LITRONIX, INC.
P.O. Box 6000
Cupertino, CA. 95014

A GUIDE TO
MACHINE CALCULATION

LITRONIX
2140
SCIENTIFIC

ALL
SOLID
STATE
DESIGN

EIGHT
DIGIT
DISPLAY

LITRONIX 2140

Thank you for purchasing the Litronix 2140 personal calculator. The Litronix 2140 is made by the people who make the insides of many of the world's electronic hand calculators and digital watches. In fact, we supply 20% of the laboratory-grown (LED) crystals that light the numbers. We also design and supply the circuits that tie everything together. Because of this world wide technological and manufacturing leadership, the Litronix 2140 is a personal calculator that combines top quality and good value to serve you.

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- **Full Accumulating Memory**—Accumulates and recalls subtotals of prior calculations. Any displayed number may be added to or subtracted from data saved in memory.

- **Square Root Key**—Provides square root of displayed number with single press of key to full seven digit floating point accuracy.

- **Square Key**—Squares displayed number with single press of key to full eight digit accuracy.

- **Reciprocal Key**—Provides reciprocal of displayed number with single press of key to full eight digit floating point accuracy.

- **Percent Key**—Provides for percentage add-on, discount, markup and yield calculations.

- **Algebraic Logic**—Allows entry sequence to be in the same order as problem develops.

- **Change Sign Key**—Changes the sign of the number shown in the display.

- **Full Floating Decimal**—Calculator automatically positions decimal point to maintain full eight digit accuracy.

- **Unconditional One Year Guarantee**—A full one year unconditional guarantee on parts and labor from date of purchase.

- **Overflow Save**—In case of overflow in display, a single press of [C/ON] clears the overflow condition and allows calculator to continue using the overflowed results divided by 10^8.

- **Automatic Constant**—Performs repetitive addition, subtraction, multiplication and division operations without need to re-enter constant or function.

- **Battery Saving Display Flasher**—After approximately 50 seconds of non-use, display will flash on and off to conserve battery power. The display can be restored by pushing the Change Sign Key [+/−] twice.

- **Error Message**—When improper sequence entry is made into calculator, word " $Error$ " will flash on display until $C/_{ON}$ is pressed once.
- **Automatic Power Off**—If power is not turned off for approximately 15 minutes of non-use, the calculator will automatically be turned off.
- **Rugged Construction**—Bright 8-digit, solid state light emitting diode display, integrated circuitry and complete solid state dependability.
- **Throw Away Batteries**—This calculator uses 3 AA penlight batteries for approximately 8 hours of continuous operation. Approximately 16 hours of continuous operation can be expected with Alkaline Batteries.
- **Optional A.C. Adapter**—This unit is available for use as an option. The internal batteries are automatically disconnected to conserve battery life when the A.C. Adapter is in use.

KEYS

C/ON — Initial power on clears calculator, including memory. If last entry was a number, one press clears last entry. If display indicates overflow, one press clears overflow condition. Two presses will clear calculator but not data saved in memory.

OFF — Turns calculator off. Once off, all data is erased from calculator, including that which was saved in memory.

1/x — The reciprocal is generated to a full eight digit floating point accuracy. If a previous arithmetic operation has been entered; it will be executed first.

X² — The square is generated to full eight digit floating point accuracy. If a previous arithmetic operation has been entered, it will be executed first.

√x — The square root is generated to full seven digit floating point accuracy. If a previous arithmetic operation has been entered, it will be executed first.
Note that the square root of a negative number is improper and will be shown as an "Error". Single press of **C/ON** restores display.

+/− — Changes the sign of the number shown in the display. This key is also used to enter negative numbers.

M+ — Adds the display to data saved in memory. Repetitive addition of the display to data saved in memory can be done with this key. Note - to subtract the display from data saved in memory, press **+/−** once then press **M+** .

RM One press of key recalls data saved in memory to the display. Two presses of key clears data saved in memory.

% Used in conjunction with **X**, the **%** is used to find the percentage of a given number. Used in conjunction with **+**, the **%** of a base number is added to that base in the display. Used with **−**, the **%** of a base number is discounted from that base in the display.
When used in conjunction with **÷**, the **%** function can be used for yield calculations.

= Used to terminate a calculation.

0 **9** Number entry keys.

• Enters decimal point.

+ Directs calculator to add display to following number. Repetitive pushes of **=** will increase display by multiples of base number.

− Directs calculator to subtract following number from display. Repeated depressions of **=** will decrease display by multiples of base number.

X Directs calculator to multiply display by following number. Display may be raised to "N"th power by (N-1) depressions of **=** key.

÷ Directs calculator to divide display by following number. Dividing by "0" is improper and will be shown as an "Error".

Error Signal—When improper sequence of functions is entered into calculator, word "Error" will flash on display. A single press of **C/ON** restores display.

Memory Indicator—A memory indicator light appears at the left side of display window when non-zero data is saved in memory.

Minus Sign—Appears to left of display to indicate negative number.

Decimal Point—Calculator automatically positions decimal point to maintain full eight digit floating point accuracy.

Overflow Indication—A square around the decimal point **⊡** will appear in display when calculator has gone beyond capacity and refuse to permit further entries until **C/ON** Key has been pushed.

Battery Saving Display Flasher—After approximately 50 seconds of non use, display will begin flashing on and off and continue to do this until approximately 15 minutes of non-use have passed at which time it will automatically turn itself completely off. If the information in the display is needed sometime after the flashing sequence has begun, but before the machine is completely off, the display may be restored by pushing the Change Sign Key **+/−** twice.

BATTERY INSTALLATION—Remove the battery cover which is located on the back of the calculator, by placing thumb on the grooves at the cover bottom and sliding it away from the case. Insert three AA batteries in proper sequence per the battery outline imprinted in the battery compartment. Replace the battery compartment cover.

BATTERY LIFE—This calculator is designed to operate on 3 AA penlight batteries, which will provide up to 6 hours of continuous use. For the best cost/power ratio for your unit, use leakproof Alkaline Batteries, which will improve operating life up to 12 hours of continuous use. When the display becomes erratic, dim or refuses to turn on, the batteries should be replaced.

OPTIONAL A.C. ADAPTER OPERATION—An optional A.C. Adapter/Battery Eliminator (Model #102 for 110 volt operation and Model #104 for 230 volt operation) is available that will allow this unit to be used with normal A.C. Power. When the adapter is used, the internal batteries are automatically disconnected to conserve battery life.

1. Floating point display

C/ON	1 · 2345678 +	▮
10	+	▮
100	+	▮
1000	=	▮

2. Clear entry 1.2345678 × 1000 = 1234.5678

C/ON	1 · 2345678	×	▮
10	C/ON		▮
100	C/ON		▮
1000	=		▮

3. Overflow

C/ON		1234567	×	▮
89	=		(flashing)	▮
1	(cannot continue)			

C/ON   (clears overflow)
correct answer $= 1.0987646 \times 10^8$ ▮

÷   · 0001 =   ▮

4. Change sign

$14 \times (-2) = -28$

| C/ON | 14 | × | 2 | +/− | = | ▮ |

5. Error signal

C/ON	9 9 9 9 9	+/−	√x	▮
C/ON		+/−	√x	▮
C/ON	7 8 9	÷	0	=	▮

6. Power of number

$14^3 = 2744$

[C/ON]   14   [×]   [=]   [=]   ▮

or

$6^5 = 7776$

[C/ON]   6   [x²]   [=]   [=]   [=]   ▮

7. Reciprocal

x = 95

$^1/_x = .01052631$

[C/ON]   95   [¹/ₓ]   ▮

8. Square

x = 17; x² = 289

[C/ON]   17   [x²]   ▮

9. Square root

x = 123; $\sqrt{x}$ = 11.090536

[C/ON]   123   [√x̄]   ▮

10. Addition

756 + 436 = 1192

[C/ON]   756   [+]   436   [=]   ▮

11. Subtraction

743.14 − 18.007 = 725.133

[C/ON]   743 [•] 14   [−]   18 [•] 007   [=]   ▮

12. Multiplication

165 × 13 = 2145

[C/ON]   ·   165   [×]   13   ·   [=]   ▮

13. Division

16.041 ÷ (−18) = − .8911666

[C/ON]

16 [•] 041 [÷]   18   [+/−]   [=]   ▮

14. Automatic constant

$ .29 + $.69 + $.69 = $1.67

$1.75   + $.69 = $2.44

[C/ON] [•] 29 [+] [•] 69 [=]   [=]   ▮

                    1 [•] 75   [=]   ▮

 1.65 − .09 = 1.56

29.98 − .09 = 29.89

[C/ON]   1 [•] 65 [−]   [•] 09 [=]   ▮

       29 [•] 98   [=]   ▮

16 × 14 = 224.

18 × 14 = 252.

[C/ON]   ·   16   [×]   14   [=]   ▮

               18   [=]   ▮

534 ÷ 2 = 267.

(− 14) ÷ 2 = − 7.

[C/ON]   534   [÷]   2   [=]   ▮

         14   [+/−]   [=]   ▮

15. Percent operations

60 % of 120 = 72

`C/ON` 120 `×` 60 `%` ███████

$1.33 + 12% = $1.49

`C/ON` 1.33 `+` 12 `%` add on ███████

`=` total ███████

$475 − 6% = $446.50

`C/ON` 475 `−` 6 `%` discount ███████

`=` net ███████

$85 is 16 % of what number = $531.25

`C/ON` 85 `÷` 16 `%` ███████

16 Chain operations

$\sqrt{(16 + 5 - 4) \times 3}$ = 7.141428

`C/ON` 16 `+` 5 `−` 4 `×` 3 `√x̄` ███████

$[(\sqrt{12} + 14 - 3) \times 6]^2$ = 7531.5678

`C/ON` 12 `√x̄` `+` 14 `−` 3 `×` 6 `x²` ███████

$\dfrac{1}{18 \times 3 - 4}$ = .02

`C/ON` 18 `×` 3 `−` 4 `1/x` ███████

12 × 7 + 6 = 90

`C/ON` 12 `×` 7 `+` 6 `=` ███████

17. Memory operation

10 + (6 × 1.54) + (18 × .75) + (6 × .89) = 38.08

`C/ON` `RM` `RM` 10 `M+` ███████

6 `×` 1 `•` 54 `=` `M+` ███████

18 `×` `•` 75 `=` `M+` ███████

6 `×` `•` 89 `=` `M+` ███████

`RM` subtotal ███████

`RM` total ███████

`RM` verification of memory=0 ███████

$\dfrac{12}{6+8+2}$ = .75

6 `M+` 8 `M+` 2 `M+` ███████

12 `÷` `RM` `=` ███████

1. Area of triangle—

$$A = \frac{b \times h}{2}$$

$$A = \frac{7 \times 12.3}{2} = 43.05$$

h=12.3, A=?, b=7
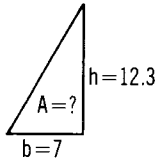
C/ON	7	☒ ×	12 ⊙ 3	÷	▮▮▮
			2	=	▮▮▮

2. Side of right triangle—

$$a = \sqrt{c^2 - b^2}$$

$$a = \sqrt{13.6^2 - 4.1^2}$$

$$= 12.967266$$

b=4.1, c=13.6, a=?
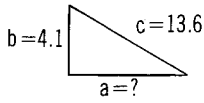
C/ON	RM	RM	4 ⊙ 1	x²	M+	▮▮▮
	13 ⊙ 6	x²	−			▮▮▮
	RM		√x			▮▮▮

3. Volume of a cone—

Find the volume of a cone with 8" diameter and 14" height (Ans. 234.57205 cubic inches).

$$Volume = \frac{d^2 \times \pi \times h}{12}$$

$$= \frac{8^2 \times 3.14159 \times 14}{12}$$

$$= 234.5725 \text{ cubic inches}$$

h=14", V=?, ←d=8"→
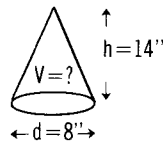
C/ON	8	×	×	3.14159	×	▮▮▮
	14	÷	12	=		▮▮▮

4. Percent discount/add-on

A pair of shoes regularly selling for $40.00 is on sale at a 20 % discount. How much does Gloria pay to get this pair of shoes if there is a 6 % sales tax? (Ans. $33.92).

C/ON	40	−	20	%	discount	▮▮▮
				+	sale price	▮▮▮
			6	%	tax	▮▮▮
				=	total cost	▮▮▮

5. Find the total cost of purchasing a new car and the monthly payments.

Window price $4,258.00
Sales tax 6 %
Trade-in allowance $795.00
License fee $59.00
Interest 10 % on the original balance
Pay back period 36 months

Total cost of car: $4,155.23
Monthly payments: $115.43

C/ON	4258	+	6	%	tax	▮▮▮
				−	total price	▮▮▮
			795	+	after down payment	▮▮▮
			59	+	after license	▮▮▮
			10	%	finance charge	▮▮▮
				÷	total cost financed	▮▮▮
			36	=	monthly payment	▮▮▮

6. Loan payment schedule

Chris and Ruth purchased a new sofa with $300 borrowed from the credit union. The interest rate was 3/4 of a percent a month on the unpaid balance (0.75%). How much of their payments will be going to pay off the loan, and how much for interest if their payments are $30 per month?

First Month

[C/ON] [RM] [RM] 300 [M+] [×] ▮▮▮▮▮▮

[.] 75 [%] — interest — ▮▮▮▮▮▮

[M+] 30 [+/−] [M+] — payment — ▮▮▮▮▮▮

Second Month

[RM] [%] — interest — ▮▮▮▮▮▮

[M+] 30 [+/−] [M+] — payment — ▮▮▮▮▮▮

Third Month

[RM] [%] — interest — ▮▮▮▮▮▮

[M+] 30 [+/−] [M+] — payment — ▮▮▮▮▮▮

[RM] — checking balance — ▮▮▮▮▮▮

Fourth Month (continuing)

[%] — interest — ▮▮▮▮▮▮

[M+] 30 [+/−] [M+] — payment — ▮▮▮▮▮▮

etc.

7. Arithmetic progression

Find the sum of the first forty integers. That is $1 + 2 + 3 + \cdots + 40$ (Ans. 820).

$$\text{Sum of 1st N} = \frac{(N + 1)\, N}{2}$$

$$= \frac{(40 + 1)\, 40}{2} = 820$$

[C/ON] 40 [+] 1 [×] 40 [÷] ▮▮▮▮▮▮

2 [=] ▮▮▮▮▮▮

8. Geometric progression

What is the sum of the first 5 terms (N) of the geometric series whose first term (a) is 4 and whose common ratio (r) is 6.7 (Ans: 9473.8603)

$$\text{Sum} = \frac{a(r^N - 1)}{r - 1} = \frac{4 \times (6.7^5 - 1)}{6.7 - 1}$$

$$= 9473.8603$$

[C/ON] [RM] [RM]

6 [.] 7 [−] 1 [=] [M+] — denominator — ▮▮▮▮▮▮

6 [.] 7 [X²] [=] [=] [=] — r^n — ▮▮▮▮▮▮

[−] 1 [×] 4 [÷] — numerator — ▮▮▮▮▮▮

[RM] [=] ▮▮▮▮▮▮

9. Solution of the quadratic formula

Given: $Ax^2 + Bx + C = 0$
Where: $A=8$, $B=28$, $C=-14.22$
Solve for x (Ans x=0.45 or x=−3.95).

$$x = \frac{-B \pm \sqrt{B^2 - 4AC}}{2A}$$

C/ON	RM	RM			
	4	×	8	×	
14	•	22	+/−	=	M+	4AC
	28	×	−	RM	RM
	√x̄	M+				√B²−4AC

"+" Root

| C/ON | 28 | +/− | + | RM | ÷ | |
| | 2 | ÷ | 8 | = | | x = |

"−" Root

| C/ON | 28 | +/− | − | RM | ÷ | |
| | 2 | ÷ | 8 | = | | x = |

10. Distance between point with rectangular co-ordinates—$(x_1, y_1, z_1,)$ and (x_2, y_2, z_2).

e.g.
$x_1 = 3$ $x_2 = 4$
$y_1 = -2$ $y_2 = 12$
$z_1 = 16$ $z_2 = 9$
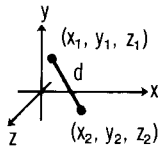
$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$$

(x_1, y_1, z_1)
d
(x_2, y_2, z_2)

C/ON	RM	RM				
	4	−	3	x²	M+	$(x_2-x_1)^2$
	12	−	2	+/−	x²	M+	$(y_2-y_1)^2$
	9	−	16	x²	M+	$(z_2-z_1)^2$
				RM	√x̄	d

11. Mean, variance and standard deviation—

Find the mean, variance and standard deviation for the values 2, 3, 6, 9, 3

Mean: $\bar{X} = \frac{1}{n} \sum_{i=1}^{n} X_i$

$= (2+3+6+9+3)/5$

$= 4.6$

| C/ON | 2 | + | 3 | + | 6 | + | 9 | |
| | + | 3 | ÷ | 5 | = | | |

Variance: $\sigma^2 = \dfrac{\sum X^2 - n\bar{X}^2}{n-1}$

$= \dfrac{2^2 + 3^2 + 6^2 + 9^2 + 3^2 - 5(4.6)^2}{4}$

$= 8.3$

C/ON	RM	RM				
2	x²	M+		3	x²	M+	
6	x²	M+		9	x²	M+	
3	x²	M+	4	•	6	x²	x
5	+/−	=	M+		RM			÷
					4		=

Standard deviation: σ

$\sigma^2 = 8.30$

$\sigma = 2.880972$

| C/ON | | | 8 | • | 3 | | √x̄ | |

12. Parallel resistors

Find the effective resistance of the three resistors in parallel: 33, 22, at 100 ohms.

$$R = \cfrac{1}{\cfrac{1}{R_1} + \cfrac{1}{R_2} + \cfrac{1}{R_3}}$$

$$= \cfrac{1}{\cfrac{1}{33} + \cfrac{1}{22} + \cfrac{1}{100}}$$

=11.660778
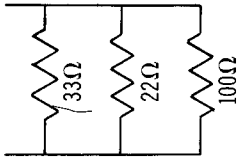
C/ON	RM	RM	33	1/x	M+	▮
			22	1/x	M+	▮
			100	1/x	M+	▮
				RM	1/x	▮

13. Temperature conversion.

Convert 37° centigrade to farenheit (Answer 98.6°F).

$F = \,^9/_5\, C + 32$

$\quad = \,^9/_5\, 37 + 32$

$\quad = 98.6$

C/ON 37 × 9 ÷ 5 + 32 = °F ▮

Convert 212° farenheit to centigrade (Answer 100°C).

$C = \,^5/_9\, (F - 32)$

$\quad = \,^5/_9\, (212 - 32)$

$\quad = 100$

C/ON 212 − 32 × 5 ÷ 9 = °C ▮

FULL ONE YEAR WARRANTY and UNCONDITIONAL GUARANTY

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Litronix, Inc. warrants your Litronix calculator in accordance with Federal minimum standards for Full Warranty for one year from the date of retail purchase by the original owner. In addition, Litronix unconditionally guarantees that your Litronix calculator will function properly for one year from the date of such retail purchase. Should your Litronix calculator cease functioning properly at any time within such one year period because of a defect, malfunction or any other cause, Litronix, without charge, will promptly repair the calculator or replace it with a new one. **CONSEQUENTIAL DAMAGES FOR BREACH OF WARRANTY OR UNCONDITIONAL GUARANTY ARE EXCLUDED.** No action for breach of warranty or unconditional guaranty may be commenced more than one year after the cause of action has accrued.

BEFORE RETURNING YOUR LITRONIX CALCULATOR FOR REPAIR, PLEASE CHECK THE BATTERIES. If, after checking the batteries, your Litronix calculator still requires repair, send it to Litronix, Inc., P.O. Box 6000, Cupertino, California 95014, Attention: Quality Assurance Department.

Litronix undertakes these obligations in good faith and with full confidence in the workmanship and quality of Litronix products.

LITRONIX 2140 WARRANTY REGISTRATION — TO REGISTER YOUR CALCULATOR UPON PURCHASE,
COMPLETE AND MAIL TO: LITRONIX, INC., P.O. BOX 6000, CUPERTINO, CALIFORNIA 95014

NAME _____

ADDRESS _____

SERIAL # _____

DATE OF PURCHASE _____

STATE _____ ZIP _____

YOUR APPROX. AGE:
UNDER 18 ☐
18-24 ☐
25-34 ☐
35-49 ☐
50 & OVER ☐

WHERE WILL MACHINE BE PRIMARILY USED?
AT HOME ☐
AT SCHOOL ☐
AT WORK ☐

YOUR OCCUPATION:
STUDENT ☐
EDUCATOR/TEACHER ☐
DOCTOR/LAWYER ☐
ENGINEER/SCIENTIST ☐
RESEARCHER ☐
SALESMAN ☐
ACCOUNTANT ☐
OTHER _____

HOW MANY PERSONAL CALCULATORS (INCLUDING THIS NEW LITRONIX) ARE OWNED BY YOUR IMMEDIATE HOUSEHOLD?
ONE ☐
TWO ☐
THREE OR MORE ☐

BOUGHT FOR SELF ☐
BOUGHT FOR GIFT ☐

AMOUNT PAID FOR CALCULATOR (NOT INCLUDING TAX) $ _____

TYPE OF STORE PURCHASED FROM:
DEPARTMENT STORE ☐
DISCOUNT STORE ☐
OFFICE SUPPLY STORE ☐
BOOK STORE ☐
MAIL ORDER ☐
COLLEGE BOOK STORE ☐
DRUG STORE ☐
OTHER _____