SX CONCEPTS & FACILITIES

2 Models: SX100 and SX300 Programmable Calculators

A. Programmed & Non-Programmed Operation
    Very simple to program; key concept;

'Programming' is effectively getting the calculator to memorise
(in its step memory) the sequence of key board operations
necessary to solve a given problem.

SX programming, at a simple problem-solving level, is very little
more than this, and has very little in common with computer
programming, which generally requires long training and close
observance to fairly involved rules of grammar.

The SX need not be always used as a programmable calculator -
in fact when operated as a non-programmable, it is as easy to
use as any other Canon calculator.

Sometimes we may find it useful to take advantage of its ability
to operate in either 'program' mode (ie operate under control
of some program), or 'keyboard' mode (operating under control of
the operator via the keyboard), or a mixture of both.

Consider the following e.g.:-

In a costing program, which calculates the cost of an order, the
program needs to know the type of material being used (so that
it can apply the right costing formula), plus the area (square
metres) of material to be used.

In a program, we normally define all the formulae to be used
in advance. However, the 'Area' in this case can be calculated
in an almost infinite number of ways, depending on the shape of
material to be used.

In this situation we can capitalise on the flexibility of the
SX - and drastically reduce the complexityof programming - by
setting the job up as follows:-

1. Program asks operator for material type code (& stops and
    waits with 'ENT' light on (ENT = Entry))

2. Operator keys Material Type, and depresses 'START' Bar to
    indicate to program that data has been entered.

3. Program proceeds, then stops for entry of area.

4. Operator then uses keyboard to calculate the area, then
    depresses 'START' Bar.

5. Program resumes execution and completes costing calculations.

From the above, it will be obvious that the depression of the START Bar tells the SX to start/restart the program.

Sometimes we need to define special one - button functions. This we can do by depressing the Program Select switch, which causes a group of function keys to be dedicated to this function. We then put an overlay on the keyboard to indicate the functions now assigned to these keys, and we write the program in a special way (see below) so that the function key automatically calls up the relevant program. Used in this way, it is like the 'START' Bar, in that it starts execution under program control, but differs in that the function key always calls up the same part of the program (such as 'print daily totals', or 'correct error line'). 'START' on the other hand, says start from the last point that the program got to before stopping for operator input.

We have thus got the ability to add additional keyboard functions tailored to the needs of the application.

B. Storage

1. Internal Memory
As mentioned above, the SX is equipped with step memory for storing programs. It also has an area of memory for data - totals, intermediate steps in a calculation, etc.

Step Memory is quoted in terms of the number of steps.

Data Memory is specified in terms of the number of memories.

The memory capacity and expansion capability of SX are as follows:-

Model	Basic Memories	Steps	Units of Expansion Memories	Steps	Maximum Memories	Steps
SX100	20	& 200	10 OR	100*	100	1000
SX300	30	& 500	10 OR	100	100	1000
SX300 (With) (SX3010 Memory Box)	200	& 2000	100 OR	1000	500	5000

*Note: SX100 expansion above Basic requires
SX1001P expansion board

Note also that SX300 can be expanded internally to a maximum of 100 memories and 1000 steps; expansion beyond this is achieved by the SX3010 Memory Box and SX3011P memory pages.

The unit of memory is the Word.
One word can hold:-

1 x Data memory capable of storing a number with up to 14 digits
in the mantissa, and 2 digits in the exponent, and signs.

OR 2 x Split Data Memories each containing a 6 digit mantissa and
2 digit exponent and signs.

OR 10   Program steps

OR 10   Alphanumeric characters (to be used for printout purposes only).

Memory is organised as follows:-

Words	Used As	Notes
000 \ 499	Step 0000 Step 4999	Step Area of Memory
500 \ 999	Memory 000 or Step 5000 Memory 999 Step 9999	Data area of Memory

Notice that Part/All of Data Area can be exchanged for more steps.
Steps however cannot be exchanged for more data memory.

The memory used will not hold data when the power is turned off.
So how do we store data when the power is turned off?
This brings us to the next topic:-

2.   External (Magnetic) Memory

The SX100 is equipped with a magnetic card reader, capable of writing
the contents of memory onto magnetic cards, and reading the cards
back into memory when required.

A magnetic card can store 20 memories or 200 memory steps per side
(a card has 2 sides). Consequently it represents an excellent way
of storing programs and data - it only takes 1.7 seconds to read
a card. Once a program has been fully developed, the card would
normally be 'write-protected' by snipping off the corners indicated,
in order to avoid accidental erasure (any attempt to 'Record' a
write-protected card will produce an error condition and the machine
will stop).

The SX300 uses magnetic tape cartridges for this purpose. 2
sizes are available:-

D-100   Capacity 100 memories or 1000 steps
D-500   Capacity 500 memories or 5000 steps

The cartridge is provided with 'write-protect' tabs which serve
exactly the same purpose as snipping off the card corners on
the SX100 card.

With both the magnetic cards and the cartridges, all the contents
must be read - you cannot select just part of a card of cartridge.

C. Arithmetic

The SX does its arithmetic in the way that is easiest for most of
us - simple algebra.

For instance, to calculate:-

a x b + c
where a = 10, b = 20, c = 30

one enters:

10 x 20 + 30 =

The SX automatically maintains a stack of 7 registers to take
care of the calculation of intermediate results, in a way which
is invisible to the user, so that very complicated expressions
can be handled.

Numbers are stored internally in floating point format, thus
relieving the user of the need to keep track of decimal points.
Formatted print instructions are provided for ease of report output.

D. Printer

One of the SX's most attractive features is its inbuilt alpha-
numeric thermal printer, which is sufficiently wide (48 characters)
to produce meaningful reports - with row and column heading data.
On most other equipment the printout is too narrow to be effective
for this purpose, so the customer has to go to the extra expense
of adding an auxiliary printer.

The printer uses a 5 x 7 dot matrix, is relatively fast (24 c.p.s.)
and very quiet.

It is switchable between 24 character and 48 character - wide
output, using 2 different widths of roll.

E. <u>Program Library</u>

Canon is building up a large library of programs applicable to many spheres of activity (see 'Software Library List'). Many of these are already available (at cost of media plus transcription).

F. <u>Technical Support</u>

Rank provides, free-of-charge to SX Dealers, technical product support. This covers answering technical queries concerning SX equipment, but does not extend to writing programs for dealers.

G. <u>SX300 Peripherals</u>

The SX300's versatility can be supplemented by the variety of peripherals that can be connected to it - currently as follows:-

- IBM 735 typewriter
- Paper Tape Reader/Punch
- Drum Plotter
- Cassette Drive (for storage of up to 100,000 steps per side)
- Data Input Interface for connection of instrumentation.

Note that delivery of these items is not necessarily ex store.

H. <u>SX300's Statistics Functions Pack.</u>

This equips the SX300 with a whole host of additional program and keyboard functions for statistical work, making it into a very powerful 'statistics machine'.

I. <u>Applications</u>

The cost of labour today has become so high that only a small saving in hours paid is necessary to justify SX.

It can handle a wide variety of repetitive scientific and commercial calculations with ease (see Software Library List to give some idea of scope).

Additionally, it can assist management to make better decisions by making it possible to use better techniques and produce timely information, particularly as to alternatives, which would have been previously impractical to obtain.

There are, however, limits to the capability of SX - it is <u>not</u> in the same league as a mini computer or mainframe - nor, at the price, should it be! Failure to recognize these limitations prejudices the success and profitability of a sale. So:-

- Get to know your product
- Keep it simple
- Try to see the problems through your prospect's eyes.

This course is designed to give you an initial sense of perspective about SX - it is a starting point only, for which, it is well worthwhile continuing independently until you are really confident about your knowledge of the product.