# THE TEXAS TI 59 REVIEWED

**As technology increases in leaps and bounds, calculators become more powerful and computers more stupid — The gap in the middle ever decreasing. Les Bell has taken a look at the new Texas Pocket Programmable (PPC), the latest in calculator technology . . . . .**


THE MAJOR DIFFERENCE between the TI59 and previous PPCs is its use of 'Solid State Software'. If you flip the calculator over and slide out the panel in its base, you will find a 0.85" x 0.7" x 0.35" block of plastic labelled 'Master Library Module'. This is, in fact, a read only memory containing anything up to 5,000 steps of program, which in the case of the Master Module provide 25 programs designed to solve a variety of problems.

The Master Library Module can be changed easily for different modules in the fields of Surveying, Business, Navigation, Aviation and Statistics (no Mathematics or Electrical Engineering modules as yet). A spare module can be carried in the wallet supplied along with 40 magnetic cards.

Programs are called up from the Module by the keystroke sequence '2nd Pgm nn,' where nn is the program number, and the user-definable keys can then be used to run the programs. In addition, Module programs can be called as subroutines from user programs by the same sequence of keystrokes since the Module programs do not occupy the same address space as the read/write memory in which the user's program runs. The Solid State Software can also be downloaded into the RAM section for examination or modification, using the keystroke sequence '2nd Pgm nn 2nd Op 09.' The calculator can then be put into the 'Learn' mode and the program modified.

## User Memory

This leads us naturally into a discussion of the block of memory available to the user in the TI59. Here again TI's semiconductor memory expertise has come to the fore; the P59 is, in terms of memory, way ahead of its competition, with a possible 960 steps of program memory.

Why 'possible'? Well, the TI59 has inherited an organizational hangover (if that's the word!) from its predecessor, the SR52. In that calculator, program memory and data memory are physically the same, and, as many owners discovered, spare program space can be used for data storage. The TI59 employs a similar scheme, but now TI openly admit to it, and partitioned memory has become what PPC owners call a 'supported feature'. Another SR52 unsupported feature which has turned up respectably in the P59 is the ability to store data on magnetic cards. ▶

When initially turned on, the TI59 has 480 steps of program memory and 60 data registers. However, the user can repartition memory, trading off 80 program steps for every 10 data registers, so that one may have 800 steps/20 data registers or 320 steps/80 registers – or one of several other combinations.

The TI59 has a kid brother, the TI58, which has identical features, including the Solid State Software, but less memory (240 steps/30 registers on switch-on) and no magnetic card capability. Except where memory size or magnetic cards are concerned, all my remarks apply equally to both PPCs.

## Printing

The third main area of advance is in the incorporation of printing facilities in the P59. Like the SR52, the TI59 is designed to operate with the PC100A print cradle. The important difference between this and previous PPCs is that the P59/PC100A combination can print alpha-numerics. The PC100A can print 20 characters wide, and this can be divided up into 5-character quarters, with each character being represented by a two digit code, e.g. A is 13 and ( is 55. Five characters therefore fill a 10-digit display, and four such displays are successively loaded into a print buffer, which is then completely printed. Alternatively, the current answer can be printed along with four characters on the right to identify it.

This opens up tremendous scope for PPC users. Firstly, alphanumeric printing may be used to prompt untrained operators when using a program — with 960 steps of program memory there is surely some going spare for this! Secondly, complex programs can provide identification of results for the skilled user. Thirdly, error messages can be printed if a program detects errors in data. Fourthly, games programs can be livened up with messages — I could go on and on.

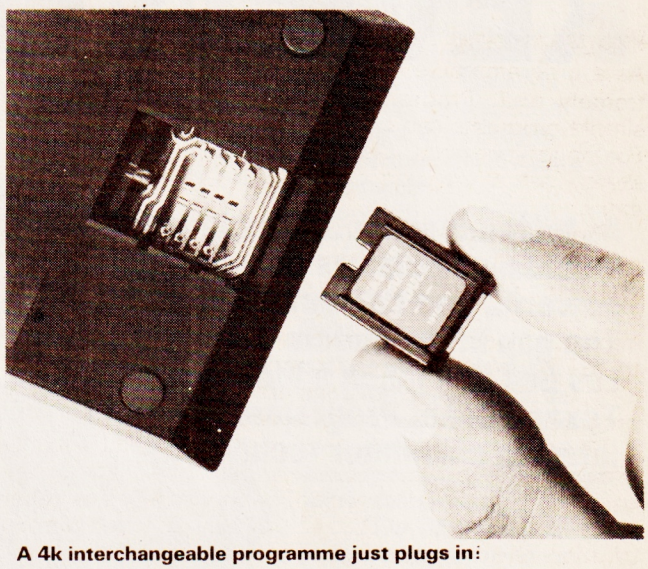
But the printing capabilities of the TI59 don't stop there — you can also plot graphs! Admittedly, this is a fairly crude sort of graphical output, but it works, and graphically presented data is much easier to use than tables of results when your're looking for trends or experimental relationships. It works like this: since the PC100A has 20 columns, the command '2nd Op 07' will print an* in the column specified by the display. So if you've produced a result which is a percentage, say 60%, you divide it by 5 (to scale it) giving 12 and then '2nd Op 07' will print an * in the right column (the 12th, in this example).


**The printer even plots curves:**

The printer can also be used to produce a listing of the labels in your program, a listing of the program itself, results (obviously), and, in the trace mode, all intermediate results and the instructions that generate them as a program executes.

## Functions

From the technological advances of the P59, we move on now to the design of the machine, the way it operates, and its ease of use — all functions not of the technology, but of the time, effort and ingenuity/insight of the design team.



**A 4k interchangeable programme just plugs in:**

The appearance and construction of the P59 are pretty well standard, as you can see from the photographs. The keys have a good 'tactile feedback' feel, and are spaced at what is probably the minimum spacing for convenient, fast and accurate operation. This brings me to the only bugbear I found with the calculator — the visibility angle of the display. A PPC, by the nature of the beast, spends a lot of its time on a desk-top, but I discovered that working with a notepad on the desk in front of me and the P59 to the right of that (say, 7" from dead centre), I had to constantly lean over to read the display. Now that's bad — are you listening, TI? Mind you, with the TI59, I could learn to live with it!

As a manual calculator, the TI59 performs very nicely indeed, although the keyboard is perhaps a little crowded for occasional heavy sessions of keybashing; but if you use it a lot, you'll get to know it like the back of your hand and if you use it a little, the busyness won't bother you. I've experienced no difficulties in finding my way around the keyboard, but some colour-coding might have helped.

The TI59 uses TI's 'Algebraic Operating System which makes use of parentheses to over-ride the rules of algebraic hierarchy, and enables you to enter calculations as they are written.

The TI59 sports a tremendous array of functions, including all the usual trig, exponential and scientific functions. In addition, there are also two-variable mean and standard deviation, and although there is no sign of it on the keyboard, the statistical capability is further extended by functions accessed by the key sequence '2nd Op nn', where nn is a two-digit code assigned to each function. Other special operations include the print

functions, library program downloading the signum function, memory partitioning, error flagging and a set of operations which can increment or decrement data registers.

While this scheme is slightly awkward to use manually, it does give an additional 40 infrequently used functions without cluttering the keyboard. And of course, most of these functions will be used almost exclusively from programs, so their ease of use is not very important. A list of special operations on the back of the calculator would have been handy, though.

## Programming

As a programmable calculator, the TI59 performs extremely well. Program entry is extremely easy, and simple programs can be made up as they are entered. For longer programs, it is, of course, advisable to at least sketch out a program on paper before commencing entry.

Programs consist basically of the same set of keystrokes as you would use to solve the problem manually. However, in order to let a program run without the need for human intervention, PPCs have a number of instructions not found on conventional calculators, such as go to (GTO), label (Lbl), and conditional branches ($x=t$, $x\geq t$, etc.). These instructions are used to structure the program and transfer control between sections.

The TI59 allows the use of 72 labels to identify program sections: these are the usual 'Lbl A,' 'Lbl 2nd A' type as well as others created using virtually any other key as a label, e.g. 'Lbl CLR,' 'Lbl × .' This permits the creation of extremely large programs in sections, each with a specific function.

There are four different tests which can be made in order to decide program branching ($x=t$, $x\neq t$, $x\geq t$, $x<t$), which are fairly standard on PPCs. In addition, a Decrement and Skip on Zero (DSZ) instructions can be implemented on registers 0.9 to control program looping, as well as the inverse function, Decrement and Skip on Non-Zero.

The power of most memory referencing instructions can be multiplied by the use of Indirect addressing. For instance, it is possible to branch indirectly, to store and recall data indirectly, to call Library Module programs indirectly, to set flags indirectly, all manner of tricks. A good example is the instruction 'If flg Ind 02 Ind 22', which will recall register 2, and on finding the value 5 there will test flag 5. If that flag is set, it will recall register 22, giving the value 64 and will then jump to step 64. If flag 5 is not set, the program will continue normally. As you can see, instructions of this type pack real programming power, but only 'STO Ind' and 'RCL Ind' are used often.

Programs can be written as subroutines, so that they can be called by other programs, simply by avoiding the use of '=' (which completes all pending operations) and terminating the program with a subroutine return, 'INV SBR'. If this technique is used, you can have up to six levels of subroutines, which is probably enough to process three-dimensional arrays in quite complex fashions. (I haven't tried it yet though!)

Editing a program is very easy, as you can over-write, insert or delete steps and can single-step, backstep or jump about in your examination of the program. If you use the PC100A printer, then its trace mode will let you see what is happening as each instruction is executed, as well as providing complete program listings (it can't be easy to write down 960 steps!).

## The Card Reader

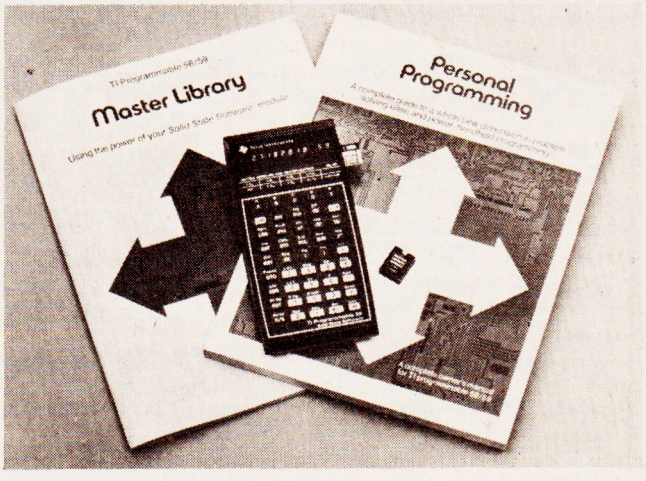
Since there are 960 steps of program memory in total (regardless of whether they contain program or data) it is just not possible to put the whole memory onto one magnetic card. To get round this, the memory is divided into four banks, each of which may be separately written onto one side of a magnetic card. The bank number should be in the display, and the key sequence '2nd Write' will then record that bank onto a card. Each card has two sides, consequently two cards are required to store the whole memory.

It the bank number in the display is negative, when the program is subsequently reloaded, it will be found impossible to list it, or to enter the 'learn' mode to examine or modify it. This provides a means of protecting software from accidental (or deliberate) modification, and ensures security of confidential data.

Cards can be read under program control, enabling large amounts of data to be entered for processing.

## Documentation

The most incredible calculator ever devised would be of dubious value without the knowledge of how to use it, which is the result of experience and a long session with the owner's manual. The P59 manual is called 'Personal Programming' and is an A4 format book almost ¾" thick. This provides plenty of examples to explain both the operation of the various calculator functions, and the rudiments of programming.




**The T159 comes with very good instructions and a manual with details of the programs in the software module.**

With a PPC of this complexity, there is just no way you can sit down and start writing programs — even display control takes two pages of explanation. The only way to do it is to sit down with the manual and start at the beginning, working through every example. Programming is a skill you learn by doing, not by reading, and 'Personal Programming' is well organised for this. In short, the manual doesn't let the machine down.

Also supplied is a programming pad, and a guide to the programs in the Master Library Module. This guides the user through the keystroke sequences needed to enter data and run the programs, as well as explaining the program operation and providing necessary information on registers used, parentheses levels etc. Again familiarity breeds ease of use: you have to sit down and play with the machine to learn how to really use it.

## Summing Up

The Programmable 59 incorporates several major advances over previous PPCs, specifically in terms of memory. The basic calculator has a more than adequate range of functions, but the addition of the 'Solid State Software' modules converts it into a general- or special-purpose calculator of extraordinary power.

Probably the greatest compliment I could pay the P59 is to say that as a long time HP and RPN user, I would never have contemplated any other kind of calculator. I'll probably still use my HPs (I don't need another calculator), but if I was a first time PPC buyer, the TI Programmable 59 would be top of my list.

Both calculators are available from Texas Instruments retailers. The Programmable 58 retails for around £80 inc. tax and the TI59 for £210. These are recommended retail prices — discount prices may be considerably lower. The PC100A is yours for only £175 and extra Library Modules are £25 each. ETI