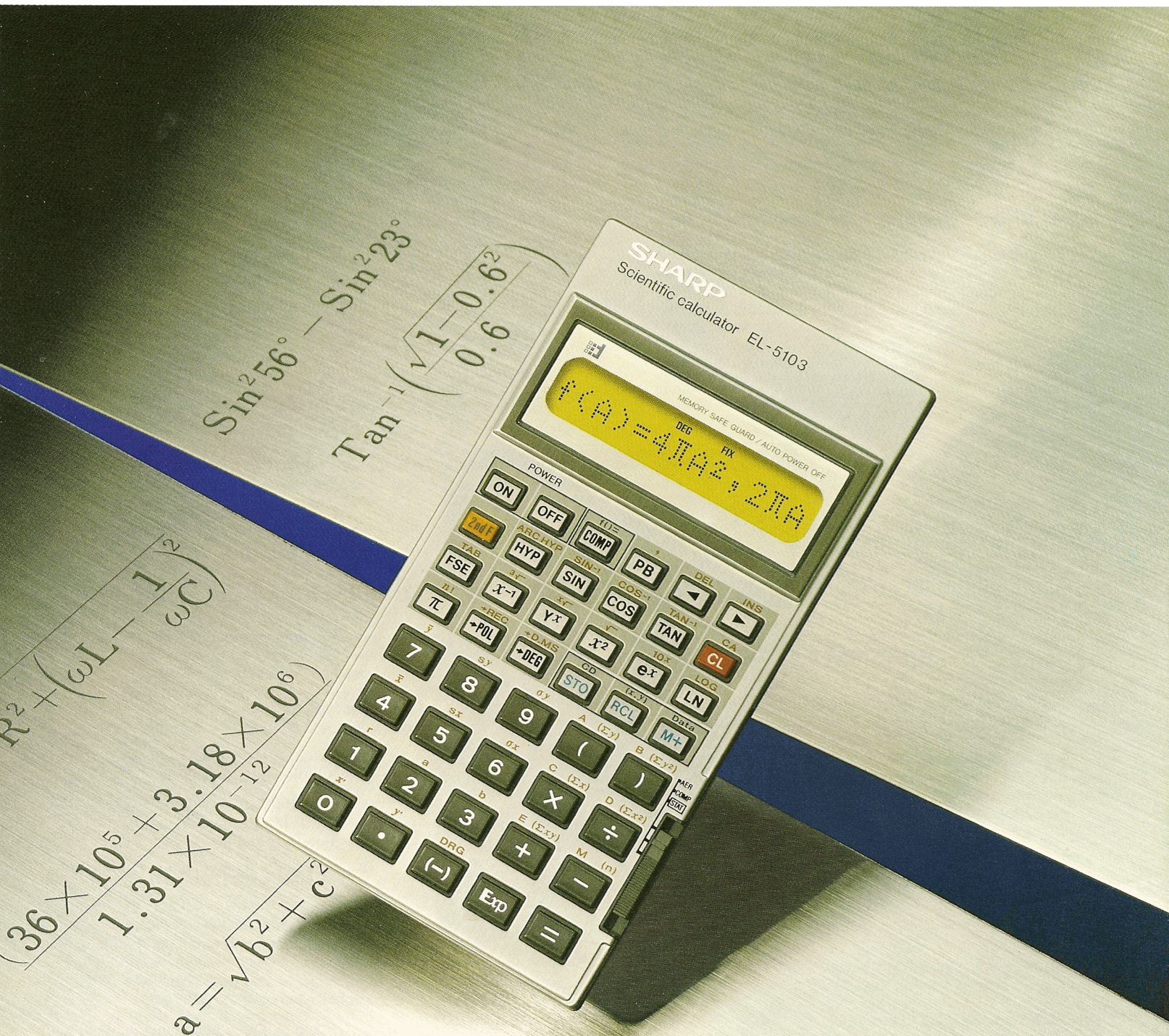# SHARP

EL-5103
Electronic Calculator

The Pocketable Scientific Calculator with Direct Formula Entry and Rolling Writer Display

Scientific Problem Solver Goes Portable

Sharp introduces a pocketable, easy-to-use scientific calculator with tremendous versatility. It is small in size but comes with big features. Such as **direct formula entry** *and* **algebraic expression reserve***. With the* **playback key***, you can recall entries at any time for checking, correcting, inserting and deleting. The* **EL-5103** *also features 6 memories for storing variables, constants or results and is programmed for* **63 scientific and statistical functions**.

Tremendous versatility is what is claimed for Sharp's **EL-5103** *and this is no empty boast. It is programmed for trigonometric functions. Linear regression is no problem nor is the impedance of a series circuit out of its range. The* **EL-5103** *is right at home performing a host of calculations that are commonly found in mathematics, statistics, probability, engineering, physics and business. With the handy* **EL-5103***, you will find the answer to almost any problem—simple or complicated.*
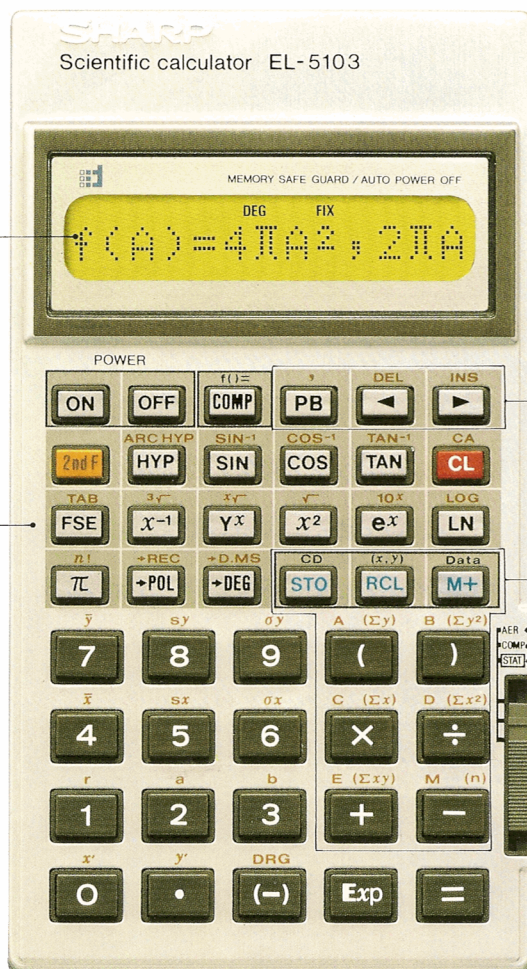
Rolling Writer Dot Matrix Display

Tabulation/FSE key

Playback

Multiple Data Memories

AER Mode

COMP Mode

Statistical Mode

Brief Summary of Outstanding Features

Rolling Writer Dot Matrix Display

The secret behind the EL-5103's ability to replace the pencil and converse with its user is the dot matrix liquid crystal display, the first of its kind in a handy-type scientific calculator.
Thanks to this system, it can display not only numbers but also letters and symbols. This 13-digit display will roll as it writes to a maximum of 80 steps, a very practical capacity.

Direct Formula Entry

- With this Sharp scientific calculator, the user can enter formulas as they are written. Solutions to problems are simplified and the chance of mistakes is reduced. There is no need to write a formula down or to translate it into machine language.
- You can input the complicated algebraic expression with up to 15 levels of parentheses and 8 levels of pending operations.

How to Enter a Formula

Example; $\sqrt{A^2 + B^2}$

Operation

2ndF | √ | (| 2ndF | A | x^2 | + | 2ndF | B | x^2 |)

Display

$\sqrt{(A^2 + B^2)}$

Try it with any other hand-held scientific calculator! And if the formula you are working on is long… The calculator will store up to 80 steps, with Sharp's rolling writer. The characters that roll off the display are stored and can be recalled at the touch of a key.

Algebraic Expression Reserve   ,

- With AER mode, complicated algebraic formulas can be stored and the Memory Safe Guard™ will retain them even after the power to the calculator has been turned off.
- By punctuating with ⌐,⌐ key, multiple formulas with up to 48 steps can be stored for easy operation. A touch of the PB or CL key will bring the first of the original input formulas to the display.
- Variables from A-E,M can be entered in the formulas.

63 Functions

- Scientific and statistical functions provide maximum versatility.
- Calculation of double variable statistical functions, linear regression and estimation.
- Use the FSE (FIX, SCI, ENG mode) key to select fixed decimal place, limit total digits and move decimal place, for easy operation.

Playback   PB

- The rolling writer display is capable of storing up to 80 steps, and you can instantly playback the formula simply by the playback PB key.
- When the calculation exceeds the 13-digit display capacity the PB can be still used. The playback feature is in 13-step segments.
- The user can correct or change any entry at any place in the calculation.
- Insertions and deletions are also possible with the Sharp scientific calculator. The entire formula does not have to be reentered, only the segment you wish to change.
- Playback is possible even after calculation is completed and result obtained.

How to Make a Correction
After moving the cursor to the position desired by depressing PB , ▶ or ◀ , input a correct number or a symbol, letter. (The cursor moves to the next step.)

Step to be corrected.

How to Make a Deletion
After moving the cursor to the step to be deleted, push the DEL key. (The cursor doesn't move.)

Step to be deleted.

How to Make an Insertion
After moving the cursor to a position immediately after the step to be inserted, push the INS key. The insertion symbol ☼ will appear. And then push the key for the insertion.

Insertion symbol.

Multiple Data Memories   M

- 6 memories (A—E,M) for storing variables, constants, or results.
- Independently accessible M has memory plus and memory minus (2ndF M+) function.
- All the memories including the AER (Algebraic Expression Reserve) are protected by Memory Safe Guard™ only you can remove the stored information. Turning the calculator on and off will not affect the material stored in the memory.

Additional Features

- Auto Power-Off function automatically turns the power off when the calculator has not been used for approx. 10 minutes.
- Memory Safe Guard™ protects data and formulas stored.
- Scientific functions: trigonometric, inverse trigonometric, hyperbolic, arc hyperbolic and exponential calculations and even time calculations.
- Statistical calculations with statistical mode STAT : number of samples n , mean $\bar{x}$, sum Σx , standard deviation σx / sx and other functions such as linear regression

- (estimate function x' / y').
- Factorial n! .
- Polar coordinates⇌Rectangular coordinates transformation.
- Degree/Minute/Second⇌Decimal notation degree transformation.
- Tabulation TAB key allows you to freely choose the decimal place. Round-off is automatic.
- The Sharp scientific calculator in an attractive wallet.
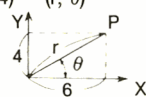
CALCULATOR'S MULTIPLE AND VARIED USES

Four Arithmetic Calculations

Mixed calculation

	Operation	Display
Example; $$\frac{(36 \times 10^5 + 3.18 \times 10^6)}{1.31 \times 10^{-12}} =$$	→[COMP] (36 Exp 5 + 3.18 Exp 6) ÷ 1.31 Exp (−) 12 =	COMP MODE (36 E5 + __ 36 E5 + 3.18 E6) __ E6) ÷ 1.31 E − 12 __ 5.1755725 E 18

Memory calculation

	Operation	Display
Example; $$ 58 + 24 + 72 =$$ $$-) \; 321 - 143 + 21 =$$ $$+) \;\; 81 + \;\; 73 + 54 =$$	→[COMP] CL STO 2ndF M 58 + 24 + 72 M+ 321 − 143 + 21 2ndF M+ (Memory minus = 2ndF M+) 81 + 73 + 54 M+ RCL 2ndF M	COMP MODE 0. 154. 199. 208. 163.

Function Calculations

Trigonometric function

	Operation	Display
Example; $$\text{Sin}^2 56° - \text{Sin}^2 23° =$$	→[COMP] (SIN 56) x^2 − (SIN 23) x^2 =	COMP MODE (SIN 56)² − __)² − (SIN 23)² __ 0.534632482

Inverse trigonometric function

	Operation	Display
Example; $$\text{Tan}^{-1}\left(\frac{\sqrt{1-0.6^2}}{0.6}\right) =$$	→[COMP] 2ndF TAN⁻¹ (2ndF √ (1 − .6 x^2) ÷ .6) =	COMP MODE (√(1 − .6²) __ √(1 − .6²) ÷ .6) __ 53.13010235

Time calculation

	Operation	Display
Example; $$8_H 52_M 34_S$$ $$+) \; 11_H 21_M 47_S$$	→[COMP] FIX MODE (Depress FSE key untill "FIX" appears.) 2ndF TAB 4 8.5234 →DEG + 11.2147 →DEG = 2ndF →D·MS =	COMP MODE 0.0000 8.5234 → DEG + __ 11.2147 → DEG __ 20.2392 20.2392 → DMS __ 20.1421 (20ₕ14ₘ21ₛ)

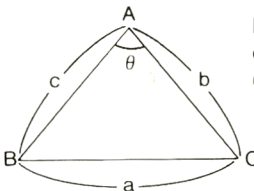**Coordinates conversion (Rectangular coordinates → Polar coordinates)**

	Operation	Display
Example; (6, 4) → (r, θ) (diagram)	→[COMP] 6 →POL 4 = RCL 2ndF E	COMP MODE 6 → POL 4 __ 7.211102551 (r) 33.69006753 (θ)

Linear regression
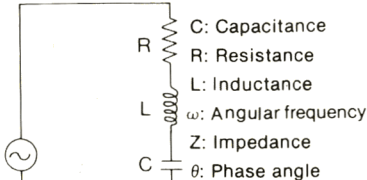
	Operation	Display
Example; The linear regression is calculated for the seven samples given below. |	Height (x)	Weight (y)
A	172cm	67kg
B	167	54
C	179	68
D	163	51
E	181	70		→ [STAT] 2ndF CA 172 (x,y) 67 Data 167 (x,y) 54 Data 179 (x,y) 68 Data 163 (x,y) 51 Data 181 (x,y) 70 Data 173 (x,y) 59 Data 169 (x,y) 61 Data	STAT MODE 0. 1. 2. 3. 4. 5. 6. 7.

F 173 59	[2ndF] [r]	0.904970862
G 169 61	[2ndF] [a]	− 115.4657375
r = coefficient of correlation	[2ndF] [b]	1.028455285
a = ⎱ coefficient of regression b = ⎰ (y = a + bx)	162 [2ndF] [y']	51.14401858
How much would a 162 cm tall person weigh? How tall would a 80 kg person be?	80 [2ndF] [x']	190.0575946

Cosine Theorem

Formula;	Operation	Display
$a = \sqrt{b^2 + c^2 - 2bc\cos\theta}$ A θ c b B ——a—— C b = B c = C θ = D When b = 2, c = 3 and θ = 60° → a = ?	[DRG] (Depress until "DEG" appears.) → [AER] [2ndF] [CA] [f()=] [2ndF] [B] [2ndF] [C] [2ndF] [D] [f()=] [2ndF] [√] ([2ndF] [B] [x²] + [2ndF] [C] [x²] − 2 [2ndF] [B] [2ndF] [C] [COS] [2ndF] [D] [AER] → [COMP] [COMP] 2 [COMP] 3 [COMP] 60 [COMP]	**AER MODE** — f(B C D) = __ C D) = √(B² + C² − __ ² − 2 BC COS D __ **COMP MODE** B = ☀ C = ☀ D = ☀ 2.645751311

Impedance of a Series Circuit (RLC Series Circuit)

Formula;	Operation	Display
$Z = \sqrt{R^2 + \left(\omega L - \dfrac{1}{\omega C}\right)^2}$ $\theta = \text{Tan}^{-1}\left(\dfrac{\omega L - \dfrac{1}{\omega C}}{R}\right)$ R L C C: Capacitance R: Resistance L: Inductance ω: Angular frequency Z: Impedance θ: Phase angle R = A, ω = B, L = C, C = D When R = 10⁴, ω = 120 × π (However When F = 60), L = 10⁻³, C = 10⁻⁶ → Z = ?, θ = ?	→ [AER] [2ndF] [CA] [DRG] (Depress until "DEG" appears.) [f()=] [2ndF] [A] [2ndF] [B] [2ndF] [C] [2ndF] [D] [f()=] [2ndF] [√] ([2ndF] [A] [x²] + ([2ndF] [B] [2ndF] [C] − ([2ndF] [B] [2ndF] [D]) [x⁻¹]) [x²]) [2ndF] [,] [2ndF] [TAN⁻¹] (([2ndF] [B] [2ndF] [C] − ([2ndF] [B] [2ndF] [D]) [x⁻¹]) ÷ [2ndF] [A] [AER] → [COMP] [COMP] [Exp] 4 [COMP] 120 π [COMP] [Exp] [(−)] 3 [COMP] [Exp] [(−)] 6 [COMP] [COMP]	**AER MODE** — — f(A B C D __ (A B C D) = √(A² + __ √(A² + (BC − (BD __ BC − (BD)⁻¹)²), __ ²), TAN⁻¹((BC − (__ BC − (BD)⁻¹) ÷ A __ **COMP MODE** A = ☀ B = ☀ C = ☀ D = ☀ 10345.7331 (Z) − 14.85403325 (θ)

TYPICAL APPLICATIONS

MATHEMATICS
- Area of a triangle
- Cosine theorem
- Conversion of oblique crossing
- Distance between two points on polar coordinates
- Linear equation with two variable numbers, etc.

STATISTICS-PROBABILITY
- $n, \Sigma x, \bar{x}, \Sigma y, \bar{y}, \Sigma x^2, \Sigma y^2, s_n, \sigma_n, s_n, \sigma_n,$ Σxy
- Poisson distribution
- Binomial distribution
- Binomial coefficient
- Normal distribution
- Standard normal distribution
- Coefficient of correlation, Linear regression, etc.

ENGINEERING
- Closed traverse
- Tachymetry
- Area of a sector
- Density of the ground
- Stability of the slope
- Determination of the sectional shape of a waterway
- Head lost by friction in a water pipe
- Head lost by friction
- Head lost by inflow
- Measurement of Discharge by Weir, etc.

ELECTRICITY
- Calculation of parallel resistance & series capacitance
- Vio Savare's method
- Power acting between electric current
- Magnetic field strength on the central axis of a circular coil
- Magnetic field strength by a micro magnet
- Electromagnetic power
- Compund magnetic field by a direct electric current
- Magnetic field on the solenoid axis of a single-phase cylinder
- Impedance (RLC series circuit)
- The 3/2 power rule
- Equivalent resistance of noise
- Planning of regular K-type filter
- Illuminance of a point light source, etc.

PHYSICS
- Inertia efficiency
- Movement over a flat surface involving an increasing speed
- Circular movement in uniform velocity
- Atmospheric pressure on the point, Zm high, etc.

BUSINESS
- Money conversion
- Interest on loan
- Interest on deposit
- Present & future value of a compound

OTHER APPLICATIONS
- Relation between power level and sound pressure level
- Correction of noise
- Separation standard of sulfur oxide, etc.

EL-5103

Specifications

Type:	Wallet-type scientific calculator
Power Source:	DC: Alkaline manganese battery (LR44) × 3 (Approx. 450 hrs.) Silver oxide battery (S15 or G13) × 3 (Approx. 1400hrs.)
Display:	FEM type liquid crystal dot matrix display with 13-digit display capacity
Decimal Point:	10-digit full-floating or 8-digit mantissa (7-digit in negative)/2-digit exponent
Sign & Indicators:	Minus sign, Error, 2ndF, HYP, DEG, RAD, GRAD, FIX, SCI, ENG, etc.
Calculations:	Four arithmetic calculations, power calculation, reciprocal calculation, chain calculation, memory calculation, parentheses calculation, statistical calculation, linear regression (estimate function), sin x, cos x, tan x, $\sin^{-1}x$, $\cos^{-1}x$, $\tan^{-1}x$, sinh x cosh x, tanh x, $\sinh^{-1}x$, $\cosh^{-1}x$, $\tanh^{-1}x$, Y^x, e^x, 10^x, ln, log, x^2, $\sqrt{\ }$, $\sqrt[3]{\ }$, x^{-1}, $\sqrt[x]{Y}$, n!, $r\theta \leftrightarrow xy$, DEG$\leftrightarrow$DMS, π, etc.
Components:	LSI, etc.
Operating Temperature:	0° ∼ 40°C (32° ∼ 104°F)
Dimensions:	69(W) × 7.8(H) × 128(D)mm 2-23/32″(W) × 5/16″(H) × 5-1/32″(D)
Weight:	Approx. 80g (0.18 lbs.)
Accessories:	Battery LR44 × 3 (built-in) and wallet

*Design and specifications subject to change without notice.

Comes with an attractive wallet.

Sharp Offers the World Many Innovative Products from Its Home Bases.
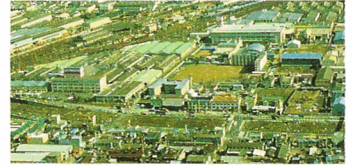

Head Office, Electronic Components Division (Osaka)

Engineering Center. Electronic Components Group. Training Institute (Nara)

Audio Systems Group (Hiroshima)

Home Appliance Division and Commercial Utility Appliance Division (Osaka)

Kitchen Appliance Division (Osaka)

TV and Video System Group (Tochigi)

Industrial Instruments Group (Nara)
Sharp industrial instruments manufactured in this plant are delivered to various countries the world over.

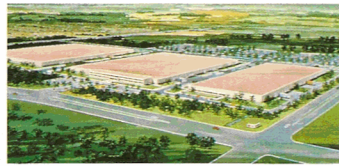From these and numerous other major sales and manufacturing bases

Sharp Markets Its Products in 135 Countries.

Executive Offices of Sharp Electronics Corporation (SEC) [New Jersey, U.S.A.]

Executive Offices of Sharp Electronics (Europe) GmbH (SEEG) [Hamburg, F.R. of Germany]

Sharp Manufacturing Company of America (SMCA) [Tennessee, U.S.A. a Division of SEC]

Sharp Electronics (U.K.) Ltd. (SUK) [Manchester, U.K.]

SEC's Los Angeles Branch Office [California, U.S.A.]

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