

New Sinclair Scientific pocket calculator

Logs, trig and
arithmetic at the touch
of a button...

Scientific notation
over a 200-decade range...

Chain calculations
of unlimited length.



The Sinclair Scientific: specialised – but sensible

To the scientist, the technologist, the engineer – even the mathematician – the normal arithmetic pocket calculator offers only limited help.

Accuracy, number of digits displayed or used, and exponent range may be restricted; and the route through complex chain calculations or those involving tortuous functions is inevitably tortuous – or simply impossible.

Yet the portable alternatives – slide-rules, and log and trig tables – are time-consuming and tedious.

Theoretically, the functions which can be built into a portable calculator are almost unlimited. Add a key...add some extra circuitry...and a new

function can be handled at a single stroke.

Inevitably, the logical outcome of this approach is a bulky, expensive calculator, with a bewildering array of keys.

The Sinclair Scientific tackles it differently.

The Sinclair alternative

The Sinclair Scientific is based on a different approach. Most complex scientific or mathematical calculations can be handled with ease, provided

the four arithmetic functions
(+, −, ×, ÷),

and eight transcendental functions
(log₁₀ and antilog₁₀, sin and arctan,
cos and arccos, tan and arctan)

are readily available and can be incorporated in chain calculations.

A special \sqrt{x} key, for example, offers very little saving in time compared with the sequence $\log x \dots \div 2 \dots$ antilog – yet may add substantially to cost, bulk and keyboard complexity.

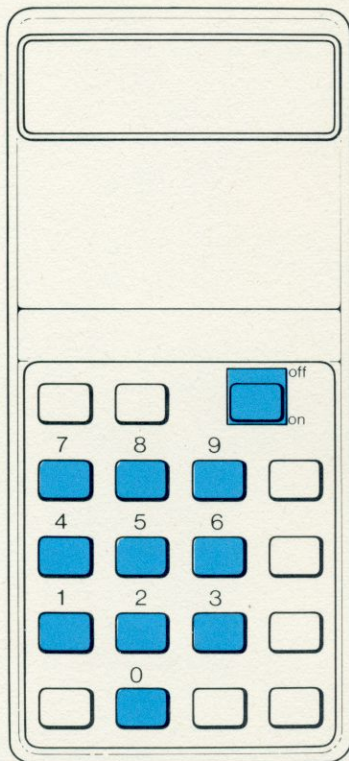
The Sinclair Scientific offers all 12 functions, and incorporates them in chain calculations, without adding a single key to the basic arithmetic calculator keyboard layout.

Small, light and stylish: the physical characteristics of the Sinclair Scientific

The Sinclair Scientific is as elegant physically as it is in performance.

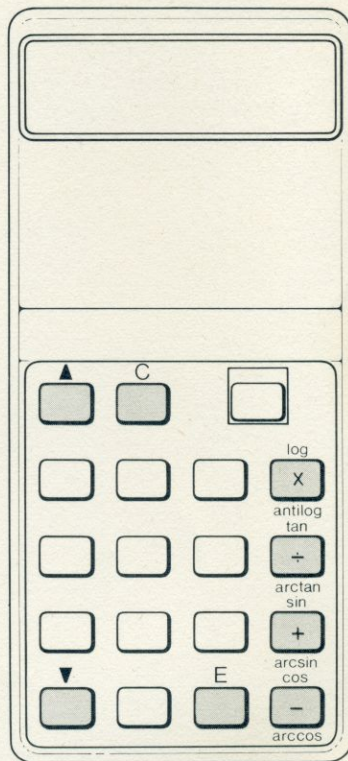
The first principle of a pocket calculator is that it should fit in a pocket. The Scientific does. The front-cover illustration shows it full size. It weighs a mere 4 oz – heavy enough to be satisfying in your hand, but not so heavy that it bags even a lightweight suit. It is contoured to sit easily and naturally in your palm, and attractively styled in grey, blue and ivory.

The Scientific is robustly engineered, and carries a comprehensive one-year guarantee. It is supplied with an aide-memoire of operating instructions, a skin-tight hinged carrying case, and a set of batteries.



Number keys

Blue keys follow normal arithmetic keyboard layout. All keys are well separated, and operate with audible click – no need to check display to see whether digit keyed has registered.



Function keys

There are four function keys and two function-select keys. The function keys operate normally as arithmetic operators (+, −, ×, ÷), but each also offers two additional functions – an 'upper mode' and a 'lower mode'. A function-select key (\blacktriangle or \blacktriangledown) pressed before a function key automatically switches it into the chosen mode. See examples on page 6. The E key precedes the entry of the exponent part of a number (see page 4).

Remarkable integrated circuit development keeps price and size to minimum

This Sinclair achievement—the refinement of functions to the valuable minimum, instead of the proliferation of functions to a bewildering maximum—has been made possible by a brilliant and exclusive integrated circuit design.

All the logic of the Sinclair Scientific is concentrated on a single chip, 5 mm square, which carries over 7,000 components. The logical arrangement of the components, and the accuracy with which they can be physically disposed, determine the performance of the calculator.

The Sinclair development team have programmed this single chip to offer all the necessary functions and

scientific notation over a 200-decade exponent range. The development of a new complex integrated circuit is normally extremely tricky, involving a great deal of trial-and-error production.

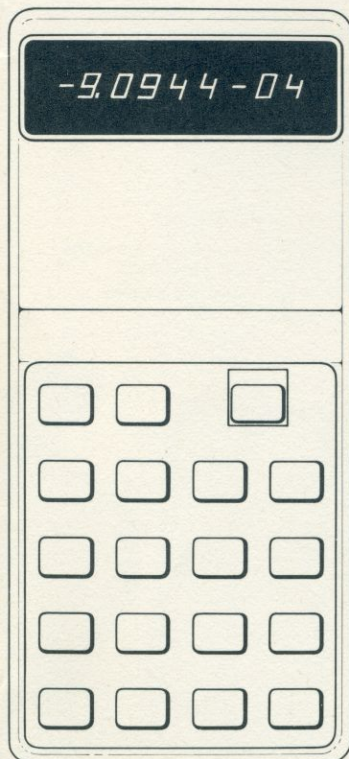
Every stage of the design of the Scientific chip was computer-tested, and the very first production chip functioned precisely as it was designed to do.

This outstanding single-chip achievement is the basis of a calculator of sophisticated capability, comparatively straightforward and economical manufacture—and very reasonable price. The calculator uses minimum power (running for 25 hours on a set of low-price, disposable batteries), and is uniquely convenient in use.

A calculator of unusual versatility

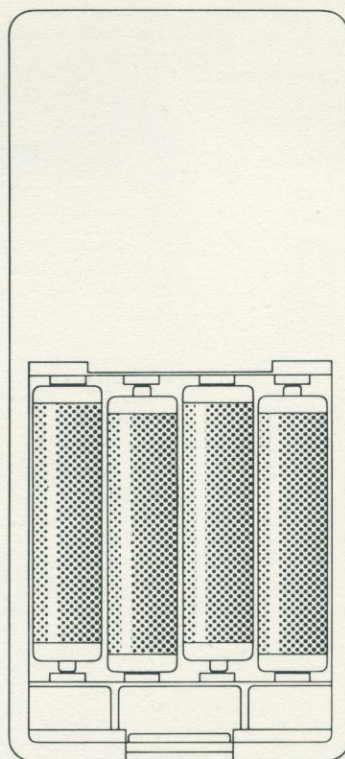
Because it provides general calculating capability of great power, rather than an accumulation of specialised functions, the Sinclair Scientific is a very versatile machine.

Although it was designed primarily for scientists and engineers, its price puts it well within the reach of students and schools; and its power makes it invaluable for any commercial and industrial managers with or without a technological background.



Display

Numbers are represented with a 5-digit mantissa and a 2-digit exponent (see page 4), each with allowance for signing. The decimal point is fixed in position after the first digit of the mantissa. New display assembly with ultra-violet window gives clear view in strong light.



Disposable batteries

Completely independent of external power, the Scientific gives about 25 hours' continuous use from four easily available, easily fitted AAA manganese alkaline batteries.



Compact format

4 1/2" x 2" x 1 1/16".
Weight 4 oz.

The simple operating principles of the Sinclair Scientific

The Sinclair Scientific is programmed to be simple to use.

It uses post-fixed operators (reverse Polish notation) to work on numbers entered and displayed in standard scientific notation.

Scientific notation

'Scientific' (mantissa and exponent) notation is the basis of the calculator's power. It allows it to operate over the enormous 200-decade exponent range.

If you are accustomed to working with it you will find nothing strange in the method of entering numbers or reading the display of the Sinclair Scientific – and you will know how convenient it is.

If you are not, you will find it extremely easy to pick up. The following note may be helpful.

Scientific and engineering calculations often employ positive or negative numbers of very large or very small dimensions.

To avoid handling long strings of digits, these numbers are often represented by the first significant digits (the 'mantissa') and an 'exponent'. The exponent tells you how many times the number as written has to be multiplied by ten to be the 'real' number.

Take 1¼ million. Expressed as 1,250,000 it is an unwieldy number to handle. To multiply it by 133 entails a sum like this:

$$\begin{array}{r} 1250000 \times \\ \underline{133} \\ 3750000 \\ 37500000 \\ \underline{125000000} \\ 166250000 \end{array}$$

Yet actually, all the calculation has gone on using only the first 3 digits of 1250000 – namely, 125. The strings of 0's are confusing, irrelevant and dangerous (since missing one out will throw out the whole calculation.)

Now suppose we write 1250000 as 1.25×10^6 – in other words, 1.25 (the mantissa), multiplied by 10 six times (the exponent). Then the sum is cut to its bare bones:

$$\begin{array}{r} 1.25 \quad (\times 10^6) \\ \underline{1.33} \\ 3.75 \\ 3.75 \\ \underline{1.25} \\ 166.25 \quad (\times 10^6) \end{array}$$

It is then extremely easy to multiply by 10 six times, simply by moving the decimal point six times to the right, thus:

$$166.250000 = 166,250,000.$$

But 133 can also be written in mantissa and exponent form, as 1.33×10^2 .

$$(1.33 = 133.)$$

So the sum can be written as:

$$\begin{array}{r} 1.25 \quad \times 10^6 \\ \underline{1.33 \quad \times 10^2} \\ 3.75 \\ 3.75 \\ \underline{1.25} \\ 166.25 \quad \times 10^8 \text{ (the sum of the two exponents)} \end{array}$$

This is how people who perform complex calculations with multi-digit numbers tend to work – calculating with the fewest possible digits, and simply keeping track of the exponent to indicate where the decimal point will finally be positioned.

And that is exactly what the Sinclair Scientific does. The display is in two parts, with a fixed decimal point.

$$\begin{array}{cc} \begin{array}{|c|c|} \hline 9 \cdot 2345 \quad 01 \\ \hline \end{array} & \begin{array}{|c|} \hline 92 \cdot 345 \\ \hline \end{array} \\ \text{Mantissa} \quad \text{Exponent} & \text{Actual figure} \end{array}$$

Negative numbers have a minus mantissa.

$$\begin{array}{cc} \begin{array}{|c|c|} \hline -9 \cdot 2345 \quad 01 \\ \hline \end{array} & \begin{array}{|c|} \hline -92 \cdot 345 \\ \hline \end{array} \\ \text{Mantissa} \quad \text{Exponent} & \text{Actual figure} \end{array}$$

A positive exponent indicates the number of times the mantissa has to be multiplied by ten; a negative exponent the number of times it has to be divided by ten.

$$\begin{array}{cc} \begin{array}{|c|c|} \hline 9 \cdot 2345 \quad 01 \\ 9 \cdot 2345 \cdot 01 \\ -9 \cdot 2345 \cdot 01 \\ \hline \end{array} & \begin{array}{|c|} \hline 92 \cdot 345 \\ \cdot 92345 \\ -92345 \\ \hline \end{array} \\ \text{Mantissa} \quad \text{Exponent} & \text{Actual number} \end{array}$$

As the examples on pages 6 and 7 demonstrate, scientific notation is extremely easy and logical, and rapidly becomes second nature. The exponent is entered immediately after the digits of the number have been entered, simply by pressing the E key and then entering the required number – with a minus if necessary.

**New
Sinclair**

All 12 basic mathematical functions from four keys
Convenient scientific notation over 200-decade range
Complete independent

Post-fixed operators

The logic of the Sinclair Scientific allows the maximum use of its facilities.

The Scientific works with post-fixed operators: the function key is pressed *after* the number it is meant to operate on. Pressing the operator automatically produces an immediate answer.

This system is particularly suitable for a multi-function machine like the Scientific since it allows the transcendental functions (logs and trig) to be included directly in calculations. It also eliminates an = key altogether.

The examples on pages 6 and 7 demonstrate how neatly the post-fixed operators handle complex calculations – without the need for intermediate pencil-and-paper notes.

Functions summary

Functions	Permitted argument range (Acceptable numbers)	
Addition Subtraction Division Multiplication	} 0.0001 x 10 ⁻⁹⁹ to 9.9999 x 10 ⁹⁹	
Logarithms (base 10)		1.0000 to 9.9999 x 10 ⁹⁹
Antilogarithms (10 ^x)		0.0000 to 99.999
Sine Cosine Tangent		} 0 to $\frac{\pi}{2}$ radians
Arcsine	0 to 1	
Arccosine	0.00056 to 1	
Arctangent	0 to 9.9999	
Automatic squaring		
Automatic doubling		
x ^y (including square and other roots)	x 1.0000 to 9.9999 x 10 ⁹⁹ y 0.0000 to 99.999	

Chain calculations are possible using any of the functions.



The Sinclair Scientific at work: some simple examples

I. Number entry

To enter	Key sequence	Display shows
2	2	2.0000 00
20	2 E 1	2.0000 00 2.0000 01
300	3 E 2	3.0000 00 3.0000 02
40,000,000,000	4 E 1 0	4.0000 00 4.0000 10
-300	3 E 2	3.0000 00 -3.0000 02
0.2	0 2	0.2000 00

II. Four-function arithmetic

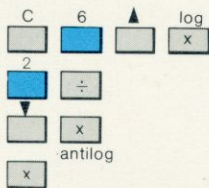
18 $\left(\frac{4.5-3.2}{7}\right)$	C (to clear machine)	0.0000 00
	4 5	4.5000 00
	3 2	1.3000 00
	7	1.8571-01
Answer: 3.3427	1 8 E 1	3.3427 00

III. Transcendental calculations

$\log \left(\frac{(-3.82+22.6) \times 0.04}{.0826} \right)$	C 3 8 2	-3.8200 00
	2 2 6 E 1	1.8780 01
	0 4 E 1	7.5120-01
	0 8 2 6 E 1	9.0944 00
Answer: 0.9588		9.5880-01

IV. Techniques

1. $\sqrt{6}$

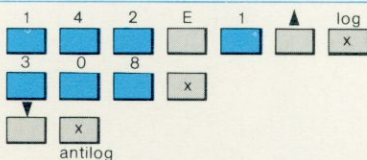


The final x has squared the result.

Answer:
2.4495

7.7818-01
3.8909-01
2.4495 00
6.0000 00

2. $14.2^{3.08}$



Answer:
3541.6

1.1523 00
3.5492 00
3.5416 03

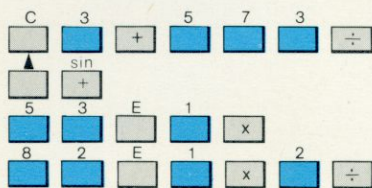
V. Trigonometry example

Find the area of a triangle having sides of 53 inches and 82 inches, enclosing an angle of 30°.

$$\text{Area} = \frac{a \times b \times \sin c}{2}$$

$$= \frac{53 \times 82 \times \sin 30^\circ}{2}$$

Answer:
Area=1086.5 square inches



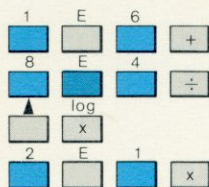
5.2356-01
=30° in radians
5.0003-01
=sin 30°
1.0865 03

VI. Electronics example

Find the voltage gain in dB where the input and output voltages are 80 μv and 1 mv respectively.

$$\text{Gain} = 20 \log \left(\frac{1 \times 10^6}{80 \times 10^3} \right) \text{ dB}$$

Answer:
21.938 dB

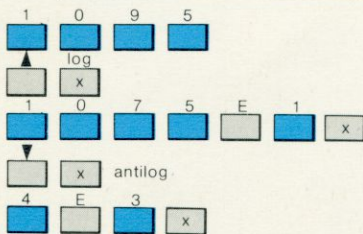


1.0000 06
1.2500 01
1.0969 00
2.1938 01

VII. Financial example

\$4,000 is invested at 9 1/2% per annum. What will the investment have grown to in 10 years 9 months?

Answer:
\$10611



1.0950 00
3.9420-02
4.2376-01
2.6529 00
1.0611 04

Latest in a line of Sinclair firsts

The Sinclair Scientific is the latest technological advance by Sinclair Radionics Ltd, Europe's largest calculator manufacturers.

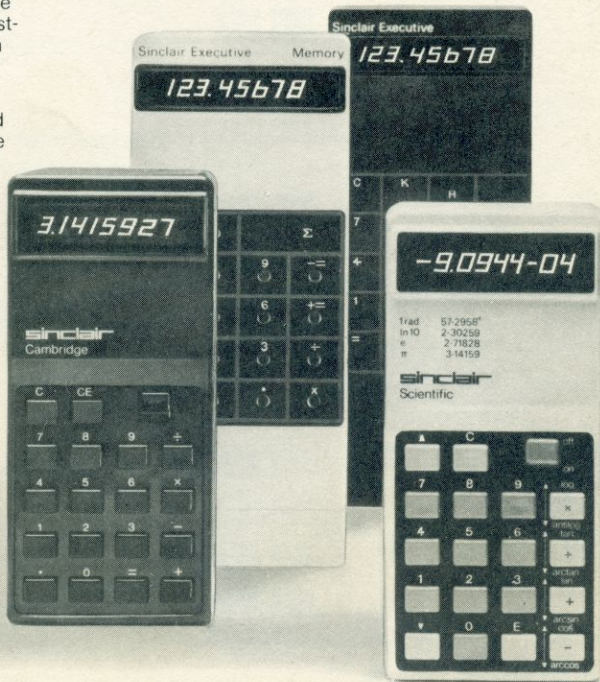
The first Sinclair pocket calculator ever produced – the Sinclair Executive – became an instant classic. The first ever genuinely pocketable calculator, it won a Design Council Award – the only product of its type ever to do so.

It was followed by the Sinclair Executive Memory, and the Sinclair Cambridge (a small, powerful, all-purpose arithmetic calculator) – and now by the Sinclair Scientific.

All Sinclair calculators are marked by the distinctive Sinclair conceptual approach – a clear, rigorous definition of the product's purpose, innovative brilliance in design and development, and high standards of engineering and manufacture.

Where to find the Sinclair Scientific

The Sinclair Scientific is the first scientific calculator to be retailed widely. It is available from most normal calculator stockists.



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