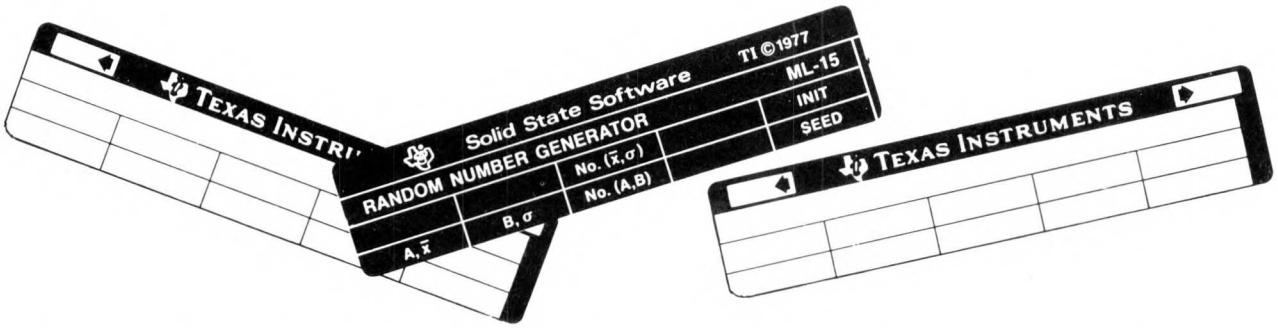
CALCULATOR CORNER

Dick Pountain examines and reports on the micro-associated world of programmable calculators



ANALYSING THE TI~59

Up until a couple of months ago, it could have been said without contradiction that the TI-59 was the most powerful hand held calculator in the world. Now that Hewlett Packard's HP41-C is upon us, the issue is no longer as clear and one could argue for weeks over which is the more powerful and, come to that, what 'powerful' means anyway.

Let's merely say that the TI-59 is a very powerful, hand held calculator which, with the optional printer (PC 100B), verges on a microcomputer system.

In hardware terms very little differentiates the TI-59 from some of the smaller microcomputers currently available. The 59 has almost 1K of user RAM on board which is more than some single board computers.

This RAM may be partitioned at will between program memory and data registers — from 960 program steps and no data registers, to 160 program steps and 100 data registers.

One difference from a micro is that the data registers have two digit addresses whereas program steps have three digit ones — program and data are rigidly segregated in memory.

In addition to this sizeable amount of user memory, the 59 accepts plug-in pre-programmed ROM modules, which go by the trade name of 'Solid State Software'. These contain 25 ready to run programs which may also be used as subroutines in a users program. The module supplied has an assortment of general purpose math statistics and financial programs, but other specialist modules can be purchased for applied statistics, navigation, electronic engineering and more.

Storage of user written programs is by magnetic cards, the reader for which is built into the body of the calculator; one up on the HP which has the card reader as an optional extra.

The cards are two-sided, each side storing one quarter of memory capacity; two cards are required to store the full contents of program and data memories. Card writing is easy and reliable which is just as well since the TI-59 does not have continuous memory and so work in progress *must* be card written before you switch off the calculator. Since the rechargeable batteries only last about 2 hours it also makes it advisable to carry the mains adaptor at all times!

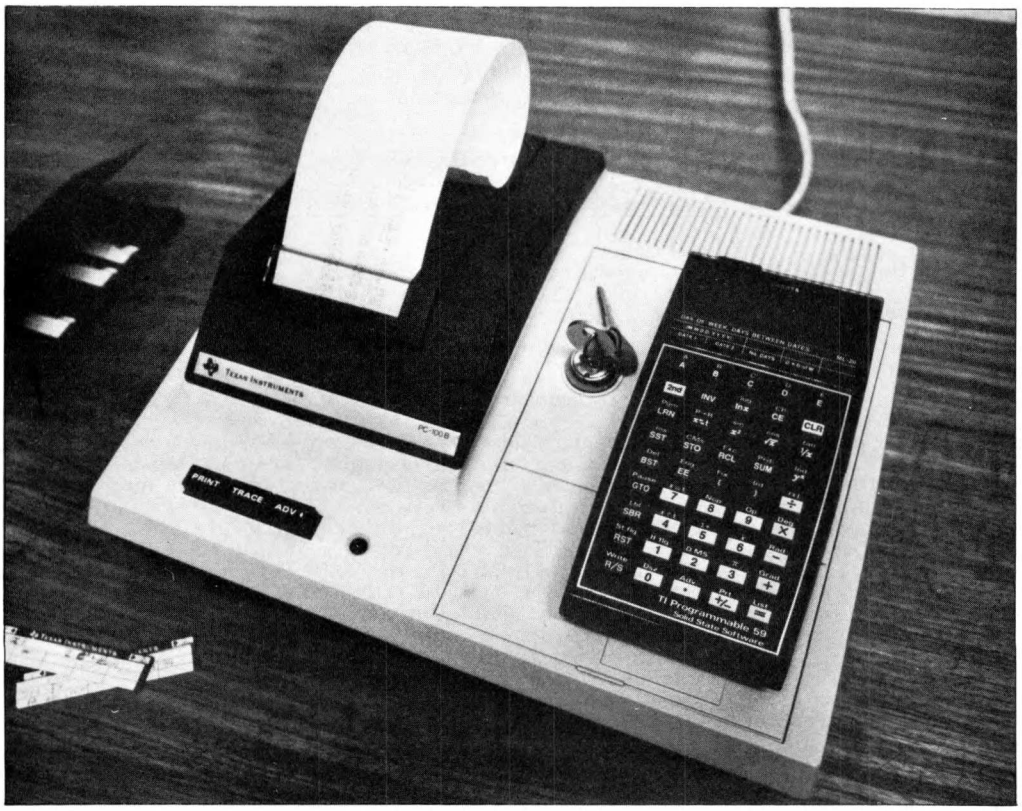
To complete the system, hard copy output is obtained via the PC 100B print cradle. The calculator plugs onto the cradle with the battery pack removed; the batteries slot into a recess in the cradle and are recharged while the calculator is being used with the printer. The calculator actually locks to the cradle with a removable key, for security. The printer is a 20 column, thermal type; it's almost silent in operation and runs from the mains supply.

Alpha characters are available on the printer, but since they are not provided on the calculator keyboard, they can only be entered as numeric codes, which becomes very tedious. To print one line of alpha characters requires over 60 keystrokes so you will not be tempted to transcribe the Old Testament in this fashion. In fact, this alpha facility is only intended for occasional prompts and titles — not for extensive text.

What of the programmed operation system itself? the 'language' is similar to that of the cheaper TI-57, differing only in being more extensive. In particular it features 10 user defined keys which are for use as labels in programs, 10 user settable flags and a test to cause branching if flag set, and a series of 40 'Special Operations' which are defined by an OP key plus a 2 digit code. These operations include printer formatting, alpha character generation, partitioning memory area, error testing, linear regression and correlation analysis, and listing of all labels in current use.

Printer controls are provided on the keyboard for use in programs; they are PRINT, ADVANCE and LIST. The latter lists the program with step numbers and mnemonic codes for the instructions which are far more comprehensible than the numeric codes used in the display.

For editing and debugging



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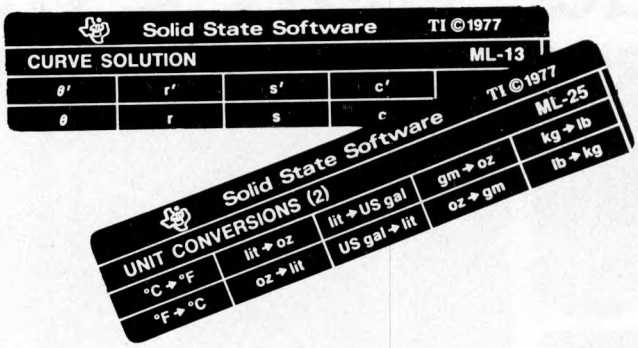

I found it preferable to LIST first and work with the listing. Debugging is provided for by a single step function in the Run mode which displays intermediate results at each step. Using the printer, the even more useful TRACE mode is available which prints instruction and intermediate result alongside one another as it steps through the program.

Indirect addressing is permitted on all memory functions and on conditional and unconditional jumps, flag set and test and subroutine calls. Full memory arithmetic including multiply and divide is provided.

Three modes of jump destination labelling are possible; absolute address (which gives fastest execution), user defined key, and 'common labels'. The latter are merely the maths function keys which may double as labels in a program, so that instructions such as LBL SIN or GTO x^2 are valid. This gives you over 70 available labels.

In effect, the TI-59 has all the capabilities and complexity of a microcomputer and to extract its full potential will require a lengthy familiarisation period. Anyone already versed in assembly language programming will be immediately at home here.

It is a professional's instrument, intended for use in the research laboratory or design office and very little concession is made to ease of use by the layman, for whom in any case much of its power will not be fully exploitable.

I found the TI-59 inconvenient and frustrating to use in several ways.

Firstly the display (LED — small, red and traditional) is very fatiguing on the eyes, and also very limited in the information conveyed (10 digits or 8 digits plus 2 digit exponent; no useful indicators such as angular mode, etc).

Secondly the editing functions don't operate in an obvious way. The step you have just entered is not displayed. A correction overwritten is not displayed. A new step inserted is not displayed. In each case a back-step is necessary to inspect the new entry. Furthermore, many instructions are not fully merged and may occupy two or more steps — which causes much anguish if they have to be edited. In short, I found editing programs to be tiresome and error prone, and this after 2 months practice. Perhaps, given a year, it may become natural.

Thirdly execution is very slow. At first I thought this was merely my imagination, but an experiment showed otherwise. Five 'benchmark' tests were written, covering a wide selection of functions. These tests were run on the TI-59 and a Casio FX502P (reviewed in a previous issue). In all cases the Casio was at least 30% faster and in the worst case, the TI took *five times* as long to run a test.

Fourthly there are some snags and idiosyncrasies in the operation of subroutine calling, which the excellent and comprehensive instruction manual identifies, but which nevertheless will trip up the beginner and expert alike; for instance any program which requires interruption of processing while control is in a subroutine is particularly tricky.

Of course, from my rather dilettante position as a reviewer, it's easy to make this sort of criticism. The people for whom this machine is designed will learn to live with such things in return for the immense calculating power on offer; power which is only otherwise available in the HP41-C (which is itself no walkover to master) or in a full scale micro system — which will probably need to be a rather expensive one to match the purely mathematical abilities of a TI-59.