06
4100	8.16
4150	8.26
4200	8.36
4250	8.46
4300	8.55
4350	8.65
4400	8.75
4450	8.85
4500	8.95
4550	9.05
4600	9.15
4650	9.25
4700	9.35
4750	9.45
4800	9.55
48500	9.65
4900	9.75
4950	9.85
5000	9.95

Applied Pressure with Penetration Tip 8mm (Range 0-5 kg)

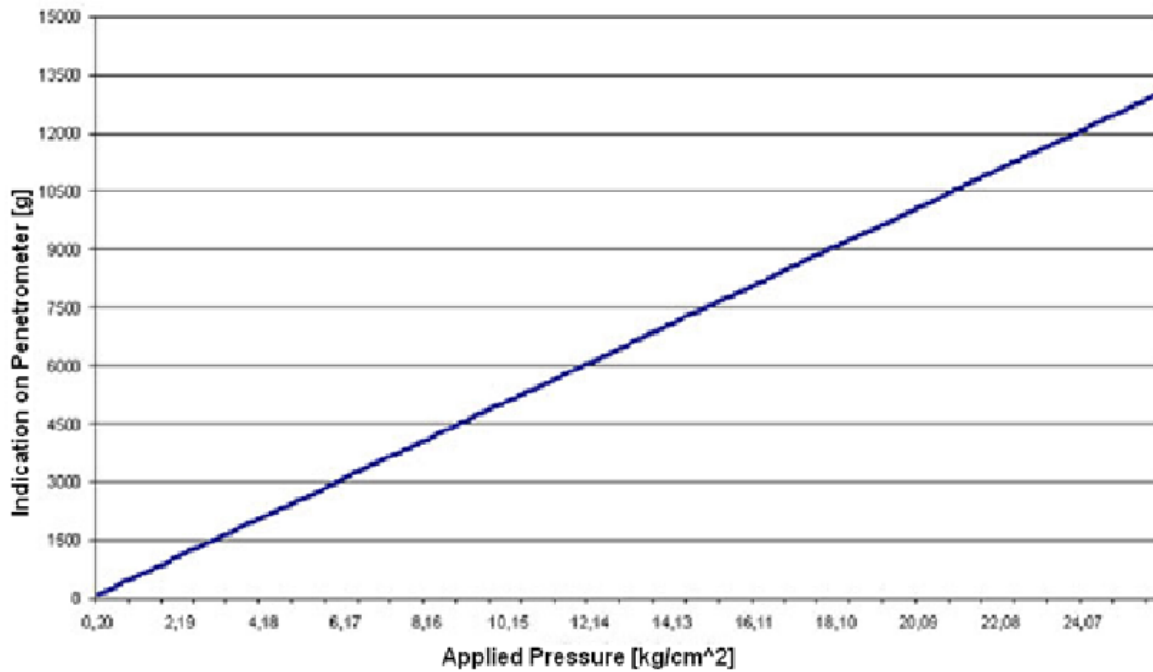
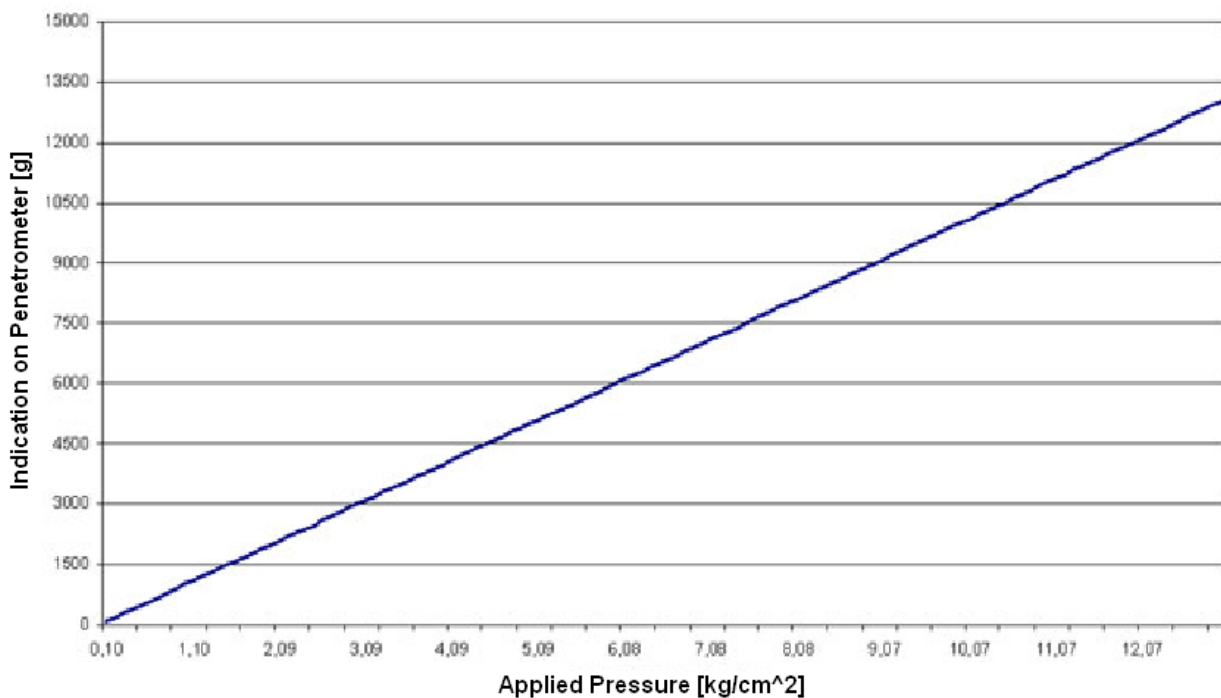


Range 0-13 kg – Penetration Tip Ø 8mm (0.5 cm²)

Indication on Penetrometer [g]	Applied pressure [kg/cm ²]
100	0.20
200	0.40
300	0.60
400	0.80
500	0.99
600	1.19
700	1.39
800	1.59
900	1.79
1000	1.99
1100	2.19
1200	2.39
1300	2.59
1400	2.79
1500	2.98
1600	3.18
1700	3.38
1800	3.58
1900	3.78
2000	3.98
2100	4.18
2200	4.38
2300	4.58
2400	4.77
2500	4.97
2600	5.17
2700	5.37
2800	5.57
2900	5.77
3000	5.97
3100	6.17
3200	6.37
3300	6.57
3400	6.76
3500	6.96
3600	7.16
3700	7.36
3800	7.56
3900	7.76
4000	7.96
4100	8.16
4200	8.36
4300	8.55
4400	8.75
4500	8.95

Indication on Penetrometer [g]	Applied pressure [kg/cm ²]
4600	9.15
4700	9.35
4800	9.55
4900	9.75
5000	9.95
5100	10.15
5200	10.35
5300	10.54
5400	10.74
5500	10.94
5600	11.14
5700	11.34
5800	11.54
5900	11.74
6000	11.94
6100	12.14
6200	12.33
6300	12.53
6400	12.73
6500	12.93
6600	13.13
6700	13.33
6800	13.53
6900	13.73
7000	13.93
7100	14.13
7200	14.32
7300	14.52
7400	14.72
7500	14.92
7600	15.12
7700	15.32
7800	15.52
7900	15.72
8000	15.92
8100	16.11
8200	16.31
8300	16.51
8400	16.71
8500	16.91
8600	17.11
8700	17.31
8800	17.51
8900	17.71
9000	17.90

Indication on Penetrometer [g]	Applied pressure [kg/cm ²]
9100	18.10
9200	18.30
9300	18.50
9400	18.70
9500	18.90
9600	19.10
9700	19.30
9800	19.50
9900	19.70
10000	19.89
10100	20.09
10200	20.29
10300	20.49
10400	20.69
10500	20.89
10600	21.09
10700	21.29
10800	21.49
10900	21.68
11000	21.88
11100	22.08
11200	22.28
11300	22.48
11400	22.68
11500	22.88
11600	23.08
11700	23.28
11800	23.48
11900	23.67
12000	23.87
12100	24.07
12200	24.27
12300	24.47
12400	24.67
12500	24.87
12600	25.07
12700	25.27
12800	25.46
12900	25.66
13000	25.86

RANGE 0-13 kg – Penetration Tip \varnothing 8 mm (0.5 cm^2)**Applied Pressure with Penetration Tip 8 mm (0.5 cm^2)****RANGE 0-13 kg – Penetration Tip \varnothing 11.3 mm (1 cm^2)****Applied Pressure with Penetration Tip \varnothing 11.3 mm [1 cm^2]**

Range 0-13 kg – Penetration Tip Ø 11.3mm (1 cm²)

Indication on Penetrometer [g]	Applied pressure [kg/cm ²]
100	0.10
200	0.20
300	0.30
400	0.40
500	0.50
600	0.60
700	0.70
800	0.80
900	0.90
1000	1.00
1100	1.10
1200	1.20
1300	1.30
1400	1.40
1500	1.50
1600	1.60
1700	1.70
1800	1.79
1900	1.89
2000	1.99
2100	2.09
2200	2.19
2300	2.29
2400	2.39
2500	2.49
2600	2.59
2700	2.69
2800	2.79
2900	2.89
3000	2.99
3100	3.09
3200	3.19
3300	3.29
3400	3.39
3500	3.49
3600	3.59
3700	3.69
3800	3.79
3900	3.89
4000	3.99
4100	4.09
4200	4.19
4300	4.29
4400	4.39
4500	4.49

Indication on Penetrometer [g]	Applied pressure [kg/cm ²]
4600	4.59
4700	4.69
4800	4.79
4900	4.89
5000	4.99
5100	5.09
5200	5.19
5300	5.28
5400	5.38
5500	5.48
5600	5.58
5700	5.68
5800	5.78
5900	5.88
6000	5.98
6100	6.08
6200	6.18
6300	6.28
6400	6.38
6500	6.48
6600	6.58
6700	6.58
6800	6.78
6900	6.88
7000	6.98
7100	7.08
7200	7.18
7300	7.28
7400	7.38
7500	7.48
7600	7.58
7700	7.68
7800	7.78
7900	7.88
8000	7.98
8100	8.08
8200	8.18
8300	8.28
8400	8.38
8500	8.48
8600	8.58
8700	8.68
8800	8.77
8900	8.87
9000	8.97

Indication on Penetrometer [g]	Applied pressure [kg/cm ²]
9100	9.07
9200	9.17
9300	9.27
9400	9.37
9500	9.47
9600	9.57
9700	9.67
9800	9.77
9900	9.87
10000	9.97
10100	10.07
10200	10.17
10300	10.27
10400	10.37
10500	10.47
10600	10.57
10700	10.67
10800	10.77
10900	10.87
11000	10.97
11100	11.07
11200	11.17
11300	11.27
11400	11.37
11500	11.47
11600	11.57
11700	11.67
11800	11.77
11900	11.87
12000	11.97
12100	12.07
12200	12.17
12300	12.26
12400	12.36
12500	12.46
12600	12.56
12700	12.66
12800	12.76
12900	12.86
13000	12.96

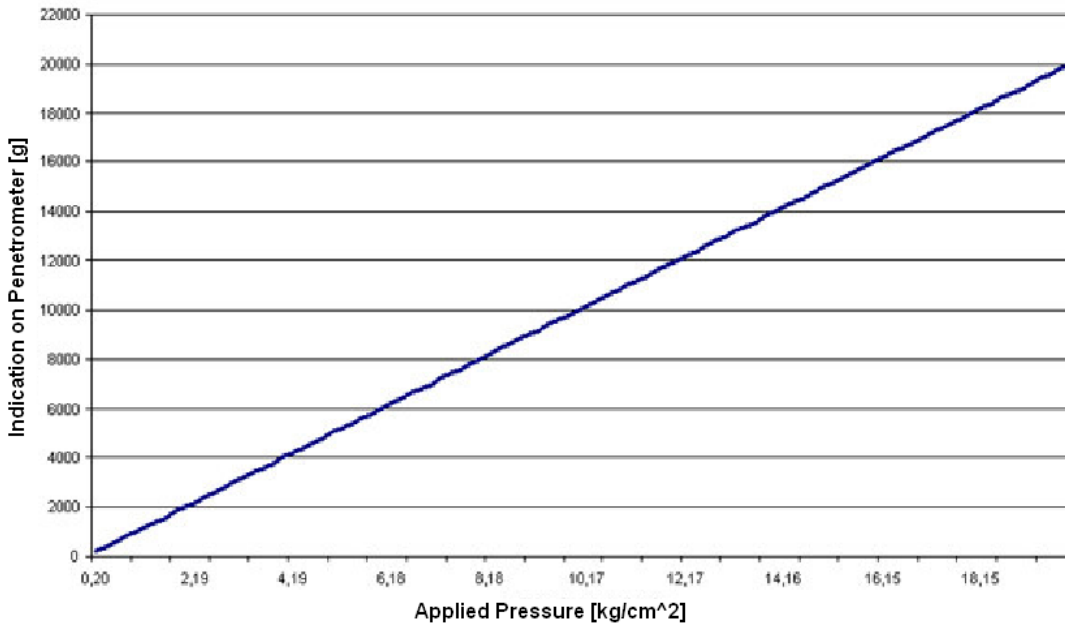
Range 0-20 kg – Penetration Tip Ø 11.3mm (1 cm²)

Indication on Penetrometer [g]	Applied pressure [kg/cm ²]
200	0.10
400	0.20
600	0.30
800	0.40
1000	0.50
1200	0.60
1400	0.70
1600	0.80
1800	0.90
2000	1.00
2200	1.10
2400	1.20
2600	1.30
2800	1.40
3000	1.50
3200	1.60
3400	1.70
3600	1.79
3800	1.89
4000	1.99
4200	2.09
4400	2.19
4600	2.29
4800	2.39
5000	2.49
5200	2.59
5400	2.69
5600	2.79
5800	2.89
6000	2.99
6200	3.09
6400	3.19
6600	3.29
6800	3.39
7000	3.49
7200	3.59
7400	3.69
7600	3.79

Indication on Penetrometer [g]	Applied pressure [kg/cm ²]
7800	7.78
8000	7.98
8200	8.18
8400	8.38
8600	8.58
8800	8.77
9000	8.97
9200	9.17
9400	9.37
9600	9.57
9800	9.77
10000	9.97
10200	10.17
10400	10.37
10600	10.57
10800	10.77
11000	10.97
11200	11.17
11400	11.37
11600	11.57
11800	11.77
12000	11.97
12200	12.17
12400	12.36
12600	12.56
12800	12.76
13000	12.96
13200	13.16
13400	13.36
13600	13.56
13800	13.76
14000	13.96
14200	14.16
14400	14.36
14600	14.56
14800	14.76
15000	14.96
15200	15.16

Indication on Penetrometer [g]	Applied pressure [kg/cm ²]
15400	15.36
15600	15.56
15800	15.75
16000	15.95
16200	16.15
16400	16.35
16600	16.55
16800	16.75
17000	16.95
17200	17.15
17400	17.35
17600	17.55
17800	17.75
18000	17.95
18200	18.15
18400	18.35
18600	18.55
18800	18.75
19000	18.95
19200	19.14
19400	19.34
19600	19.54
19800	19.74
20000	19.94

Applied Pressure with Penetration Tip Ø 11.3 mm (Range 0-20 kg)



11 Disposal

Batteries may not be put in the household waste. They have to be given in the set up collection points.

NOTE: "This instrument doesn't have ATEX protection, so it should not be used in potentially explosive atmospheres (powder, flammable gases)."

Please contact PCE Instruments if you have any questions concerning our products, service etc.

Here you will find an overview of our measuring devices: <http://www.industrial-needs.com/measuring-instruments.htm>

Here you will find an overview of our scales and balances: <http://www.industrial-needs.com/balances.htm>

Here you will find an overview of our laboratory equipment: <http://www.industrial-needs.com/laboratory-equipment.htm>

Here you will find an overview of our control systems: <http://www.industrial-needs.com/control-systems.htm>

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To follow the WEEE guidelines (Waste of Electrical and Electronic Equipment) we take our devices and either recycle them or give them to a recycling company.

