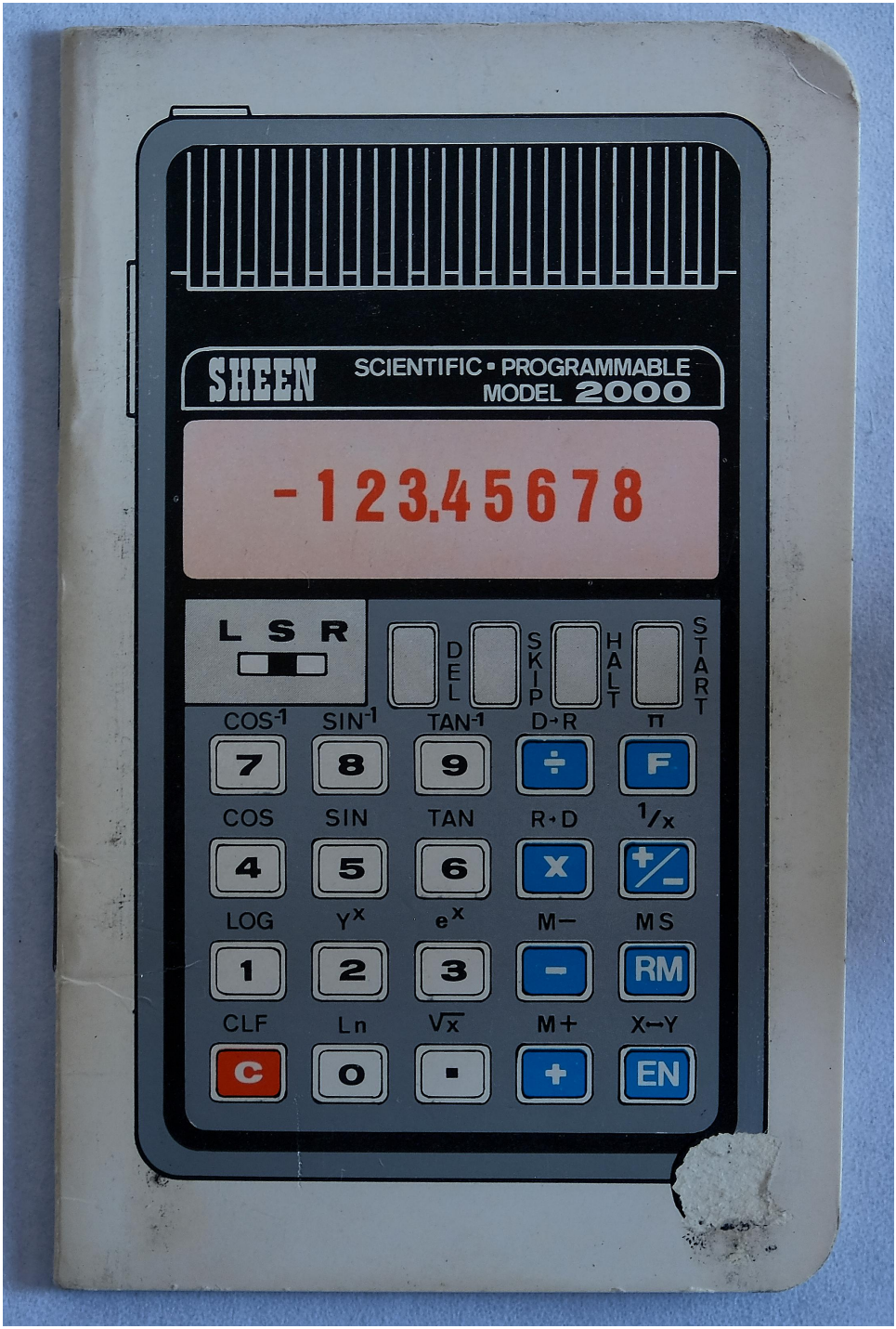
SHEEN
SCIENTIFIC • PROGRAMMABLE
MODEL 2000
-123.45678
L S R
DEL
SKIP
HALT
START
COS-1
SIN-1
TAN-1
D→R
π
7
8
9
÷
F
COS
SIN
TAN
R→D
1/x
4
5
6
x
+/-
LOG
yx
ex
M−
MS
1
2
3
−
RM
CLF
Ln
√x
M+
X↔Y
C
0
.
+
EN

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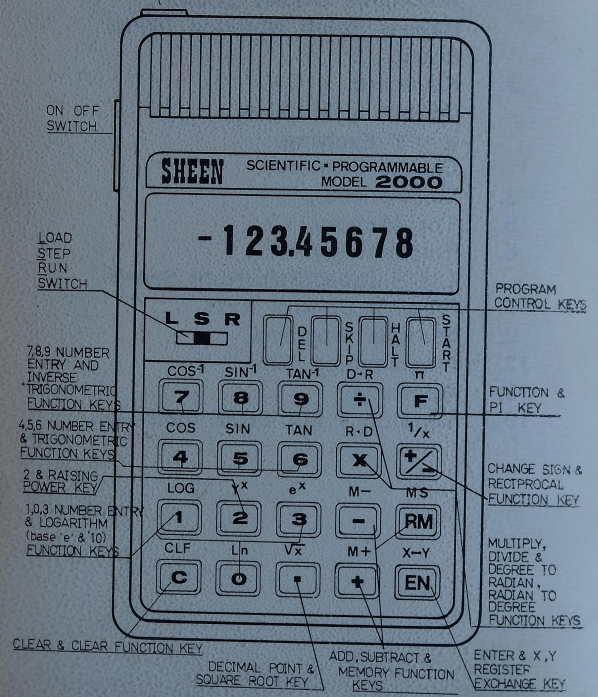
KEYBOARD LAYOUT



Turn your SHEEN 2000 on with the switch located on the left side of the calculator. The calculator is automatically cleared and the display should now show 0.

POWER SOURCE

Your calculator uses one standard 9V ordinary/alkaline battery or by an AC adaptor with 9V dc output. A low cost AC adaptor is available at the store where you purchased this calculator.

DISPLAY, OVERFLOW AND ERROR INDICATION

The SHEEN 2000 will accept and display and positive or negative number between 0.0000001 and 99999999. Any result larger than 99999999 or any logic error (i.e. division by zero) will result in an error indicated by all zeros and all decimal points showing in the display. Touching the [C] key will clear the error indication and permitting further calculations.

AUTOMATIC DISPLAY SHUTOFF

To save battery life, the SHEEN 2000 will shut off the display and shows all decimal points if no key has been touched for approximately 25 seconds. No data has been changed and further entries or operations will bring back the display. To restore the display without changing its contents, touch [+/-] key twice.

REVERSE POLISH NOTATION (RPN) ENTRY

In keeping with common practice the SHEEN 2000 provides Reverse Polish Notation (not algebraic as in simple units). This is more convenient for complex equations as you will find. Basically it means you put the first number of a calculation into the calculator and press enter [EN] to begin. From then you enter all other numbers before the function +, -, x, ÷, and then the function, this then performs its function and displays the answer without the need for an = equals key.

For eample: 2 x 3 + 4 =, you would press 2 then [EN] then 3 then [X] then 4 then [+] and the answer (10) is displayed. This is the way almost all scientific calculators operate. The advantage is that, less key presses are required to compute complex or long equations.

KEYBOARD

Because the SHEEN 2000 does so many different calculations, we have had to reduce the number of keys required by giving every key two different functions. Each key will always perform the function on that key unless the second function [F] key is pressed first, then the next key you press will perform the function written above it. The calculator then returns automatically to normal state and all keys perform their primary function unless the second function [F] key is pressed again. If you accidentally touch [F] when you didn't want to, a touch of the [C] key will cancel the effect of the [F] key.

CORRECTING MISTAKES

If you enter a wrong number, one touch of the [C] key will clear the error and bring back the previous number. Although it is not necessary to clear the calculator between problems, three touches of the [C] key will clear all except memory. If you make a mistake after touching a function key, the best way to correct your mistake is to enter the last number again and touch the opposite function. For example: If you find you have multiplied 12 by 6 when you wanted to divide 12 by 6, enter 6 again, touch [÷] (division is the opposite of multiplication) and you are back where you started before making the mistake.

X ↔ Y EXCHANGE

Pressing [F] [X ↔ Y] allows you to exchange the contents of the display with what was last in the display.

CHANGE SIGN KEY [+/-]

The [+/-] key enables you to change the sign of the number in the display. If the number is positive touching [+/-] will make it negative and vice versa. To enter a negative number, key in the number and touch [+/-] .

PI [π]

Pressing [F] [π] allows you to enter the constant Pi (3.1415926) to the display.

CALCULATIONS

One-Factor calculations: One-factor functions work directly on what is in the display, there is no need to press EN before performing the function.

[F] [ln] computes the natural logarithm of any positive number in the display.

[F] [e^x] computes the natural antilog of the number in the display by raising the constant 'e' (2.7182818) to the power in the display.

[F] [log] computes the common logarithm of any positive number in the display.

[F] [$\sqrt{x}$] computes the square root of any positive number in the display.

[F] [1/x] computes the reciprocal of the number in the display.

[F] [sin] computes the sine of the angle in the display.

[F] [cos] computes the cosine of the angle in the display.

[F] [tan] computes the tangent of the angle in the display.

[F] [$\sin^{-1}$] computes the arc sine of the number in the display.

[F] [$\cos^{-1}$] computes the arc cosine of the number in the display.

[F] [$\tan^{-1}$] computes the arc tangent of the number in the display.

[F] [r→d] to convert a displayed angle x in radian to an angle in degrees (π radian = 180°).

[F] [d→r] to convert a displayed angle x in degrees to an angle in radian.

Examples:

	key in	display shows
Square Root		
$\sqrt{144} = 12$	144	144
	[F] [$\sqrt{x}$]	12.
Reciprocal		
$\frac{1}{0.2} = 5$	0.2	0.2
	[F] (1/x)	5.
Natural logarithm		
ln 123 = 4.812184	123	123
	[F] (ln)	4.812184

Common logarithm

log 123 = 2.089905	123	123
	F (log)	2.089905

Conversion between radian and degree

0.1 rad. = 5.729578°	0.1	0.1
	F (r→d)	5.729578
180° = 3.1415926 rad.	180	180
	F (d→r)	3.1415926

Trigonometric Functions

Sin 45° = 0.7071068	45	45
	F (sin)	.7071068
$\cos^{-1}$ 0.5 = 60°	0.5	0.5
	F ($\cos^{-1}$)	60.

Two-factor calculations

To perform two-factor calculations, key in the first number, touch EN , key in the second number and touch the desired function key.

+ adds what is in the display to what was last in the display.

− subtracts what is in the display from what was last in the display.

x multiplies what is in the display by what was last in the display.

÷ divides what was last in the display by what is now in the display.

F (Y^X) to raise the displayed number Y to a power of x.

Example:	key in	display shows
$2^{3.15}$ = 8.876545	2	2
	EN	2.
	3.15	3.15
	F (Y^X)	8.876545

Chain calculation with two-factor functions

Example:	key in	display shows
$\frac{3}{12} + \frac{2}{5}$ = 0.65	3	3
	EN	3.
	12	12
	÷	.25
	2	2
	EN	2.
	5	5
	÷	.4
	+	.65

Chain calculation combining one and two factor functions

Example:

$\frac{1}{32} + \frac{1}{25}$ = 0.07125

32		32
F (1/x)		.03125
25		25
F (1/x)		.04
+		.07125

THE MEMORY

Any number displayed will be added to the memory by pressing F (M+) or subtracted from the memory by pressing F (M−). The contents of the memory may be recalled for inspection or use at any time by pressing recall memory (RM) key. The contents of the memory may be replaced with the displayed number by pressing F (MS). This is also the method of returning the memory register to zero. Place zero on the display and press F (MS), the memory is now cleared.

Example:	key in		display shows	
$\frac{2}{(153 - 3)}$	153		153	
= 0.01333333	F	(M+)	153.	memory content = 153
	3		3	
	F	(M−)	3.	memory content = 150
	2		2	
	EN		2.	
	RM		150.	recall memory
	÷		.01333333	
	0		0	clear memory by entering
	F	(MS)	0.	0 to the memory.
	RM		0	

PROGRAMMING

The addition of learn-mode programming to the already powerful SHEEN 2000 programming calculator creates a truly innovative combination of calculating power and convenience. The SHEEN 2000's programming capability means you can virtually eliminate the possibility of errors in performing repetitious calculations. And it means you can save not just minutes, but hours of valuable time in performing sophisticated problems.

Learn-mode programming is essentially automatic key pressing. once you have found an efficient sequence of steps that solves a particular problem, you can program those steps to work the problems with a full range of variables.

There are 100 steps of programming available. This means you can store up to 100 keyboard operations at one time. You can program the SHEEN 2000 with one large program or as many small programs as you can fit into the 100 steps. If you go past 100 steps, the calculator will indicate an error condition by displaying all decimal points.

L/S/R (Load / Step / Run) switch

L (Load) – To program the calculator, key in a particular calculating sequence with the switch in the [L] (Load) position. Once programmed, the calculator will perform that sequence of operations until you reprogram or turn the machine off.

S (Step) – With the switch in the [S] position, the calculator will execute one step of a stored program for each touch of the start key.

R (Run) – With the switch in the [R] position, touch start to execute a stored program.

PROGRAM CONTROL KEYS

Start – With the L/S/R switch in the L position, touching start will erase all previously stored information in the program storage area, write a START code and mark the beginning of the first program.
with the L/S/R switch in the R position, touching start begins execution of the first program. If the program is stopped at a HALT code, touching start causes execution of the program to continue from the HALT to the next HALT or to the end of the program.

Skip – With the L/S/R switch in the L position, touching skip marks the beginning of program other than the first. It writes a SKIP code for each subsequent program.
With the L/S/R switch in the R position, if the program is stopped at the beginning of the first program, touching skip will cause the first program to be skipped. Execution automatically begins again with the start of the second program and continues to the first programmed HALT or to the end. If only one program is stored and the program is stopped at a HALT, touching skip will jump over the remaining part of the program and start execution at the beginning of the program. This feature may be used to create a 'loop' within the main program. When only two programs are stored, touching skip effectively executes the second program and touching start executes the first. When more than two programs are stored, a HALT code must be programmed in somewhere in all program except the first. To execute the second program, touch skip, to execute the third program, touch skip skip, to execute the n^{th} program, touch skip n-1 times.

Halt – With the L/S/R switch in the L position, the halt key is used to insert a HALT code in the program sequence. Halt is usually used as a pause in the program execution to

allow the reading of an intermediate result and/or to input a variable for further processing. Normally, start is used to leave the HALT condition and continue execution of the program, but it will also allow branching to the next or subsequent programs if skip is touched.
The halt key is ignored if the L/S/R switch is in the R position.

del — With the L/S/R switch in the L position, touching del (delete) provides an editing function by erasing the last step entered in the program. Multiple deletes can be used to remove several steps or even complete programs. If a programmed SKIP is deleted, or if an attempt is made to delete START, the calculator will indicate an error by displaying all decimal points. If a programmed SKIP has been deleted by mistake, re-entering skip will reinitiate that program.

Example: Program the SHEEN 2000 to calculate

$$\cosh x = \frac{e^x + e^{-x}}{2} \qquad \text{for } x = 0.25,\ 2.2,\ 2.28$$

step	L/S/R sw. position	key in	display shows	comments
	L	0.25	0.25	first value of x (dummy variable)
1	L	[start]	0.25	clear program area and initiate new program.
2	L	[F]	0.25	
3	L	(e^x)	1.284025	
4	L	[EN]	1.284025	
5	L	[F]	1.284025	
6	L	(1/x)	.77880103	e^{-x}
7	L	[+]	2.062826	
8	L	2	2	program '2' as a constant
9	L	[÷]	1.031413	program is completed, first value of cosh x is calculated.

now move the L/S/R switch to R position

1	R	2.2	2.2	enter value of x
2	R	[start]	4.5679061	cosh 2.2 displayed
3	R	2.28	2.28	
4	R	[start]	4.9394791	cosh 2.28 displayed

MULTIPLE PROGRAMS

When programming with the L/S/R (Load/Step/Run) switch in the [L] position, keying in a skip terminates the current program and initiates a new one. Using this feature, you can key in as many seperate programs or subprograms as will fit into 100 steps. Remember that touching skip with the L/S/R switch in the [R] position while the current program is pausing at a HALT command terminates the current program and begins execution of the following program. The following program will then run until the first programmed HALT or to the end of all programs. If you want the SHEEN 2000 to pause at the beginning of each new program, be sure a halt is programmed immediately following skip.

Example: Calculate the circumference and area of a circle or the area and volume of a sphere, whichever is needed. Since you do not know which you will need. You can write two programs, and use whichever one is necessary.

The first program will be for the sphere using the formulas:

area = $4\pi r^2$ where r is the radius
volume = $4/3\pi r^3$ where r is the radius

The second program will be for the circle and use the formulas:

area = πr^2 where r is the radius
circumference = $2\pi r$

step	L/S/R sw. position	key in	display shows	comments
	L	2	2	enter dummy variable for r
1	L	[start]	2	

2	L	F	2.	
3	L	(MS)	2.	
4	L	EN	2.	
5	L	x	4.	r^2
6	L	F	4.	
7	L	(π)	3.1415926	
8	L	x	12.56637	πr^2
9	L	4	4	constant
10	L	x	50.26548	
11	L	halt	50.26548	pause to display area of sphere
12	L	RM	2.	
13	L	x	100.53096	$4\pi r^3$
14	L	3	3	
15	L	÷	33.51032	$4/3\pi r^3$ and first program stop here.
	(R)	1	1	switch to (R) position for entering another dummy variable of r.
16	L	skip	1	initiate second program (circle program)
.				
17	L	F	1	
18	L	(MS)	1	
19	L	EN	1.	
20	L	F	1.	
21	L	(π)	3.1415926	
22	L	x	3.1415926	
23	L	2	2	constant
24	L	x	6.2831852	$2\pi r$ circumference of circle.
25	L	halt	6.2831852	pause to display the circumference of circle
26	L	RM	1.	
27	L	EN	1.	
28	L	x	1.	r^2
29	L	F	1.	
30	L	(π)	3.1415926	
31	L	x	3.1415926	πr^2 area of circle

Move the L/S/R switch to R position

Problem 1

Find the area and volume of sphere with radius 2.75, and a sphere with radius 3.85.

step	L/S/R sw. position	key in	display shows	comments
	R	2.75	2.75	enter value of r
1	R	start	95.033176	start program 1 and the area of sphere is displayed
2	R	start	87.113743	volume of sphere, program continues to end of program 1
	R	3.85	3.85	enter value of r
1	R	start	186.26502	start program 1 again and the area of sphere is displayed. Program executes to first programmed HALT.
.				
2	R	start	239.0401	volume of sphere, program continues to end of program 1.

Problem 2

Find the circumference and area of a circle with radius 2.85, and a circle with radius 3.5.

step	L/S/R sw. position	key in	display shows	comments
	R	2.85	2.85	enter value of r
1	R	skip	17.907077	skip over program 1 and start program 2 calculates and displays circumference of circle. Program is stopped at the first programmed HALT of program 2.

2	R	start	25.517585	area of circle is displayed. Program continues to end of program 2.
.				
	R	3.5	3.5	enter value or r
1	R	skip	21.991148	skip over program 1 again and start program 2 calculates and displays circumference of circle.
2	R	start	38.484509	area of circle is displayed. Program continues to end of program 2.
.				

PROGRAMMING TIPS

If you remember the following steps, you will quickly master your SHEEN 2000 and have confidence in its answers.

1. To clear display before starting program, touch C.
2. To program, move L/S/R swtich to L position.
3. Begin the first program with start . Begin all subsequent programs with skip .
4. To interrupt the program, whether to enter a variable or to display a result touch halt .
5. To enter a constant, key in the desired number. It becomes part of the program.
6. To enter a variable, place the L/S/R switch to R position, then the desired number. So it does not become part of the program.
7. To run program, move the L/S/R switch to R position.
8. To start first program, touch start . To start second program, touch skip .
   To start n^{th} program, touch skip n–1 times.

APPENDIX

RPN and the Stack principle

The SHEEN 2000 uses RPN with three registers called X, Y and Z. A

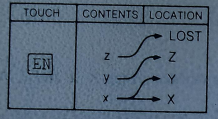
register is an electronic element used to store data while it is being displayed, processed or waiting to be proceessed. They are arranged in a stack with register X on the bottom. Register X is the displayed register.

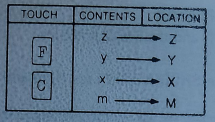
As numbers are keyed in, they go into the display (register X). When you touch EN , the number is duplicated into register Y. At the same time, the contents of register Y are transferred to register Z and the contents of register Z are transferred out of stack.

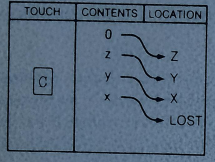
Performing an arithmetic operation (+, –, x, ÷) causes the contents of register X and Y to be combined according to the operation performed and the results transferred to register X. At the same time, the contents of register Z are transferred to register Y and register Z is cleared automatically.

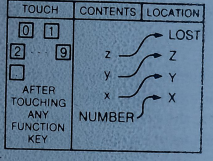
Since the memory (register M) is not affected by any operation other than specific memory functions. It is not part of the basic three-level stack.

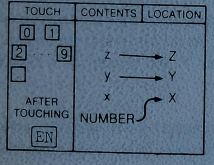
The following diagrams show what happens to the stack for each operation on the SHEEN 2000. To avoid confusion between the name of a register and its contents, the registers in these diagrams are represented by capital letters X, Y and Z and the contents of the registers by lower case letters x, y and z.

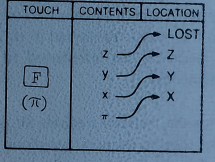


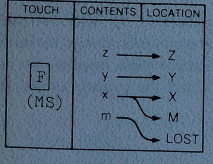


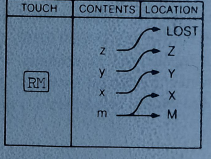


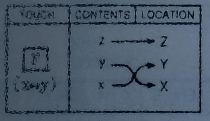


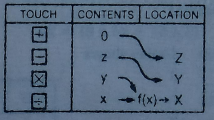




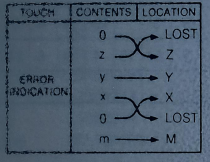


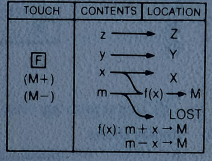




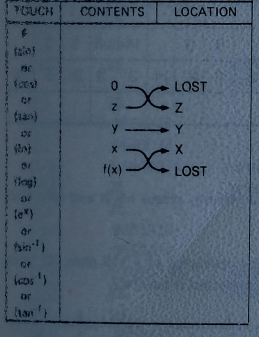


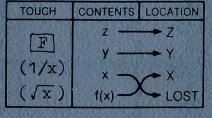
f(x): y + x → X
y − x → X
y × x → X
y ÷ x → X

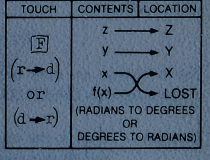


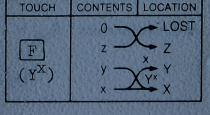


f(x): m + x → M
m − x → M









Examples:

(a) $(3 \times 5) + (4 \times 6) = 39$

key in	display shows
3	3
EN	3.
5	5
X	15.
4	4
EN	4.
6	6
X	24.
+	39.

Key	3	EN	5	X	4	EN	6	X	+
Z						15	15		
Y		3	3		15	4	4	6	
X	3	3	5	15	4	4	6	24	39
M									

(b) $(6 + 8) \times (3 + 2) = 70$

key in	display shows
6	6
EN	6.
8	8
+	14.
3	3
EN	3.
2	2
+	5.
X	70.

Key	6	EN	8	+	3	EN	2	+	X
Z						14	14		
Y		6	6		14	3	3	2	
X	6	6	8	14	3	3	2	5	70
M									

The followings are some sample problems, please try it and gain skill in operating your SHEEN 2000.

Example: What is the equivalent resistance of a 110 ohm, 82 ohm and 68 ohm resistor connected in parallel?

Using the formula: $R_{eq} = \dfrac{1}{\frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3}} = \dfrac{1}{\frac{1}{110} + \frac{1}{82} + \frac{1}{68}}$

$= 27.784029$

key in	display shows	comments
110	110	
E	110	
(1/x)	.0090909	
82	82	
E	82	
(1/x)	.01219512	
+	.02128602	
68	68	
E	68	
(1/x)	.01470588	
+	.0359919	
F	.0359919	
(1/x)	27.784029	

Example: Find the cotangent, secant and cosecant of 25°.
Using the formulae:
cot = 1/tan, sec = 1/cos, csc = 1/sin

key in	display shows	comments
25	25	
E	25	
(MS)	25.	store for further use without having to re-enter.
E	25.	
(tan)	.4663076	
E	.4663076	
(1/x)	2.1445071	cotangent 25°
RM	25.	re-enter 25°
E	25.	
(cos)	.9063078	
E	.9063078	
(1/x)	1.1033779	secant 25°
RM	25.	re-enter 25°
E	25.	
(sin)	.4226183	
F	.4226183	
(1/x)	2.3662013	cosecant 25°

Example: What is the equivalent impedance of a 250-ohm resistor and a 12.5 millihenry inductor at a frequency of 1200 Hz?

Using the formula: $Z_{eq} = R/\underline{\Theta}$ where

$$\Theta = \arctan \frac{2\pi fL}{R} = \arctan \frac{2 \times \pi \times 1200 \times 0.0125}{250}$$

$$= 20.656^\circ \text{ and}$$

$$R = \frac{2\pi fL}{\sin \Theta} = 267.17524$$

key in	display shows	comments
2	2	
[EN]	2.	
[F]	2.	
(π)	3.1415926	
[X]	6.2831852	
1200	1200	
[X]	7539.8222	
.0125	.0125	
[X]	94.247777	$2\pi fL$
[F]	94.247777	store $2\pi fL$ for re-enter
(MS)	94.247777	
250	250	
[÷]	.3769911	
[F]	.376991	
($\tan^{-1}$)	20.656	Θ calculated
[F]	20.656	
(sin)	.3527564	
[RM]	94.247777	
[F]	94.247777	
(x-y)	.3527564	exchange X & Y register
[÷]	267.17524	R calculated

Example
Evaluate: $\dfrac{\log [(14 + 26) / (6 - \sqrt{4})]}{\sin (25 + 5)}$

key in	display shows	comments
14	14	
[EN]	14.	
26	26	
[+]	40	14 + 26 = 40
6	6	
[EN]	6.	
4	4	
[F]	4	
[$\sqrt{x}$]	2	
[−]	4.	$6 - \sqrt{4} = 4$
[÷]	10.	$(14 + 26) / (6 - \sqrt{4}) = 10$
[F]	10.	
(log)	1.	log 10 = 1
25	25	
[EN]	25.	
5	5	
[+]	30.	
[F]	30.	
(sin)	.5	sin (25 + 5) = 0.5
[÷]	2.	answer

CONDITIONS FOR ERROR INDICATION

FUNCTION	CONDITION (x = contents of register X)
+, −, x, ÷	$X > 99999999$
÷, 1/x	$\lvert X \rvert \leqslant 0.00000001$
$\sqrt{x}$	$X < 0$
Y^X	$Y \leqslant 0$; $18.42060 < X \ln Y < -28$
log, ln	$X \leqslant 0$
e^X	$18.42068 < X < -28$
sin, cos	$X \geqslant 7$ radians, $X \geqslant 401^\circ$
tan	$\lvert X \rvert \geqslant 90^\circ$, $X \geqslant 7$ radians
$\sin^{-1}$, $\cos^{-1}$	$X > 1$
$\tan^{-1}$	$X > 99999999$