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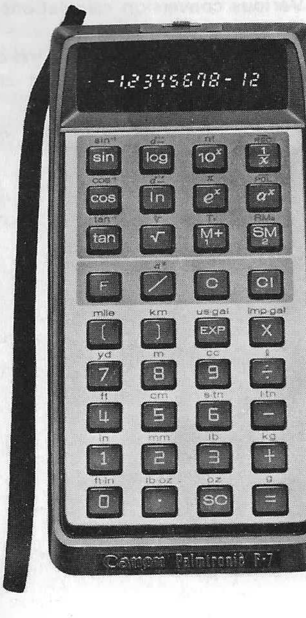
Canon
Palmtronic
F-7
INSTRUCTIONS



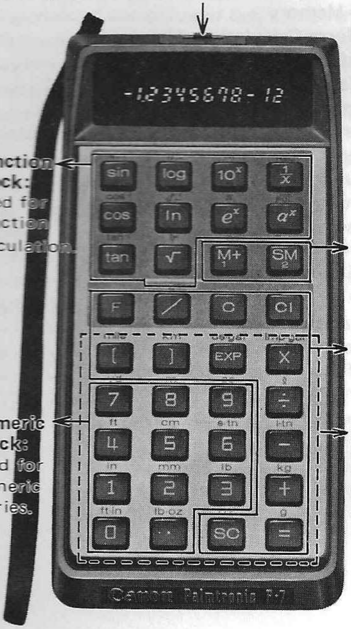
English Edition

Features

- 12-digit display and 2 memories (8 digit mantissa, sign of mantissa, 2 digit exponent, sign of exponent)
- Calculations are made accordingly to complete algebraic logical expression
- Calculation of up to seven-fold parenthesis max. and fractional calculation can be easily performed.
- Highly accurate calculation of numerals with 8 effective digits can be performed.
- Calculation of complicated functions can be promptly performed — trigonometrical, inverse trigonometrical, logarithm, power, root, cubic, factorial, constant π, conversion of sexagesimal notation into decimal notation, and vice versa, and conversion of rectangular co-ordinates into polar co-ordinates, and vice-versa
- Various conversion calculations are made by depressing keys simply.
- Easy-to-read and large LED indication
- Plates with different colors classified according to functions are adopted.
- Compact size with 3 way power source method adopted for a wide use

Contents

Operational Keys and Switches



Radian, Gradian Mode Switch: Used for designating radian mode or gradian mode.

Function Block: Used for function calculation.

Memory Block: Used for memory calculation.

Special Block:

Numeric Block: Used for numeric entries.

Conversion Block: Used for measurement conversion

OFF ON **Power Switch:** Slide the power switch to ON and the Palmtronic is ready for immediate use.

C **Clear Key:** This key clears all registers except memory.

CI **Clear Indicator Key:** Used for correcting numeric entries.

F **F Key:** Used when instruction to execute function calculations (Functions written on key top are excluded) and instruction to execute conversion of unit systems are set and when the first memory is called out and cleared, and the second memory is called out.

Instruction set by F key is released by depressing the key but in case of unit systesm alone, instruction is continued until two keys for converted unit and unit system are depressed.

SC **Sign Change Key:** Used for converting signs of the indicated value.

However signs in the exponential part are only converted after the depression of the Exponential key EXP .

EXP **Exponential Key:** Used for designating the exponential part of the input value.

× **Multiplication Key:** Used for performing multiplication.

÷ **Division Key:** Used for performing division.

− **Minus Key:** Used for performing subtraction.

+ **Plus Key:** Used for performing addition.

= **Equal Key:** Used for obtaining calculating results.

(**Open Parenthesis Key:** Used for performing calculations according to its expression. Used as an open parenthesis when parenthesis function is required.

) **Closed Parenthesis Key:** Used for performing calculations according to its expression. Used as a closed parenthesis when parenthesis function is required.

/ **Fraction Key:** Used for inputting data by fraction expression.

T₁ M+ **Plus-Memory Key:** Used for adding the displayed numerals to the first memory.

Total Recall Memory Key: Used for recalling the content of the first memory and clear it, together with F key.

[RM2/SM2] **Store Memory Key:** Used for storing the displayed numerals in the second memory.
Recall Memory Key: Used for recalling the content of the second memory, together with [F] key.

Before Calculation

1. Slide the power switch to ON.
2. Slide the switch to any necessary mode: [RAD DEG GRAD] when performing calculations dealing with degrees.
3. As all registers are cleared when the power switch is ON, Palmtronic is ready for immediate use.
4. When incorrect entries are made, depress the [CI] key to make correct entries and continue the operation.
5. Depress the [C] key when the next calculation is performed without depressing the [=] key.
6. Clear the first memory before starting calculation when it is used.
7. Please keep in mind that accurate results depend on correct key operation.

How to Input Numerals

1. Input numerals as they are written on paper when numerals within 8 digits including decimal points are input.
   When numerals are negative, input the numerals and depress the [SC] key afterwards.

Numerals input	Operation	Display
456	4 5 6	456.
1234.5678	1 2 3 4 [·] 5 6 7 8	1234.5678
−12.345678	1 2 [·] 3 4 5 6 7 8 [SC]	−12.345678

2. To input numerals including exponential part, depress the [EXP] key after inputting the mantissa part.
   Then input the numerals of the exponential part.
   When the sign of the exponential part is negative, depress the [SC] key after inputting the numerals in the exponential part.

Numerals input	Operation	Display
12.83×10^{18}	1 2 [·] 8 3 [EXP] 1 8	12.83 18
-34.567×10^{25}	3 4 [·] 5 6 7 [SC] [EXP] 2 5	− 34.567 25
42.28×10^{-21}	4 2 [·] 2 8 [EXP] 2 1 [SC]	42.28−21
-58.42×10^{-46}	5 8 [·] 4 2 [SC] [EXP] 4 6 [SC]	− 58.42−46

3. In mantissa part and exponential part, numerals up to 8 digits and 2 digits max. may be input respectively.
4. Fraction data can be input without performing fraction calculations.
   In this case, use the [·] key and [/] key in the following manner:
   Example: In 12-5/16 operation 1 2 [·] 5 [/] 1 6

   In 7/16 operation 7 [/] 1 6

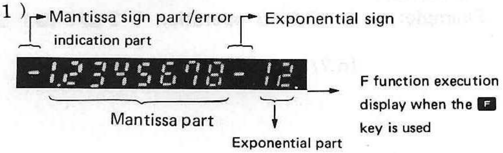
How to Correct Numerals Input

1. Clear all digits by the CI key and input the right figures.
2. When the exponential part alone has to be corrected, depress again the EXP key. Then input the correct exponent.
3. When only signs of the exponential part have to be corrected, depress the SC key.
4. It is possible to input and correct denominators by depressing the CI key after inputting incorrect denominators. But when all numerals are corrected after depressing the fraction / key, depress the C key to perform calculation again. In this case, all registers are cleared.

	Numerals to be input	Operation	How to correct
1	1 2 3 4 5	1 2 3 7 5 ↓ Correct to 4.	CI 1 2 3 4 5
2	34.567×10^{42}	3 4 · 5 6 7 EXP 4 4 ↳ Correct to 2.	EXP 4 2
3	42.786×10^{21}	4 2 · 7 8 6 EXP 2 1 SC ↑ Correct to plus.	SC
4	128 13/16	1 2 9 · 1 3 / 1 6 ↳ Correct to 8.	C 1 2 8 · 1 3 / 1 6 Clear all registers.

How to Read Numerals Output

(＊1)



1. When no exponent is used, the exponential part and the exponential sign part are not displayed.
2. In case of calculations not using exponents, intermediate calculation results and calculation results are automatically displayed with exponents in the following case.

   Floating 123456780.
   Exponential expression →1.2345678 09

   Floating 0.00123450
   Exponential expression →1.2345 −03

* When intermediate results and calculation results are displayed with exponents, the display will be that of a mantissa part within 8 digits with one digit of the integer.

3. Sign of mantissa and sign of exponent are negative, each negative sign lights up. No sign is displayed in plus.
4. Overflow error signs are displayed with E mark.
5. Decimal point on the rightmost display panel lights up only when F function works.
6. The (*1) Page 8 shows $-1.2345678 \times 10^{-12}$ (F function is in execution.)

How to Use the F Key

Each function written on the top of the keys may be operated and executed by one touch but other functions written above the keys are made to execute and select instructions by the F key.

For example, in sin key, Sin function works when it is operated by one touch and when the F key is depressed, Sin^{-1} function works.

Example:

When Sin 30° has to be found, → operation 30 sin
When Sin^{-1} 0.5 has to be found, → operation 0.5 F sin

To offer a maximum function with minimum keys, the F key is provided as so-called second function.

Fundamental in Using

	Classification	Function	Operation procedure
1	Recalls the content of memory and constant	π , T_1 , RM_2	F Constant or memory
2	Function executed by one variable input	$\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$, $a\xrightarrow{\circ\prime\prime\prime}$ $a\xleftarrow{\circ\prime\prime\prime}$ $\sqrt[3]{\ }$, n!, a^2	Variable input F Function
3	Function executed by two variables input	$\overrightarrow{\text{POL}}$, $\overrightarrow{\text{REC}}$	Variable input 1 F Function Variable input 2 F Function Function
4	Conversion function by designation of two unit systems of one variable input	Mutual conversion of mile, yd., ft., in., ft./in., km., m., cm., mm., us·gal., imp· gal., liter , cc., s·tn., l·tn., kg., g. lb., /oz., lb., oz.,	Variable input F Converted unit system Unit system

Operation example

Calculation	Operation	Display
$\sin^{-1} 0.5$ (=30)	· 5 F $\overset{\sin^{-1}}{\sin}$	0.5 0.5 30.
$\sqrt[3]{15}$ (=2.4662121)	1 5 F $\overset{\sqrt[3]{\ }}{\sqrt{\ }}$	15. 15. 2.4662121
Constant π (=3.1415926)	F $\overset{\pi}{e^x}$	0. . 3.1415926
Recalls of the first memory (123.4 5)	F $\overset{T_1}{M_1+}$	0. . 123.45 (The content of memory is cleared.)
$x=3,\ y=4$ Conversion into polar co-ordinates	3 F $\overset{\overrightarrow{\text{POL}}}{a^x}$ 4 F $\overset{\overrightarrow{\text{POL}}}{a^x}$ $\overset{\overrightarrow{\text{POL}}}{a^x}$	3. 3. . 3. 4. 4. . 5. . 53.130102
Conversion of 135 yd into *m* (135yd=123.444m)	1 3 5 F $\overset{yd}{7}$ $\overset{m}{8}$	135. 135. . 135. . 123.444
Conversion of 2 lbs. 3 oz into kg (2 lb 3oz=0.9922333 kg)	2 · 3 F $\overset{lb\text{-}oz}{\cdot}$ $\overset{kg}{+}$	2.3 2.3 . 2.1875 . 0.9922333

How to Use the ⁄ (Fraction) Key

Use the ⁄ key in the following manner to input data with fractions without converting them into decimal system.

⁄ key usage in calculation expression

$12\frac{7}{16}\times\frac{3}{8}$ → 1 2 · 7 ⁄ 1 6 × 3 ⁄ 8 = (=4.6640625)

⁄ key usage in conversion function

$13\frac{5}{16}$feet→ ? m → 1 3 · 5 ⁄ 1 6 (=4.05765)
F $\overset{ft}{4}$ $\overset{m}{8}$

$105\frac{1}{8}$ pound→ ? kg → 1 0 5 · 1 ⁄ 8 (=47.683898)
F $\overset{lb}{3}$ $\overset{kg}{+}$

⁄ key usage in power calculation

$5^{\frac{2}{7}}$ → 5 a^x 2 ⁄ 7 = (=1.5838196)

$4.2^{\frac{3}{8}}$ → 4 · 2 a^x 3 ⁄ 8 = (=1.7128467)

$(4+2.5)^{\frac{2}{9}}$→ (4 + 2 · 5) a^x 2 ⁄ 9 = (=1.5158192)

How to Use the ( ) (Parenthesis) Keys

This is not only used for calculations with parenthesis but also for performing calculation with equations included in functions.

The Palmtronic has seven memory registers for parenthesis in addition to the accumulation memory and storage memory ordinarily used to perform parenthesis calculations. Therefore calculations up to seven-fold parenthesis can be performed as shown in the following calculation example.

$$(((((((2+3)\times4+5)\times6+7)\times8+9)\times10+11)\times12+13)\times14+15)=(2127245.)$$

But only double parentheses calculation is performed as in the following example in some cases.

$$2+3\times(4+5\times(6+7\times8))=(944)$$

* Be sure to depress the × key in multiplication calculation just before and after the parenthesis in the middle of the equation.

Example: 3 + 4 x (5 + 6 x 7) = 191

Operation 3 + 4 × (5 + 6 × 7) = (191)

Other Calculation Examples

Example	Operation	Display
$2\times(1\frac{1}{3}+2\frac{2}{5})=7.4666667$	2 × (1 . 1 ⁄ 3 + 2 . 2 ⁄ 5) =	(7.4666667)
$5\times(1+0.5\sin30^\circ)\times\sin60^\circ=$ 5.4126588	5 × (1 + .5 × 30 sin) × 60 sin =	(5.4126588)
$5\times\{\sin\frac{\pi}{6}+\frac{1}{4}\cos(0.1+\frac{\pi}{6})\}=$ 1.2956179	5 × ((F $\overset{\pi}{e^x}$ ÷ 6) sin + 4 $\frac{1}{x}$ × (. 1 + F $\overset{\pi}{e^x}$ ÷ 6) cos) =	(1.2956179)
$\frac{1}{\sqrt{1+\{2+\frac{1}{3}(1-0.2)^2\}}}=0.557856$	(1 + (2 + 3 $\frac{1}{x}$ × (1 − . 2) F $\overset{a^2}{⁄}$ ( ) √ $\frac{1}{x}$	(0.557856)

How to Use the Memories

This Palmtronic has two memories: one for accumulation and the other for storage.

- In accumulation, the operation is performed as follows:
  Displayed numeral ⟶ M+ key.
- When recalling accumulated results, the operation is performed as follows:
  F key ⟶ M+.

  Or use SM key when it is used as a storage memory.
- When numerals are memorized, the operation is performed as follows:
  Displayed numeral ⟶ SM key.
- When recalling the content of memory, the operation is performed as follows:
  F key ⟶ SM key.

1. When the first memory is used as an accumulated memory, clear the content of memory before starting calculations. Clear the keys as follows:
   F key ⟶ M+ key.
2. As soon as the content of the first memory is recalled, the content of memory is cleared.
   When it is necessary to memorize any data after recalled the content of memory, depress the M+ key to input the data in the memory again.

How to Perform Calculation According to the Calculation Expression

As this Palmtronic adopts complete algebraic calculation method in four operations, calculations can be performed according to calculation expression. Parenthesis functions are available so that operations can be made according to calculation expression as much as possible. Perform calculations according to the following examples.

General calculations

Example	Operation
* 1 45+6×8.5−7.38=88.62	45 + 6 × 8.5 − 7.38 = (88.62)
* 2 (45+6)×8.5−7.38=426.12	(45 + 6) × 8.5 − 7.38 = (426.12)
2+3×(28−6×3+4)+8−92 ×4=−316	2 + 3 × (28 − 6 × 3 + 4) + 8 − 92 × 4 = (−316.)
(1+3)×(−6.23)×(4.5+8) ×(9−8.43)=−177.555	(1 + 3) × (6.23 SC) × (4.5 + 8) × (9 − 8.43) = (−177.555)
(((4−3.63+5)×0.8−0.68) ×4.2−32.583)+6×5= 12.6042	(((4 − 3.63 + 5) × .8 − .68) × 4.2 − 32.583) + 6 × 5 = (12.6042)

(Note) In calculations according to *1 calculation expression, 6 x 8.5 shall be performed first since multiplication and division functions work ahead of addition and subtraction. Refer to *2.

Example	Operation
$30\times10^{-3}+280$ $\times(10^{-5}+47\times\frac{1}{2960}) =$ 4.4787459	30 $\boxed{\text{EXP}}$ 3 $\boxed{\text{SC}}$ $\boxed{+}$ 280 $\boxed{\times}$ $\boxed{(}$ 1 $\boxed{\text{EXP}}$ 5 $\boxed{\text{SC}}$ $\boxed{+}$ 47 $\boxed{\times}$ 2960 $\boxed{\frac{1}{x}}$ $\boxed{)}$ $\boxed{=}$ (4.4787459)
$\dfrac{1}{\dfrac{1}{1.23^2+0.55^2}\times10^{55}} =$ 1.8153999×10^{-55}	$\boxed{(}$ 1.23 $\boxed{\text{F}}$ $\overset{a^2}{\boxed{/}}$ $\boxed{+}$ .55 $\boxed{\text{F}}$ $\overset{a^2}{\boxed{/}}$ $\boxed{)}$ $\boxed{\frac{1}{x}}$ $\boxed{\times}$ 1 $\boxed{\text{EXP}}$ 55 $\boxed{=}$ $\boxed{\frac{1}{x}}$ (1.8153999×10^{-55})
$(2\frac{3}{4}+5\frac{6}{10})\times\frac{2}{25} = 0.668$	$\boxed{(}$ 2 $\boxed{\cdot}$ 3 $\boxed{/}$ 4 $\boxed{+}$ 5 $\boxed{\cdot}$ 6 $\boxed{/}$ 10 $\boxed{)}$ $\boxed{\times}$ 2 $\boxed{/}$ 2 5 $\boxed{=}$ (0.668)

Memory Calculation

Example	Operation	Display
+) sin23° ×log 2 =0.1176217	23 $\boxed{\sin}$	0.3907311
−) sin23° ×e^2 =−2.8874295	$\boxed{SM_2}$	0.3907311
+) sin23° ÷13 =0.0300562	$\boxed{\times}$	0.3907311
Total −2.7394561	2 $\boxed{\log}$	0.3010299
	$\boxed{=}$	0.1176217
	$\boxed{M+_1}$	0.1176217
To clear the first memory, depress $\boxed{\text{F}}$ $\overset{T_1}{\boxed{M+_1}}$ keys at the beginning.	$\boxed{\text{F}}$ $\overset{RM_2}{\boxed{SM_2}}$ $\boxed{\times}$	0.3907311
	2 $\boxed{e^x}$	7.3890561
	$\boxed{=}$	2.8871342
	$\boxed{\text{SC}}$	−2.8871342
	$\boxed{M+_1}$	−2.8871342
	$\boxed{\text{F}}$ $\overset{RM_2}{\boxed{SM_2}}$ $\boxed{\div}$	0.3907311
	13 $\boxed{=}$	0.0300562
	$\boxed{M+_1}$	0.0300562
	$\boxed{\text{F}}$	0.0300562 .
	$\overset{T_1}{\boxed{M+_1}}$	−2.7394561

Basic Calculations of Functions – Trigonometric and Inverse Trigonometric Functions

1. When a numeral is a degree, $\overset{\text{RAD DEG GRAD}}{\square\blacksquare\square}$ is set; when it is a radian mode, $\overset{\text{RAD DEG GRAD}}{\blacksquare\square\square}$ is set; and when it is a gradian mode, $\overset{\text{RAD DEG GRAD}}{\square\square\blacksquare}$ is set.
2. The relation between radian and gradian modes is as follows:

   360 degrees = 400 gradian
3. When calculations are performed after numerals input executed calculation expression, use the $\boxed{(}\boxed{)}$ key or find calculating results by $\boxed{=}$ key. Then perform function calculations.

   Example $\sin(45+3\times23-20\times2) = 0.9612617$

   Operation 1. $\boxed{(}$ 45 $\boxed{+}$ 3 $\boxed{\times}$ 23 $\boxed{-}$ 20 $\boxed{\times}$ 2 $\boxed{)}$ $\overset{-\sin}{\boxed{\sin}}$

   Operation 2. 45 $\boxed{+}$ 3 $\boxed{\times}$ 23 $\boxed{-}$ 20 $\boxed{\times}$ 2 $\boxed{=}$ $\overset{\sin}{\boxed{\sin}}$
4. When degree unit is degree, minute, second mode, convert it into a decimal notation and then perform trigonometric functions. (Refer to conversion of sexagesimal notation into decimal notation.)
5. When a result becomes 0, 1 or infinity in radian mode, the following is shown in an approximate value calculation due to exponent display priority.

   1) $\sin\pi = 1.8849556\times10^{-9}$ ($\doteqdot 0$)

   2) $\cos\frac{\pi}{2} = 2.8060578\times10^{-8}$ ($\doteqdot 0$)

   3) $\tan\frac{\pi}{4} = 0.9999999$ ($\doteqdot 1$)

   4) $\tan\frac{\pi}{2} = 35637185$ ($\doteqdot \infty$)

   5) $\tan\frac{3}{4}\pi = -0.9999999$ ($\doteqdot -1$)

   6) $\tan\pi = -1.8849556\times10^{-9}$ ($\doteqdot 0$)

Example	Setting	Operation	Display
Degree mode sin30° +cos(15° +4×5°)− tan(−150°)=0.7418017	RAD DEG GRAD	.30 sin + (15 + 4 × 5) cos 150 SC tan =	(0.7418017)
cos65.4° +tan48° 12′ 30″ = 1.5350474		65.4 cos + 48.123 F log tan =	(1.5350474)
sin^{-1} 0.7071 +cos^{-1} 0.5 − tan^{-1} (0.78×2−0.2) = 51.326276		.7071 F sin + .5 F cos − (.78 × 2 − .2) F tan =	(51.326276)
(Radian mode) sin0.558 −cos(0.25+1.23) = 0.438819	RAD DEG GRAD	.558 sin − (.25 + 1.23) cos =	(0.438819)
tan^{-1} 0.794 +sin^{-1} (0.6 −0.08 ×4) = 0.9548657		.794 F tan + (.6 − 0.08 × 4) F sin =	(0.9548657)

(Gradian mode) sin50° −cos28.57° + tan(25° −4× 50°) = 0.2203417	RAD DEG GRAD	50 sin − 28.57 cos + (25 − 4 × 50) tan =	(0.2203417)
tan^{-1}0.826− sin^{-1} 0.6 28 = 0.726653		.826 F tan − .628 F sin =	(0.726653)

Basic Calculations of Functions – Logarithmic Function

Example	Operation	Display
Common logarithm log58+log(30+3× 50) − log32 = 2.5135505	58 log + (30 + 3 × 50) log − 32 log =	(2.5135505)
log128.65−log(4× 10^{2} −376.3) = 0.7346615	128.65 log − (4 EXP 2 − 376.3) log =	(0.7346615)
Natural logarithm ln4.8−ln(0.8+4.5×2) + ln 47.6=3.1490663	4.8 ln − (.8 + 4.5 × 2) ln + 47.6 ln =	(3.1490663)
ln(2.3×10^{10} +4.2× 10^{6})−ln380=17.918772	(2.3 EXP 10 + 4.2 EXP 6) ln − 380 ln =	(17.918772)

Basic Calculations of Functions – Power Function

Example	Operation	Display
10^{23} = 1.0000000 23	23 10^{x}	(1.0000000 23)
$10^{2.38}$ = 239.88329	2.38 10^{x}	(239.88329)
$10^{2/7}$ = 1.9306977	2 ⁄ 7 10^{x}	(1.9306977)
$10^{(2+3\times 0.6)}$ = 6309.5734	(2 + 3 × .6) 10^{x}	(6309.5734)
$e^{3/7}$ = 1.535063	3 ⁄ 7 e^{x}	(1.535063)
5.82^{2} =33.8724	5.82 F ⁄	(33.8724)
$4.5^{2.8}-(4.75+6\times 3)^{6.51}$ =−6.8225836×10^{8}	4.5 a^{x} 2.8 − (4.75 + 6 × 3) a^{x} 6.51 =	(−6.8225836 08)

Basic Calculations of Functions – Square Root, Cubic Root, Factorial, and Constant π

Example	Operation	Display
(Square root) $\sqrt{28.45}=5.3338541$ $\sqrt{3.651\times10^{23}}=6.0423505\times10^{11}$	28.45 √ 3.651 EXP 23 √	(5.3338541) (6.0423505 11)
(Cubic root) $\sqrt[3]{27}=3$ $\sqrt[3]{29.568\times10^{52}}$ $=6.6620411\times10^{17}$	27 F √ 29.568 EXP 52 F √	(3.). (6.6620411 17)
(Extraction of n-th root) $\sqrt[5.3]{100}=2.3842868\times10^{25}$	100 a^x 5.3 $\frac{1}{x}$ =	(2.3842868)
(Factorial) 25 ! = 1.5511210 (4×2−3) ! = 120	25 F 10^x (4 × 2 − 3) F 10^x	(1.5511210 25) (120.)
(Constant π) 3.1415926	F e^x	(3.1415926)

Basic Calculations of Functions – Conversion of Sexagesimal Notation into Decimal Notation, and Vice-Versa

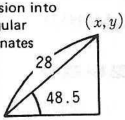
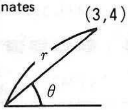
Example	Operation	Display
Sexagesimal notation into decimal notation 360°12′38″ ➡ 12′35″ ➡	360.1238 F log .1235 F log	(360.21056) (0.2097222)
Decimal notation into sexagesimal notation 4.38973 ➡ 3.38×10^{-4} ➡	4.38973 F ln 3.38 EXP 4 SC F ln	(4.2323028) (1:2168000−04)

1. To input sexagesimal notation, follow the following procedure:

e.g 123° 45′ 12″ 34 → 123 ■ 45 12 34

Results by conversion of decimal notation into sexagesimal notation are performed the same way as in the above procedure.

Basic Calculations of Functions – Conversion into Polar Co-ordinates or into Rectangular Co-ordinates

Example	Operation	Display
Conversion into rectangular co-ordinates 	RAD DEG GRAD 28 F $\frac{1}{x}$ 48.5 F $\frac{1}{x}$ $\frac{1}{x}$	(18.553361) (20.97076)
Conversion into polar co-ordinates 	RAD DEG GRAD 3 F a^x 4 F a^x a^x	(5.) (53.130102)

1. Input data as follows in conversion into rectangular co-ordinates: x co-ordinates and y co-ordinates; in conversion into polar co-ordinates, input data in the order of r and θ.
2. Two results can be found for two variables but in conversion into polar co-ordinates, data are output in the order of r and θ and in conversion into rectangular co-ordinates, they are output in the order of x and y.

Various Calculations

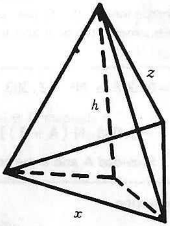
Example	Operation
$\sqrt{\sin^2 23+\cos^2 43}=$ 0.8291857	RAD DEG GRAD 23 sin F $\overset{a^2}{/}$ + 43 cos F $\overset{a^2}{/}$ = √ (0.8291857) or ((23 sin F $\overset{a^2}{/}$ + (43 cos F $\overset{a^2}{/}$)) √
$\sin^{-1}\frac{1}{\sqrt{2}}+\cos^{-1}\frac{\sqrt{3}}{2}$ $-\tan^{-1}\sqrt{3}=15$	RAD DEG GRAD 2 √ $\frac{1}{x}$ F $\overset{\sin^{-1}}{\sin}$ + (3 √ ÷ 2) F $\overset{\cos^{-1}}{\cos}$ − 3 √ F $\overset{\tan^{-1}}{\tan}$ = (15.)
$\sinh 0.5=\frac{1}{2}(e^{0.5}-$ $e^{-0.5})$	2 $\frac{1}{x}$ × (.5 e^x − .5 SC e^x) = (0.5210953)
$\cosh 0.6=\frac{1}{2}(e^{0.6}+$ $e^{-0.6})$	2 $\frac{1}{x}$ × (.6 e^x + .6 SC e^x) = (1.1854652)
$\sinh^{-1}2.5=\ln(2.5+$ $\sqrt{2.5^2+1})$	(2.5 + (2.5 F $\overset{a^2}{/}$ + 1) √) ln (1.64722311)
$\cosh^{-1}4.0=\ln(4+$ $\sqrt{4^2-1})$	(4 + (4 F $\overset{a^2}{/}$ − 1) √) ln (2.0634371)

Example 1.

If a tetrapot containing 250cc milk is made from a regular triangle paper box, what will be one base in inch?

Calculation expression

Let one base of the paper vessel be x and the height be h.



Area of one surface $(S)=\frac{1}{2}\times x\times\frac{\sqrt{3}}{2}x=\frac{\sqrt{3}}{4}x^2$

Volume: $=250(\mathrm{cc})=\frac{1}{3}\times S\times h=\frac{1}{3}\times S\times$

$$\sqrt{x^2-(\frac{1}{\sqrt{3}}x)^2}=\frac{1}{3}\times\frac{\sqrt{3}}{4}x^2\times$$

$$\sqrt{\frac{2}{3}}x=\frac{\sqrt{2}}{12}x^3$$

$\therefore\ x=\sqrt[3]{250\times 12/\sqrt{2}}$ ➡ convert cm into inch.

Operation

250 × 12 ÷ 2 √ = F $\overset{\sqrt[3]{}}{\sqrt{}}$ F $\overset{\mathrm{cm}}{5}$ $\overset{\mathrm{in}}{1}$ (=5.0586547)

Example 2.

Here is a regular triangle coil with one base being 100cm long. Unsealed copper wire 0.1cm diameter is in four coils and its pitch is 0.5cm. What μH will be self-inductance L?

Calculation expression

Let the length of one base of the triangle be a(cm), the number of coils times pitch be b and the number of coils be N.

$$L = 0.008\ a\ N^2\ \left[2.303\ \log\frac{a}{b} + 0.726 + 0.2231\frac{b}{a}\right.$$
$$\left. - 0.008aN\ (A+B)\right]$$

Provided A and B are constants (A=−1.053 and B=0.197).

Operation

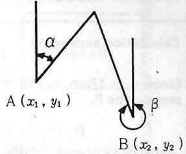
.008 × 100 × 4 F $\overset{a^2}{/}$ × (2.303 × (100 ÷ (4 × .5)) log + .726 + .2231 × 4 × .5 ÷ 100 − .008 × 100 × 4 F $\overset{a^2}{/}$ × (1.053 SC + .197)) = (199.67987)

Example 3.

Obtain intersecting co-ordinates C(x, y) of two straight lines from directional angles α and β to co-ordinates A(x, y) and B(x_1, y_1), and intersecting point.

Provided

$$A\begin{cases} x_1 = 103.5 \\ y_1 = 24.3 \\ \alpha = 26^\circ\ 50'\ 23'' \end{cases} \qquad B\begin{cases} x_2 = 309 \\ y_2 = 5.62 \\ \beta = 335^\circ\ 3'\ 19'' \end{cases}$$



Calculation expression

Let its respective distance from the intersecting point C through A and B be l_1 and l_2.

$$l_1 = \frac{(x_2 - x_1)\sin\beta - - (y_2 - y_1)\cos\beta}{\sin(\beta - \alpha)},$$

$$l_2 = \frac{(x_2 - x_1)\sin\alpha - (y_2 - y_1)\cos\alpha}{\sin(\beta - \alpha)}$$

Co-ordinates C(x, y) to be obtained as follows:

$$x = x_1 + l_1\cos\alpha = x_2 + l_2\cos\beta$$
$$y = y_1 + l_1\sin\alpha = y_2 + l_2\sin\beta$$

Operation

RAD DEG GRAD

x : 103.5 + ((309 − 103.5) × 335.0319 F $\overset{d°'''}{\text{log}}$ sin − (5.62 − 24.3) × 335.0319 F $\overset{d°'''}{\text{log}}$ cos) ÷ (335.0319 F $\overset{d°'''}{\text{log}}$ − 26.5023 F $\overset{d°'''}{\text{log}}$) sin × $\overset{RM_2}{SM_2}$ 26.5023 F $\overset{d°'''}{\text{log}}$ cos =

(x: 182.69035)

y : 24.3 + F $\overset{RM_2}{SM_2}$ × 26.5023 F $\overset{d°'''}{\text{log}}$ sin = (y: 64.370858)

Example 4.

What kg/cm² will be inner pressure obtained, if allowable stress of 650kg/cm² has a 38cm ID and thick wall 4cm cylindrical tube?

Calculation expression

Since r_1 = 19cm, r_2=19+4=23cm, and J_0=650kg/cm², let the inner pressure be P_1.

$$(\sigma\theta)\max = \frac{P_1(r_2^2 + r_1^2)}{r_2^2 - r_1^2}$$

$$\therefore P_1 = \frac{(\sigma\theta)\max(r_2^2 - r_1^2)}{r_2^2 + r_1^2} = \frac{650(23^2 - 19^2)}{23^2 + 19^2}$$

Operation

650 × (23 F $\overset{a^2}{/}$ − 19 F $\overset{a^2}{/}$) ÷ (23 F $\overset{a^2}{/}$ + 19 F $\overset{a^2}{/}$) =
(122.69663)

Example 5.

When a copper bar 1.4m long and having a regular triangle section of 6.2cm² receives 5800kg tensile strength and a pressure of 290kg/cm² from the surrounding area, how is the length of this bar changed?

Calculation expression

l = length

$\sqrt{x}$ = Stress of length direction

$\sqrt{y}$, $\sqrt{z}$ = Stress of width and thickness direction

$$\sigma_x = \frac{5800}{6.2}\text{kg/cm}^2$$

$$\sigma_y = \sigma_z = -290\text{kg/cm}^2$$

$$E = 2.1\times10^6\text{ kg/cm}^2$$

$$m = 10/3$$

Ex = Distortion to $\sqrt{x}$

then,

$$\varepsilon_x = \frac{l}{E}\left(\sigma_x - \frac{\sigma_y + \sigma_z}{m}\right) = \frac{l}{2.1\times10^6}\left(\frac{5800}{6.2} - \frac{-580}{10/3}\right)$$

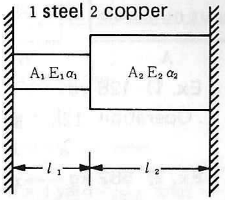
$$\lambda_z = 5.2832565\times10^{-4}\times140 = 0.0739655\text{cm}$$

Operation

140 ÷ 2.1 EXP 6 × (5800 ÷ 6.2 − 580 SC ÷ 10 / 3)
= (0.0739655)

Example 6.

As illustrated, an assembled bar with two different sections and materials is fixed on steel wall on both sides. What will be thermal stress when a temperature of 60°C (t_1) raised to 98°C (t_2)?



Provided

$$\begin{cases} A_1 = 48.6\text{cm}^2 \\ A_2 = 15.7\text{cm}^2 \\ E_1 = 0.93\times10^6\text{kg/cm}^2 \\ E_2 = 2.12\times10^6\text{kg/cm}^2 \end{cases}$$

l_1 = 23cm

l_2 = 31cm

$\alpha_1 = 1.84\times10^{-5}$

$\alpha_2 = 1.12\times10^{-5}$

Calculation expression

Let thermal stress arising in 1 and 2 be $\sqrt{1}$ and $\sqrt{2}$ and elongation be λ1 and λ2,

$$\sigma_1 \cdot A_1 = \sigma_2 \cdot A_2 \quad \cdots\cdots\cdots(1) \qquad \lambda_1 + \lambda_2 = \frac{\sigma_1}{E_1} l_1 + \frac{\sigma_2}{E_2} \cdot l_2 \quad \cdots\cdots(2)$$

And free expansion amount by heat is as follows:

$$\triangle l = \alpha_1 (t_2 - t_1) l_1 + \alpha_2 (t_2 - t_1) l_2 \quad \cdots\cdots\cdots(3)$$

Since equations (2) and (3) are the same,

$$\frac{\sigma_1}{E_1} l_1 + \frac{\sigma_2}{E_2} l_2 = (\alpha_1 l_1 + \alpha_2 l_2)(t_2 - t_1)$$

Thus,

$$\sigma_1 = \frac{(\alpha_1 l_1 + \alpha_2 l_2)(t_2 - t_1)}{l_1/E_1 + A_1 l_2/A_2 E_2} \qquad \sigma_2 = \frac{(\alpha_1 l_1 + \sigma_2 l_2)(t_2 - t_1)}{l_2/E_2 + A_2 l_1/A_1 E_1}$$

Operation

σ_1 : ((1.84 EXP 5 SC × 23 + 1.12 EXP 5 SC × 31) × (98
− 60)) SM ÷ (23 ÷ .93 EXP 6 + 48.6 × 31 ÷ 15.7 ÷
2.12 EXP 6) = (418.24)

σ_2 : F SM ÷ (31 ÷ 2.12 EXP 6 + 15.7 × 23 ÷ 48.6 ÷ .93 EXP
6) = (1294.6792)

How to Perform Conversion Calculation

1. Conversion calculations are performed as follows:

Input numerals	➡	F key	➡	Conversion unit	➡	Conversion Unit
A		B		C		D

Ex. 1) 128 yd $\longrightarrow x_1$ $(=117.0432)\,m$

Operation 128 $\boxed{F}$ $\overset{yd}{\boxed{7}}$ $\overset{m}{\boxed{8}}$

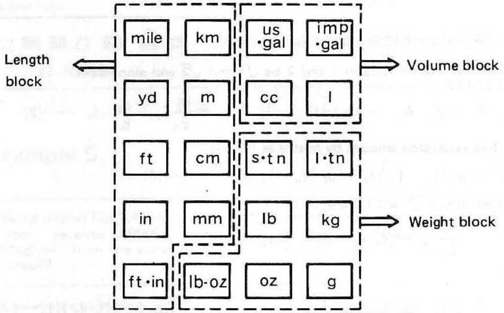
A B C D

Ex. 2) 582 kg $\longrightarrow x_2$ $(=12830904)\,pound$

Operation 582 $\boxed{F}$ $\overset{kg}{\boxed{+}}$ $\overset{lb}{\boxed{3}}$

A B C D

2. The blocks of this Palmtronic are as shown below.



*1 Error sign (E) lights up on the left side of the display panel when calculations other than mutual conversion within the same block are performed.

*2 Abbreviated letters written on the upper parts of the keys mean the following:

us. gal	American gallon
imp. gal	British gallon
S. tn	Short ton
l. tn	Long ton
ft./in.	Foot and inch. Used when both of the units are input and output simultaneously.
lb./oz.	Pound and ounce. Used when both of the units are input and output simultaneously.

3. Mutual conversion rules between each unit are as follows:

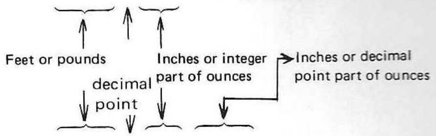
Premise	1 litter is equal to 1 dm^3.
Definition	1 yard =0.9144m 1 pound =0.45359237 kg 1 (US) gallon =231 $inch^3$ 1 (imp) gallon =1.200942 (US) gallon
Mutual relation	36 inches = 3 feet = 1 yard $=\frac{1}{1760}$ miles 1 pound=16 ounces $=\frac{1}{2240}$ (imp) tons 1 short·ton=2000 pounds 1 long·ton=2240 spunod

4. The rules when mixed units are input or output are as follows:

Integer part . . . Feet or pounds

Decimal point part . . . Integer part of inch or ounces by two decimal point digits

Input display ××× · ××



Output display ××× · ××××××

Ex. 1) When 12 feet 5 inches,

Input: 1 2 $\boxed{\cdot}$ 5 $\boxed{F}$ $\overset{ft\cdot in}{\boxed{0}}$

Output: 12.05

(Display)

Ex. 2) When 5 pounds 3 ounces,
Input: 5 $\boxed{\cdot}$ 3 $\boxed{F}$ $\overset{\text{lb·oz}}{\boxed{\cdot}}$
Output: 5.03
(Display)

*1 Fraction key and input key of mixed units cannot be used simultaneously.

*2 Input numerals within two digits when inch or ounce is input.

*3 When inch or ounce is one digit, for example, 5 inches, it does not matter whether x x. 05 is input or x x. 5 is input. However, be sure to represent the integer part by two digits after decimal points as x x.05 when output is made. (See Ex. 1)

*4 If any numeral converting 16 in case of inch unit system and ounce unit system with two digits after decimal point is input, feet and pounds are respectively round off automatically. For example, if 3 feet 20 inches are input as they are, it will be the same as when 4 feet 8 inches are input.

Conversion – (Length)

Conversion	Operation	Display
12.584 miles ➡ km	1 2 $\boxed{\cdot}$ 5 8 4 $\boxed{F}$ $\overset{\text{mile}}{\boxed{(}}$ $\overset{\text{km}}{\boxed{)}}$	(20.251985)
0.482 miles ➡ m	$\boxed{\cdot}$ 4 8 2 $\boxed{F}$ $\overset{\text{mile}}{\boxed{(}}$ $\overset{\text{m}}{\boxed{8}}$	(775.70381)
38.7×10^8 cm ➡ mile	3 8 $\boxed{\cdot}$ 7 $\boxed{\text{EXP}}$ 8 $\boxed{F}$ $\overset{\text{cm}}{\boxed{5}}$ $\overset{\text{mile}}{\boxed{(}}$	(24047.065)
6.89 feet ➡ m	6 $\boxed{\cdot}$ 8 9 $\boxed{F}$ $\overset{\text{ft}}{\boxed{4}}$ $\overset{\text{m}}{\boxed{8}}$	(2.100072)
$3\frac{7}{8}$ feet ➡ cm	3 $\boxed{\cdot}$ 7 $\boxed{/}$ 8 $\boxed{F}$ $\overset{\text{ft}}{\boxed{4}}$ $\overset{\text{cm}}{\boxed{5}}$	(118.11)
$\frac{11}{16}$ inches ➡ mm	1 1 $\boxed{/}$ 1 6 $\boxed{F}$ $\overset{\text{in}}{\boxed{1}}$ $\overset{\text{mm}}{\boxed{2}}$	(17.4625)
32 feet 6 inches ➡ cm	3 2 $\boxed{\cdot}$ 0 6 $\boxed{F}$ $\overset{\text{ft·in}}{\boxed{0}}$ $\overset{\text{cm}}{\boxed{5}}$	(990.6)
38.689 cm ➡ feet/inches	3 8 $\boxed{\cdot}$ 6 8 9 $\boxed{F}$ $\overset{\text{cm}}{\boxed{5}}$ $\overset{\text{ft·in}}{\boxed{0}}$	(1.0323189)
382 m^2 ➡ cm^2	3 8 2 $\boxed{\sqrt{}}$ $\boxed{F}$ $\overset{\text{m}}{\boxed{8}}$ $\overset{\text{cm}}{\boxed{5}}$ $\boxed{F}$ $\overset{a}{\boxed{/}}$	(3819999.8)
148.67 cm^2 ➡ $feet^2$	1 4 8 $\boxed{\cdot}$ 6 7 $\boxed{\sqrt{}}$ $\boxed{F}$ $\overset{\text{cm}}{\boxed{5}}$ $\overset{\text{ft}}{\boxed{4}}$ $\boxed{F}$ $\overset{a}{\boxed{/}}$	(0.160027)
98.067 $feet^3$ ➡ cm^3	9 8 $\boxed{\cdot}$ 0 6 7 $\boxed{F}$ $\overset{\sqrt[3]{}}{\boxed{\sqrt{}}}$ $\boxed{F}$ $\overset{\text{ft}}{\boxed{4}}$ $\overset{\text{cm}}{\boxed{5}}$ $\boxed{a^x}$ 3 $\boxed{=}$	(2776947.8)

Conversion – (Volume)

Conversion	Operation	Display
32.83 (US) gallon ➡ ℓ	3 2 $\boxed{\cdot}$ 8 3 $\boxed{\text{F}}$ $\overset{\text{us·gal}}{\boxed{\text{EXP}}}$ $\overset{\ell}{\boxed{\div}}$	(124.27507)
4.83×10^6 (imp) gallon ➡ ℓ	4 $\boxed{\cdot}$ 8 3 $\overset{\text{us·gal}}{\boxed{\text{EXP}}}$ 6 $\boxed{\text{F}}$ $\overset{\text{imp-gal}}{\boxed{\times}}$ $\overset{\ell}{\boxed{\div}}$	(21957470.)
0.3721 (US) gallon ➡ cc	$\boxed{\cdot}$ 3 7 2 1 $\boxed{\text{F}}$ $\overset{\text{us·gal}}{\boxed{\text{EXP}}}$ $\overset{\text{cc}}{\boxed{9}}$	(1408.5517)
29.41×10^8 cc ➡ ℓ	2 9 $\boxed{\cdot}$ 4 1 $\overset{\text{us·gal}}{\boxed{\text{EXP}}}$ 8 $\boxed{\text{F}}$ $\overset{\text{cc}}{\boxed{9}}$ $\overset{\ell}{\boxed{\div}}$	(2941000.)
32.9971 ℓ ➡ (US) gallons	3 2 $\boxed{\cdot}$ 9 9 7 1 $\boxed{\text{F}}$ $\overset{\ell}{\boxed{\div}}$ $\overset{\text{us·gal}}{\boxed{\text{EXP}}}$	(8.7169116)
80.07 ℓ ➡ (imp.) gallons	8 0 $\boxed{\cdot}$ 0 7 $\boxed{\text{F}}$ $\overset{\ell}{\boxed{\div}}$ $\overset{\text{imp-gal}}{\boxed{\times}}$	(17.613054)

Conversion – (Weight)

Conversion	Operation	Display
4.386 short tons ➡ kg	4 $\boxed{\cdot}$ 3 8 6 $\boxed{\text{F}}$ $\overset{\text{s·tn}}{\boxed{6}}$ $\overset{\text{kg}}{\boxed{+}}$	(3978.9123)
52.08 long tons ➡ kg	5 2 $\boxed{\cdot}$ 0 8 $\boxed{\text{F}}$ $\overset{\text{l·tn}}{\boxed{-}}$ $\overset{\text{kg}}{\boxed{+}}$	(52915.723)
29.847×10^4 pounds ➡ g	2 9 $\boxed{\cdot}$ 8 4 7 $\boxed{\text{EXP}}$ 4 $\boxed{\text{F}}$ $\overset{\text{lb}}{\boxed{3}}$ $\overset{\text{g}}{\boxed{=}}$	(1.3538371 08)
389 g ➡ ounces	3 8 9 $\boxed{\text{F}}$ $\overset{\text{g}}{\boxed{=}}$ $\overset{\text{oz}}{\boxed{\text{SC}}}$	(13.721571)
350 pounds 4 ounces ➡ g	3 5 0 $\boxed{\cdot}$ 4 $\boxed{\text{F}}$ $\overset{\text{lb·oz}}{\boxed{\cdot}}$ $\overset{\text{g}}{\boxed{=}}$	(158870.73)
284.6 g ➡ pounds	2 8 4 $\boxed{\cdot}$ 6 $\boxed{\text{F}}$ $\overset{\text{g}}{\boxed{=}}$ $\overset{\text{lb}}{\boxed{3}}$	(0.6274356)
104.289 kg ➡ pound/ounce	1 0 4 $\boxed{\cdot}$ 2 8 9 $\boxed{\text{F}}$ $\overset{\text{kg}}{\boxed{+}}$ $\overset{\text{lb·oz}}{\boxed{\cdot}}$	(229.14686)

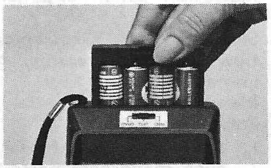
NiCd Battery Pack

1. Insert the battery pack into the Palmtronic so that the metallic part of the battery pack will contact to that of the Palmtronic.
2. When removing, pull out the battery pack while pushing down the latch of the battery pack. Be careful that the metallic part of the pack will not touch any other metal.

- For charging the NiCd battery pack, please refer to the instruction manual of the Canon Palmtronic Charger II.

Dry Battery Cassette

1. Load the dry battery cassette with four new penlight dry batteries (size AA). When loading the batteries, first lay the black tape which comes attached with the cassette, on the bottom and then put the batteries from the (–) side according to the diagram inside. The Palmtronic will not operate if the batteries are placed upside down.
2. Load the dry battery cassette into the battery chamber of the Palmtronic.
3. When changing the dry batteries, take them out while holding the latch of the cassette. Change all of the four batteries at the same time. The dry batteries can be easily taken out by pulling the black tape of the cassette.



Specifications

Type: "Palmtronic" (miniaturized) electronic-calculator with function keys.

Keyboard: 10-key system

Display: LED (Light Emitting Diodes)
8-digit (mantissa part) + 1-digit (mantissa sign)
2-digit (exponential part) + 1-digit (exponential sign) display totalling 12-digit display

Calculation capacity: Calculation range; $\pm 1.0000000 \times 10^{-99} \sim \pm 9.9999999 \times 10^{99}$
Effective accuracy; 8 digit

Types of calculation: Addition, subtraction, multiplication, and division. Parenthesis calculation, fraction calculation, and mixed calculation. Function calculations (Trigonometric, Inverse trigonometric, Logarithmic, Exponential, Square and Cubic root, Power, and Reciprocal)
Conversion calculations (length, weight, volume). Conversion (Polar co-ordinates, rectangular co-ordinates). Conversion of sexagesimal notation into decimal notation and vice-versa.

Calculation speed: Four operation: Within 0.1 seconds.
Function calculations: 2 seconds max.

Memory: Two memories (One for storage and the other for accumulation)

Negative numbers: True value indication with a minus sign.

Decimal point system: Leftmost digit priority with all-floating decimal point system.

Indication functions: Error indication. Zero suppressed indication panel/ exponential indication with a minus sign.

Safety devices: Electronically locked when results overflow or error presents. Automatic clearing circuit for immediate use.

Elements: MOS-LSI.

Power source:

1. 4 penlight dry batteries. D.C. 6V 0.9W. High performance manganese batteries: About 10 hours of continuous use. Alkaline batteries make possible about 18 hours of continuous use.
2. NiCd battery pack (charged with the Palmtronic Charger). D.C. 6V 1W. About 7 hours of continuous use is possible with one full charge.
3. AC with the Palmtronic Charger AC power source.

Usable temperature: 0°C ~ 40°C (32°F ~ 104°F)

Size: 175mm long x 86mm wide x 48mm high (6-7/8" x 3-3/8" x 1-7/8")

Weight: 370g (13 oz)

Subject to alterations.