instruction manual

# electronic pocket calculator for engineering and science

# MR 610

## INTRODUCTION

You have purchased a high-quality electronic calculator that requires proper handling in order to ensure trouble-free operation and to allow unlimited use of its many capabilities.

Please read this manual carefully before taking this hand-held calculator into use. It is advisable to observe the cautionary notes given in the following to prevent operational failure.

— Do not store nor operate the calculator in a temperature range other than specified. Note that it should not be exposed to direct sunlight.
— Be sure to prevent impact, shocks or mechanical vibration.
— The calculator should be kept away from water.
— Protect the unit against strong electric or magnetic radiation or X-rays (e. g., in airport check-ups).
— Do not exert pressure to the display as the panel is made of glass.
— A soft, dry cloth or a cloth slightly moistened with a neutral wetting agent (domestic rinsing agent) should be used to clean the surfaces. Do not use quick-volatizing liquids such as spirits, thinners or benzine!
— The battery provides approximately 2000 hours of operation. When the battery is running down, the digits and symbols will become dim and hard to read. Replace the exhausted battery immediately.



We trust that our Model MR 610 will give you full performance satisfaction.

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# MR 610



## 1. SPECIFICATIONS

| | |
|---|---|
| Arithmetic operations: | Addition<br>Subtraction<br>Multiplication<br>Division<br>Chain calculation<br>Mixed calculation<br>Constant calculation<br>Algebraic logic<br>Two levels of parenthesis |
| Functions: | sin, cos, tan, arc sin, arc cos, arc tan (three modes of degrees, radians or grads); sinh, cosh, tanh, ln, lg, $e^x$, $10^x$, $y^x$, $\Delta\%$, $X^2$, $1/X$, $\sqrt{}$, $\sqrt[3]{}$, X!, change sign |
| Conversions: | degrees minutes seconds to decimal angles or vice versa; polar coordinates to rectangular coordinates or vice versa |
| Constant call-up: | the value of $\pi$ |
| Register exchange: | X to Y or vice versa |
| Statistics: | Mean and standard deviation, $\Sigma X$, $\Sigma X^2$, number of keyed-in values |
| Memory: | One memory for constants (usable as accumulating memory) exchange of memory with display register, memory recall, memory clear |



| | |
|---|---|
| Clearing: | Clear all,<br>Clear entry,<br>Function reset |
| Numeral display: | 8-digit mantissa plus 2-digit exponent and 2-digit sign |
| Display of special symbols: | Error indication,<br>Level of parenthesis,<br>Display of second function of dual-fu ction keys,<br>„Memory-in-use" indication<br>Display of statistical calculations mode |
| Power consumption: | 0.0005 Watts |
| Power supply: | two silver oxide button cells type SR 44 |
| Dimensions: | 144 × 70 × 8.5 millimetres |
| Weight: | 90 g approx. |
| Working temperature: | in a range 0 °C to +40 °C |

Temperatur during transport: in a range −10 °C to +40 °C

Shelf life and transportation in original packing: one year



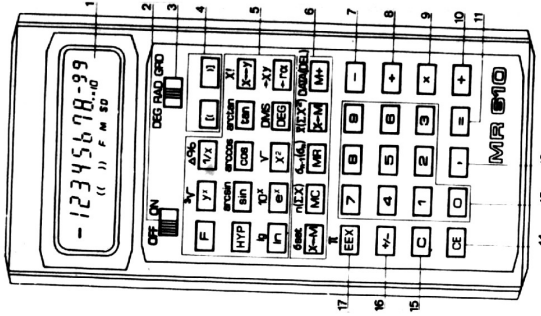
**ELECTRONIC POCKET CALCULATOR**

for engineering and science

# MR 610



## 2. KEYBOARD



1 — Display

2 — ON/OFF power switch

3 — Degree, Radian and Gradian switch

4 — Keys for parentheses

5 — Keys for functions and conversions, register exchange

6 — Keys for memory and statistical calculations

7 — Subtraction key

8 — Division key

9 — Multiplication key

10 — Addition key

11 — Result key

12 — Decimal point key

13 — Numeral keys 0 to 9

14 — Clear entry of last entered number

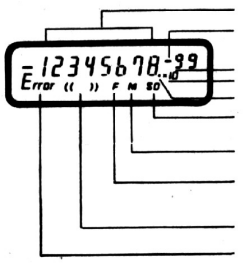
15 — Clear all except memory contents

16 — Change Sign key

17 — Enter Exponent key and $\pi$ key



## 3. DISPLAY






## 4. KEYS AND CONTROLS

ON/OFF power switch
Positioned at ON: Calculator is on
Positioned at OFF:
Calculator is off

Degree, Radian and Gradian switch
This switch is used for the three trigonometric modes, their inverse functions, and for coordinate conversions.
Positioned at DEG: Entry and result in degrees
Positioned at RAD: Entry and result in radians
Positioned at GRD: Entry and result in grads

[0] ... [9]

Numeral keys

[.]

Decimal point key for specifying values with decimal places

[+/-]

Change Sign key
Changes the sign of the displayed number from positive to negative or vice versa.
Changes the sign of the exponent after

depression of the [EEX] key.

[+] [−] [÷] [×]

Keys for addition, subtraction, division, and multiplication

[CE]

Clear entry key. Clears the last entered number. (Used to clear an erroneous entry).

[C]

Clear all key. Clears the contents of all arithmetic registers. This key does not clear the memory contents.



[F]

Function key. On depression of this key the dual-function keys will then function as indicated by their upper designations. A renewed depression of the F key resets the "Function" mode. Note special features for statistical analysis.

[π]
[EEX]

"Enter Exponent" key and π key.
Example: $205 \cdot 10^{12}$
Keystroke sequence:

[2] [0] [5] [EEX] [1] [2]

Note: The multiplication key is not depressed.

Only two digits can be entered for the exponent. If you enter more than two digits, only the two last entered digits are effective (correction facility after erroneous entry).
The constant Pi is called up on depression of the [F] and [π] keys.

[$y^x$]
[$\sqrt[3]{x}$]

Key for calculating the $y^x$ function and for extracting the cubic root.

[Δ%]
[$\frac{1}{x}$]

Key for calculating the reciprocal and for percentage calculation

Examples of per cent calculation:

$a + b$ [F] [Δ%] $\triangleq \frac{a+b}{b} \cdot 100$

$a - b$ [F] [Δ%] $\triangleq \frac{a-b}{b} \cdot 100$

$a \times b$ [F] [Δ%] $\triangleq \frac{a \cdot b}{100}$

$a \div b$ [F] [Δ%] $\triangleq \frac{a}{b} \cdot 100$

[(] [)]

Keys for parentheses
The parenthesis symbol is displayed.



arcsin
[sin]
arccos
[cos]
arctan
[tan]

Keys for performing trigonometric functions and their inverse functions.

[HYP]

Key for implementing hyperbolic functions
Example:

[HYP] [sin] $\triangleq$ sinh

[x!]
[x⇌y]

Key for register exchange and for calculating the factorial of a number

[ln]

Key for calculating the natural logarithm and common logarithm

[$10^x$]
[$e^x$]

Key for calculating the exponential functions $e^x$ and $10^x$

$\sqrt{\ }$
$x^2$

Key for calculating the square and square root of a number

DMS
DEG

Key for converting decimal angles to degrees, minutes, and seconds or vice versa Example: 15° 22' 16"
Keystrokes: 15 [.] 2216 [DEG]
Display: 15.371111
Conversely, the first two places after the decimal point are interpreted as minutes and the following as seconds.

→xy
→rα

Key for converting rectangular coordinates to polar coordinates or, after depression of the function key [F], from polar coordinates to rectangular coordinates.

Gset
X→M

Key for exchange of the displayed number with the number in the memory, and for the "Statistical calculations" mode.



n(ΣX)
MC

Key for memory clear, number of the keyed-in values and sum of the keyed-in numbers in statistical calculations.
In the "Statistics" mode the number n of the keyed-in values is obtained.
After the keystroke sequence [F] [{∑X̄}] the sum of the keyed-in values is obtained.

$\sigma_{n-1}(\sigma_n)$
MR

Key for memory recall and standard deviation.
Operation of this key causes display of the memory contents without altering it.
In the "Statistics" mode of operation the standard deviation $\sigma_{n-1}$ is obtained.
After the keystroke sequence [F] [$\sigma_n$] the standard deviation $\sigma_n$ is obtained.

Σ(ΣX²)
X→M

Key for memory entry, arithmetic mean and sum of the squares of the entered values.
Writes the displayed number into the memory, replacing the previous contents of the memory.
In the "Statistical calculations" mode the



arithmetic mean is obtained as also the sum of the squares of the entries after the keystroke sequence [F] [{∑X̄²}]

DATA(DEL)
M+

Key for addition to the memory, entry of values and deletion of values.
Adds the displayed number to the memory contents. In the "Statistical calculations" mode this key serves to enter values for the calculation of $\Sigma X$, $\Sigma X^2$; $\bar{x}$; $\sigma_{n-1}$ and $\sigma_n$.

After the keystroke sequence [F] [{DEL}] the displayed value is deleted. In this way an erroneous entry can be corrected.

Example:

| | | Display | Counter |
|---|---|---|---|
| a | [DATA] | a | m |
| b | [DATA] | (erroneous entry) | m + 1 |
| F | [DEL] | b | m |
| | [n] | m | m |

**Remarks**
When the calculator is in the "Statistical calculations" mode, all computations can be performed with the exception of

coordinate conversions, calculations in parentheses and the conversion of decimal angles to degrees, minutes, seconds or vice versa. Neither are memory functions possible in the "Statistics" mode. While in the "Statistics" mode $\bar{x}$; $\Sigma X$; $\Sigma X^2$; $\sigma_{n-1}$; $\sigma_n$ and n are found out in between, further entries can be made nevertheless.

All registers are cleared by a depression of the [aset] key. The "Statistical calculations" mode of operation is reset on operation of the [C] key or by a renewed depression of the [aset] key.

Definition of the mean value $\bar{x}$ and the standard deviation $\sigma_{n-1}$ and $\sigma_n$

$$\bar{x} = \frac{\Sigma X}{n}$$

$\bar{x}$ = keyed-in values
n = number of values

$$\sigma_{n-1} = \sqrt{\frac{\Sigma X^2 - \frac{(\Sigma X)^2}{n}}{n-1}}$$

$$\sigma_n = \sqrt{\frac{\Sigma X^2 - \frac{(\Sigma X)^2}{n}}{n}}$$



## 5. GENERAL REMARKS FOR USE OF THE POCKET CALCULATOR

When the ON/OFF slide switch is positioned to ON, a zero (0.) appears on the extreme right in the display. The calculator has been provided with an automatic clearing device and allows immediate operation.

Depress the CE key after an erroneous entry, then key in the correct digits.

When the +; −; x; ÷ keys have been operated by mistake, it is only necessary to depress the correct key, and you will obtain the correct result.

The result of a calculation is obtained in exponential notation when the numbers $\geq 1 . 10^8$ or numbers $< 1$ are obtained in case they exceed 7 decimal places.



## CONDITIONS FOR ERROR INDICATION

- The result or an intermediate result of a calculation exceed the capacity of the calculator.
- Calculation of numbers outside the domain of definitions (cf. par. 6).
- When division by zero is attempted.
- During the "Statistics" mode of operation when calculating $\sigma_{n-1}$
  if n = 0 or 1, when calculating $\sigma_n$,
  if n = 0 and when entering values
  greater than $9.9 . 10^{49}$ or
  less than $9.9 . 10^{-49}$.

Error indication is reset by a depression of the C key.

## 6. DOMAIN OF DEFINITION AND ACCURACIES

| Function | | Domain of definition | Accuracy |
|---|---|---|---|
| sin x | DEG | $0; 4.5 . 10^{-10} \leq \lvert x \rvert \leq 4.4999999 . 10^{8}$ | 8th digit ± 1 |
| | RAD | $0; 7.8539817 . 10^{-10} \leq \lvert x \rvert \leq 7853980.7$ | $0 \leq \lvert x \rvert < \frac{\pi}{2}$; 7th digit ± 1 |
| | | | $\frac{\pi}{2} \leq \lvert x \rvert \leq 2\pi$; 7th digit ± 5 |
| | GRD | $0; 5 . 10^{-10} \leq \lvert x \rvert \leq 4.9999999 . 10^{8}$ | 8th digit ± 1 |



| | | | |
|---|---|---|---|
| cos x | DEG | $0; 1 . 10^{-10} \leq \lvert x \rvert \leq 4.5000008 . 10^{8}$ | 8th digit ± 1 |
| | RAD | $0; 7.8539817 . 10^{-10} \leq \lvert x \rvert \leq 7853982.5$ | $0 \leq \lvert x \rvert \leq \frac{\pi}{2}$; 7th digit ± 1 |
| | | | $\frac{\pi}{2} \leq \lvert x \rvert \leq 2\pi$; 7th digit ± 5 |
| | GRD | $0; 1 . 10^{-10} \leq \lvert x \rvert \leq 5.0000009 . 10^{8}$ | 8th digit ± 1 |
| tan x | DEG | same as sin x;<br>except<br>$\lvert x \rvert = 90^{\circ} + 180^{\circ} . n$, for n = 0, 1, 2, . . . | 8th digit ± 1 |



| | | | |
|---|---|---|---|
| | RAD | same as sin x;<br>except | $0 \leq \lvert x \rvert < \frac{\pi}{2}$; 7th digit ± 1 |
| | | $\lvert x \rvert = \frac{\pi}{2} + \pi . n$, for n = 0, 1, 2 . . . | $\frac{\pi}{2} \leq \lvert x \rvert \leq 2\pi$; 7th digit ± 5 |
| | GRD | same as sin x;<br>except<br>$\lvert x \rvert$ = 100 GRD + 200 GRD . n, for n = 0, 1, 2, . . . | 8th digit ± 1 |

| | | | |
|---|---|---|---|
| arcsin x | DEG | $0; 1.5707964 . 10^{-(n-1)} \leq \lvert x \rvert \leq 1$ | 8th digit ± 1 |
| | RAD | $0; 1 . 10^{-(n-1)} \leq \lvert x \rvert \leq 1$ | 8th digit ± 1 |
| | GRD | $0; 1.5707964 . 10^{-(n-1)} \leq \lvert x \rvert \leq 1$ | 8th digit ± 1 |
| arccos x | DEG | $0; 1 . 10^{-n} \leq \lvert x \rvert \leq 1$ | 8th digit ± 1 |
| | RAD | $0; 1 . 10^{-n} \leq \lvert x \rvert \leq 1$ | 8th digit ± 1 |
| | GRD | $0; 1 . 10^{-n} \leq \lvert x \rvert \leq 1$ | 8th digit ± 1 |



| | | | |
|---|---|---|---|
| arctan x | DEG | $0; 1.5707964 . 10^{-(n-1)} \leq \lvert x \rvert \leq 9.9999999 . 10^{n}$ | 8th digit ± 1 |
| | RAD | $0; 1 . 10^{-(n)} \leq \lvert x \rvert \leq 9.9999999 . 10^{n}$ | 8th digit ± 1 |
| | GRD | $0; 1.5707964 . 10^{-(n)} \leq \lvert x \rvert \leq 9.9999999 . 10^{n}$ | 8th digit ± 1 |



| | | |
|---|---|---|
| sinh x | $0; 1 . 10^{-9n} \leq \lvert x \rvert \leq 227.95592$ | $1 < \lvert x \rvert \leq 227.95592$; 8th digit ± 1<br>$0.1 < \lvert x \rvert \leq 1$; 8th digit ± 2<br>$1 . 10^{-i} \leq \lvert x \rvert \leq 0.1$;<br>each last but one decimal place ± 0<br>$0; 1 . 10^{-n} \leq \lvert x \rvert \leq 9.9999999 . 10^{-i}$<br>8th digit ± 0 |

| | | |
|---|---|---|
| cosh x | same as sinh x | 8th digit ± 1 |
| tanh x | $0; 1 . 10^{-99} \leq \|x\| \leq 227.95592$ | same as sinh x |
| ln x | $0 < x$ | 8th digit ± 1 |
| lg x | $0 < x$ | 8th digit ± 1 |



| Function | Domain of definition | Accuracy |
|---|---|---|
| $e^x$ | $-227.95592 \leq x \leq 230.2585$ | 8th digit ± 1 |
| $10^x$ | $-99 \leq x \leq 99.999999$ | $0; 1 . 10^{-99} \leq \|x\| < 5$<br>8th digit ± 2<br><br>$5 \leq \|x\| < 40$<br>7th digit ± 1<br><br>$40 \leq \|x\| < 99$<br>7th digit ± 2<br><br>$99 \leq \|x\| \leq 99.999999$<br>7th digit ± 5 |

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| | | |
|---|---|---|
| $\frac{1}{x}$ | $1 . 10^{-99} < \|x\| < 1 . 10^{99}$ | |
| $x^2$ | $0; 1 . 10^{-99} \leq \|x\| \leq 9.9999999 . 10^{99}$ | |
| $\sqrt{x}$ | $0; 1 . 10^{-199} \leq x \leq 9.9999999 . 10^{99}$ | |
| $\sqrt[y]{x}$ | $0; 1 . 10^{-99} \leq \|x\| \leq 9.9999999 . 10^{99}$ | $0; 1 . 10^{-99} \leq \|x\| \leq 1 . 10^{99}$<br>6th digit ± 1<br><br>on other range<br>7th digit ± 1 |
| DMS → DEG | $0; 1 . 10^{-99} \leq \|x\| \leq 99999999.$ | 8th digit ± 0 |

| DEG → DMS | $0; 2.7777778 \cdot 10^{-m} \leq \lvert x \rvert \leq 99999999.$ | 8th digit ± 0 |
|---|---|---|
| $y^x$ | $y > 0;$<br>$-227.95592 \leq \lvert x \rvert \cdot \ln y \leq 230.2585$ | $1 \cdot 10^m \leq y^x; y^x \leq 1 \cdot 10^m$<br>6th digit ± 1<br><br>on other range<br>7th digit ± 2 |
| $x, y \rightarrow r, \alpha$ | $0; 1 \cdot 10^{-m} \leq x, y \leq 9.9999999 \cdot 10^{m}$<br>and $\frac{y}{x}$ identical with arctan x | $r$: 8th digit ± 0<br>$\alpha$: same as arctan x |
| $r, \alpha \rightarrow x, y$ | $r \geq 0$<br>$\alpha$ identical with sin x | x: same as cos x<br>y: same as sin x |



| x! | $0 \leq x \leq 69$; integer | |
|---|---|---|



## 7. CALCULATION EXAMPLES

The following examples are given to demonstrate the principal calculator functions. Note that they are not comprehensive.

## 7.1 BASIC FOUR ARITHMETIC CALCULATIONS

| Problem | Key operation | Display |
|---|---|---|
| 123 + 456 = 579 | 123 [+] 456 [=] | 579. |
| − 456 − 789 = − 1245 | 456 [+/−] [−] 789 [=] | − 1245. |
| (− 3.2 . $10^{-3}$) . (2.5 . $10^{2}$) = −80000 | 3 [.] 2 [+/−] [EEX] 2 [+/−] [×] 2 [.] 5 [EEX] 6 [=] | − 80000. |
| 2 ÷ (3 . $10^{2}$) = 6.6666667 . $10^{-3}$ | 2 [÷] 3 [EEX] 8 [=] | − 09<br>6.6666667<br>x10 |



Note:

A depression of the [+/−] key after the entry of the mantissa causes sign change for the mantissa.
The sign for the exponent can be changed in that the [EEX] key is depressed first followed by a depression of the [+/−] key.

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## 7.2 CONSTANT CALCULATIONS

**In the following practical examples the constant numbers are underlined.**

| Problem | Key operation | Display |
|---|---|---|
| 2 + 3 = 5 | 2 [+] 3 [=] | 5. |
| 4 + 3 = 7 | 4 [=] | 7. |
| 9 − 4 = 5 | 9 [−] 4 [=] | 5. |
| 8 − 4 = 4 | 8 [=] | 4. |
| 5 . 3 = 15 | 5 [×] 3 [=] | 15. |
| 5 . 4 = 20 | 4 [=] | 20. |

| | | |
|---|---|---|
| 6 ÷ 2 = 3<br>8 ÷ 2 = 4 | 6 [÷] 2 [=]<br>8 [=] | 3.<br>4. |



## 7.3. USE OF THE MEMORY

Before you use the memory, first depress the [MC] key and make sure that the "Memory-in-use" symbol has darkened.

| Problem | Key operation | Display |
|---|---|---|
| 3 + 6 + 7 − 8 − 8 | 3 [M+] 6 [M+] 7 [M+] 8 [−] [M] [MR] | 8.<br>M |
| 123 . 45.6 = 5608.8 | [MC] 123 [×] 45 [,] 6 [M+] | 5608.8<br>M |
| +) 789 . 12.3 = 9704.7 | 789 [×] 12 [,] 3 [M+] | 9704.7<br>M |
| −) 25.8 . 36.9 = 952.02 | 25 [,] 8 [×] 36 [,] 9 [=] [+/−] [M+] | − 952.02<br>M |
| 14361.48 | [MR] | 14361.48<br>M |



| | | |
|---|---|---|
| 789 : 45 = 17.533333 | [MC] 789 [÷] 45 [M+] | 17.533333<br>M |
| +) 65.4 : 12.3 = 5.3170732 | 65 [,] 4 [÷] 12 [,] 3 [M+] | 5.3170732<br>M |
| −) 147 : 25.8 = 5.6976744 | 147 [÷] 25 [,] 8 = [+/−] [M+] | 5.6976744<br>M |
| 17.152732 | [MR] | 17.152732<br>M |

## 7.4. CALCULATION OF FUNCTIONS

Note:

- The domain of definition of the functions and the accuracies of the functional values are specified in par. 6.
- All functions can be chained. An exception to this are statistical calculations and coordinate conversions.

## 7.4.1 TRIGONOMETRIC FUNCTIONS AND INVERSE TRIGONOMETRIC FUNCTIONS (sin, cos, tan, arc sin, arc cos, arc tan)

| Problem | Key operation | Switch in position | Display |
|---|---|---|---|
| sin 15° 15' 15'' = 2.6310136 . $10^{-1}$ | 15 [,] 15 15 [DEG] [sin] | DEG | $2.6310136 \times 10^{-01}$ |
| $\cos \frac{\pi}{3} = 0.5$ | [F] [π] [÷] 3 [=] [cos] | RAD | 0.5 |
| tan (– 35 GRD) = – 6.1280079 . $10^{-1}$ | 35 [+/–] [tan] | GRD | $-6.1280079 \times 10^{-01}$ |



| | | | |
|---|---|---|---|
| arcsin 0.5 = 30° | [,] 5 [F] [arcsin] | DEG | 30. |
| arccos 0.5 = 60° | [,] 5 [F] [arccos] | DEG | 60. |
| arctan 1 = 45° | 1 [F] [arctan] | DEG | 45. |
| 2 . sin 30° . cos 60° = 0.5<br>arcsin 0.5 – arccos 0.5 = – 30 | 2 [×] 30 [sin] [×] 60 [cos] [=]<br>[,] 5 [F] [arcsin] [–] [,] 5<br>[F] [arccos] [=] | DEG | 0.5<br>–30. |



## 7.4.2 HYPERBOLIC FUNCTIONS (sinh, cosh, tanh)

| Problem | Key operation | Display |
|---|---|---|
| sinh 2 = 3.6268604 | 2 [HYP] [sin] | 3.6268604 |
| cosh (– 0.5) = 1.127626 | [,] 5 [+/–] [HYP] [cos] | 1.127626 |
| tanh 25 = 1 | 25 [HYP] [tan] | 1. |
| sinh 1 + cosh 2 = 4.9373969 | 1 [HYP] [sin] [+] 2 [HYP] [cos] [=] | 4.9373969 |

**Definitions:**

$$\sinh x = \frac{e^x - e^{-x}}{2}$$

$$\cosh x = \frac{e^x + e^{-x}}{2}$$

$$\tanh x = \frac{e^x - e^{-x}}{e^x + e^{-x}} = \frac{\sinh x}{\cosh x}$$





## 7.4.3 LOGARITHMIC FUNCTIONS AND INVERSES (ln, lg, $e^x$, $10^x$, $y^x$)

| Problem | Key operation | Display |
|---|---|---|
| ln 2 = 0.69314718 | 2 [ln] | 6.9314718 −01 x10 |
| lg 12 = 1.0791812 | 12 [F] [lg] | 1.0791812 |
| lg 26 : ln 13 = 0.55165742 | 26 [F] [lg] [÷] 13 [ln] [=] | 5.5165742 −01 x10 |
| $e^{2.3} = 9.9741824$ | 2 [,] 3 [$e^x$] | 9.9741824 |
| $10^{1.4} = 25.118864$ | 1 [,] 4 [F] [$10^x$] | 25.118864 |
| $2.4^{1.6} = 4.058242$ | 2 [,] 4 [$y^x$] 1 [,] 6 [=] | 4.058242 |



| | | |
|---|---|---|
| $(26 - 13)^{3.2} = 3669.6$<br>$(35 - 15)^{-1.6} = 0.0004143068$ | 26 [−] 13 [$y^x$] 3 [,] 2 [=]<br>35 [−] 15 [$y^x$] 2 [,] 6 [+/−] [=] | 3669.6<br>−04<br>4.143068 x10 |
| $4^{2.5} = 32$<br>$0.16^{0.5} = 0.01024$<br>$5.76^{2.5} = 79.62624$ | 4 [$y^x$] 2 [,] 5 [=]<br>[,] 16 [=]<br>5 [,] 76 [=] | 32<br>0.01024<br>79.62624 |
| $5^6 + e^2 = 15632.389$ | 5 [$y^x$] 6 [+] 2 [$e^x$] [=] | 15632.389 |
| $(3)^{-} = 14348910$ | 3 [$y^x$] 3 [$y^x$] 5 [=] | 14348910. |

## 7.4.4 SQUARE ROOT, SQUARE, RECIPROCAL, CUBIC ROOT ($\sqrt{}$, $x^2$, $\frac{1}{x}$, $\sqrt[3]{}$)

| Problem | Key operation | Display |
|---|---|---|
| $\sqrt{2} + \sqrt{3} = 3.1462644$ | 2 [F] [$\sqrt{}$] [+] 3 [F] [$\sqrt{}$] [=] | 3.1462644 |
| $3^2 + 4^2 = 25$ | 3 [$x^2$] [+] 4 [$x^2$] [=] | 25. |
| $1 : 4 . 10^{-4} = 2500$ | 4 [EEX] 4 [+/−] [1/x] | 2500. |
| $\sqrt[3]{253} + \sqrt[3]{166} = 11.820568$ | 253 [F] [$\sqrt[3]{}$] [+] 166 [F] [$\sqrt[3]{}$] [=] | 11.820568 |
| $\sqrt[y]{A} = B$ is obtained from $B = A^{\frac{1}{y}}$<br>$\sqrt[5]{40} =$ | Entry A [$y^x$] Entry n [1/x] [=]<br>40 [$y^x$] 5 [1/x] [=] | 2.091279 |



## 7.4.5 THE CONSTANT PI and X FACTORIAL (π, X!)

| Problem | Key operation | Display |
|---|---|---|
| $\pi . 2^2 = 12.566371$ | [F] [π] [x] 2 [$x^2$] [=] | 12.566371 |
| $13! = 6.2270208 . 10^9$ | 13 [F] [X!] | $6.2270208_{\times 10}{}^{09}$ |



## 7.4.6 CONVERSION OF DECIMAL ANGLES TO DEGREES, MINUTES AND SECONDS OR VICE VERSA

| Problem | Key operation | Display |
|---|---|---|
| 62.124228° = 62°7'27.22"<br>≈ 62°7'27" | 62 [.,] 124228 [F] [DMS] | 62.072722 |
| 52°43'25" = 52.723611 | 52 [.,] 4325 [DEG] | 52.723611 |
| 12°34'56" + 46°8'29"<br>58°43'24.99"<br>≈ 58°43'25" | 12 [.,] 3456 [DEG] [+]<br>46 [.,] 0829 [DEG] [=]<br>[F] [DMS] | 58.432499 |

## 7.4.7 CALCULATIONS IN PARENTHESES

| Problem | Key operation | Display |
|---|---|---|
| $3(32-18)+83.6=540$ | 3 × (( 32 − 18 )) + (( 83 × 6 )) = | 540. |
| $5\{6[(25-6)^2-0.6:4^2]\}=10829.813$ | 5 × (( 6 × (( 25 − 6 )) $x^2$ − (( , 6 ÷ 4 $x^2$ )) )) = | 10829.813 |

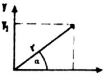


Note:

- The two levels of parenthesis can be used for all computations with the exception of statistical calculations and coordinate conversions.
- Only the first level of parenthesis can be used for the conversion of decimal angles to degrees, minutes, and seconds.



## 7.4.8 COORDINATE CONVERSIONS (→ rα, → xy)

| Problem | Key operation | Display |
|---|---|---|
| **Conversion of rectangular coordinates to polar coordinates** | | |
|  | | |
| $y=y_1$; $x=x_1$ | $x_1$ [+] $y_1$ [→r∠] | $r$ |
| Find: $r$, $\alpha$ | [x↔y] | $\alpha$ |
| $x_1=3$; $y_1=4$ ( DEG ) | 3 [+] 4 [→r∠] | 5. |
| $r=5$ | [x↔y] | 53.130102 |
| $\alpha=53.130102°$ | | |

| Conversion of polar coordinates to rectangular coordinates | | |
|---|---|---|
| $r = r_1;\ \alpha = \alpha_1$ | $r_1$ [+] $\alpha_1$ [F] [→xy] | x |
| Find x and y | [x↔y] | y |
| $r_1 = 4;\ \alpha_1 = 45°$ (DEG) | 4 [+] 45 [F] [→xy] | 2.8284271 |
| x = y = 2.8284271 | [x↔y] | 2.8284271 |

Note:

- The input or output of the angles α depends on the position of the slide switch (DEG, RAD, or GRD)
- Coordinate conversions can also be performed by means of the [−] [×] [+] keys instead of the [+] key.



## 7.4.9 STATISTICAL CALCULATIONS

| Problem | Key operation | Display |
|---|---|---|
| Calculate $\Sigma X, \bar{x}, \sigma_{n-1}, \sigma_n, \Sigma X^2$ | | |
| from | [F] [n̄set] | |
| 12.52 | 12 [,] 52 [DATA] | |
| 12.63 | 12 [,] 63 [DATA] | |
| 12.77 | 12 [,] 77 [DATA] | |



| | | |
|---|---|---|
| 13.00 | 13 [DATA] | |
| 12.76 | 12 [,] 76 [DATA] | |
| 12.44 | 12 [,] 44 [DATA] | |
| 12.33 | 12 [,] 33 [DATA] | |
| 12.66 | 12 [,] 66 [DATA] | |
| 12.67 | 12 [,] 67 [DATA] | |
| 12.70 (error) | 12 [,] 7 [DATA] | |

| | | |
|---|---|---|
| (correction) | 12 [,] 7 [F] [DEL] | |
| 12.68 | 12 [,] 68 [DATA] | |
| $\Sigma X$ = 126.46 | [F] [$\Sigma X$] | 126.46<br>SD |
| $\bar{x}$ = 12.646 | [$\bar{x}$] | 12.646<br>SD |
| $\sigma_{n-1}$ = 0.18679757 | [$\sigma_{n-1}$] | 1.8679757 − 01<br>SD x 10 |
| $\sigma_n$ = 0.17721174 | [F] [$\sigma_n$] | 1.7721174 − 01<br>SD x 10 |
| $\Sigma X^2$ = 1599.5272 | [F] [$\Sigma X^2$] | 1599.5272<br>SD |
| n = 10 | [n] | 10.<br>SD |



For definitions of $\bar{x}$, $\sigma_{n-1}$, $\sigma_n$ see par. 4

**Note:**
To change to the "Statistical calculations" mode, depress the keys [F] and σset
This chauses clearing of all registers and display of O. and the SD symbol.

# MR 610



## 8. BATTERY REPLACEMENT

The back cover of the calculator is attached to its narrow edge by means of two claws and secured through two screws. For battery replacement, untighten these screws by means of a screwdriver, slightly lift the back cover near the screw-connection and unhook the claws of the back cover at the edge opposite the screw-connection. Remove the used button cells from their compartments and replace them with new ones.

Take care to prevent mistake of the battery's polarity for fear of damage to the calculator and the cells. When you look into the opened unit the positive pole (+) of each cell should be up pointing to you. A label inside the calculator also indicates correct polarity.
Close the unit by first repositioning the rear side with its claws and securing it again by means of the two screws.