CALCULATORS OF THE FUTURE

Crystal (liquid?) gazing by H. Moorshead

One of the statistics that we have about ETI readers is that on average they own 1.8 calculators. This may sound extraordinary but it becomes mind boggling when you consider that pocket calculators have only been around for about seven years, and prices only broke the £20 barrier in the early summer of 1974. The first calculator survey we did in ETI was August 1974 and the cheapest was £10.95 (Minuteman 6) but we believe that it was a model about to be replaced: The Sinclair Cambridge kit was £14.95!

These prices were of course for simple, 4-function models, the least expensive scientific was the Sinclair at £53.90.

OK, it's an old story, we all know how prices have gone down but what of the future — are we going to see the £2 disposable calculator? We think not.

Calculators and transistor radios share a common history. In the very early 1960s the first 'trannies' appeared at £20 or so (then 1½ weeks' wages) but the competition was such that the price of a pocket transistor radio fell to about £5 in 1962-63 but although there were exceptions at £3 or so, the competition at the low end of the market was not for price but for quality and facilities. Even the Japanese giants were finding the going tough and concentrated their production and advertising on firstly LW and MW, then SW, 'Pirate Bands', tone controls and later still, FM band. Joe Public was far more interested in a decent sound at a reasonable price than an ultra-cheap model.

So with calculators. We don't know which is the cheapest calculator at the moment but few people would care. From 4 functions, the manufacturers began to include % keys, fixed/floating decimals and then memory.

With competition at the bottom end of the market far too hot for most companies, resources were channelled into chip technology and scientific facilities.

Hewlett-Packard, who were the first in the field, always refused to be pulled into the price wars, relying instead on being a year or two ahead of everyone else. A number of companies were envious of this and company after company went bankrupt, presumably many of them were muttering on until the last minute that the public did not appreciate their quality, not realising that HP were the only ones in the real, as opposed to imaginary, quality table.

So, what do we look for in the next couple of years?

Prices

We have said already that calculators parallel transistor radios remarkably. If we take this a step ahead we can expect prices to hold at their present level for some time. Certainly we'll hear from time to time of the barriers being broken yet again but it will not be dramatic or newsworthy.

What will happen is for replacement models to come out at the same price but to improve continually in facilities.

The current price brackets are approximately £4-£9 for a standard calculator — many of them with memory, square root and percentage keys. Next are the specialised and inexpensive scientifics at £10-£25. Further along still are the super-scientifics and programmables over the £25 mark.

The facilities in the upper section will fall into the middle bracket fairly quickly and we feel that the excitement will be in the £25 plus area.

Developing

The falling price of memory will bring about the biggest change in the next couple of years. Bubble memories which are non-volatile, cost about £300 for 20K. We feel that two years is a bit early for these to be incorporated in normal calculators but it will follow not all that long afterwards. CMOS, or other semiconductor memory will have an enormous growth rate and be cheap enough to provide enormous memory capacity.

At present a number of calculators use magnetic program cards — this is only used because of the cost of memory and we shall see these systems disappear in the next couple of years. It will be replaced by a memory having a capacity of say 2 000 steps. This will not of course be used (normally) for a single program as the 2 000 steps can be broken up to hold 50 personally written programs with an average of 40 steps. In addition another chip — possibly included automatically with the main chip — with 50 programs supplied by the manufacturers will be included (this is with us now of course).

Already several calculators are displaying letters in association with the programming modes. This will be expanded to a complete alphanumeric display using a dot matrix LCD display. We are certain that LCD will dominate the market in the near future as the battery savings are enormous.

Recent LCD calculators have guaranteed battery life of 5 000 hours and this had led them to use available mercury cells. The battery workers must be working on long life batteries, possibly bigger than the mercury cells.

The highly complex functions of our calculators in two years will mean that current consumption will not be insignificant, but it is likely that the machine will auto-▷

matically dump any figures being worked on into low current consumption memory if no key presses are made — this will cut down current drain considerably.

If we have a calculator which will be storing a considerable amount of user material which needs some current to hold it, there will be two batteries which are changed one at a time, each capable of retaining the information.

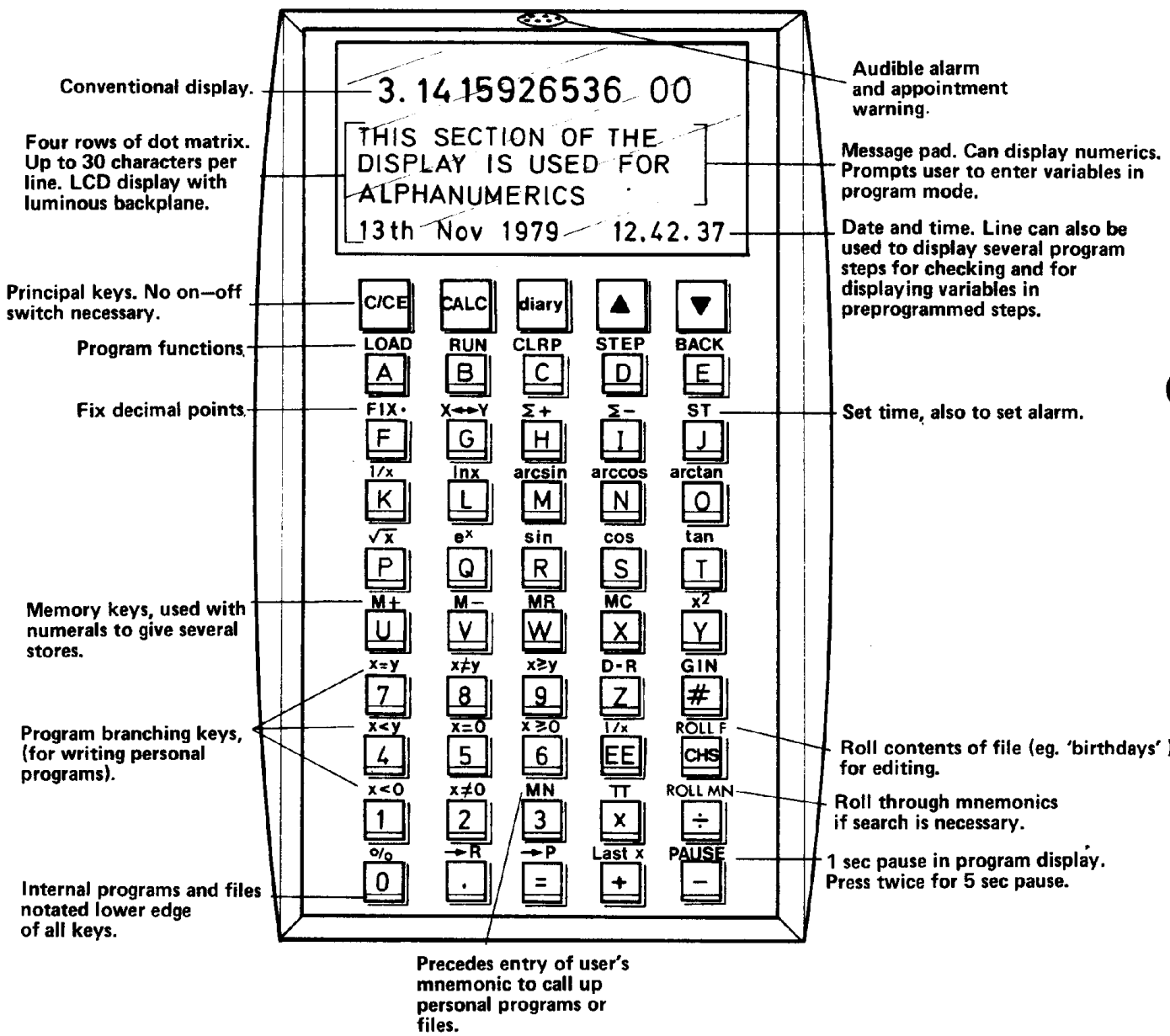
The 1979 Calculator

If, as we predict, your calculator can handle and store alphanumerics, a whole range of possibilities occur — it becomes as much a diary as a calculating machine and can store telephone numbers, appointments or any other information you might care to retain. A clock will be built in to display day, date and time and, with a small buzzer, will act as an alarm to give you notice of the events stored in the diary.

Our 1979 model will do everything that current calculators do: simple addition is still likely to be a major use but the extended keyboard will show you the last five or six figures entered so that an interuption in the entry will not be serious.

A full Alphanumeric keyboard will be provided and whilst mnemonics could be used to take the place of scientific function (eg. SR for square root) we expect the keys to serve two or three functions as they do now on several calculators. In our drawing we have shown this as the upper shifts.

The maker would have already built in 50 or so prog-



rams — we show these as the lower shift functions. Instruction books, once they have been read, are a nuisance so the program key, once pressed will give (on one or two lines of the four line display) the information to be entered. This could read: *F = frequency, L = inductance in millihenries, C = capacitance in picofarads. Enter L, Enter C, Ans. in kilohertz.*

Alternatively on a more advanced machine the display could prompt each entry. After you access the "LCF" (or similar mnemonics) program the display replies:

"LCF" PROGRAM
RESONANT FREQUENCY OF INDUCTOR
AND CAPACITOR

Then you press E (for 'enter'; this moves the program on to the next stage). The machine then displays:

ENTER INDUCTANCE IN
MILLIHENRIES

You then press 2.5, check your entry, and then press E. The machine continues:

ENTER CAPACITANCE IN
mF (M) nF (N) OR pF(P)

You press 470P and the machine displays *470 EE-12 FARADS*, so you press E and your result appears:

2.5 EE-3 HENRIES
470 EE-12 FARADS
RESONANT FREQUENCY (HERTZ)
146825.4019

There will be plenty of permanent memory for entering and retaining your own programs. These will only take up as many spaces as necessary in the memory.

To avoid the need for separate notes, there will be various 'search' keys. Since it may be difficult to remember the identification of your own programs, you may have to roll through all the titles. Similarily appointments can be run through for checking or amending.

The display will be LCD in a dot matrix — it is quite possible that instead of say four rows there will be a continuous dot pattern and some calculators will be able to display graphs and other simple graphics.

We have shown the 1979 model very much as a conventional calculator but there may be big changes in the appearance as well. The most obvious format would be similar to that of a diary which opens on a hinge, thus protecting the keys.

Although this model will almost certainly have many facilities similar to a minicomputer and some machines will undoubtably be aimed at the computer enthusiast, we do not see any larger numbers in this field. This is not because the power isn't available but because the mass market is unlikely to demand or desire a personal computer.

Five Years On .....

Our 1979 model is simply using more of current technology but whole new fields will be opened by new techniques, as yet only a twinkle in the engineer's eye. Our 1982/83 model is likely to bear little resemblance to current machines.

Our two-year hence machine has a cluttered keyboard and this will have to go. Looking into our crystal ball we see complete elimination of moving parts. We see our calculator being about the size, but half the thickness, of a packet of 20 cigarettes — or about the size of a thickish pocket diary ... it will be metal except for one surface being like a glassy slate.

Touch the top and a display comes up listing several words:

Math
Scientific
Diary
Memory Aid
Teletext
Compute

Touching *Math* (because it's likely to originate in the US) will bring up a display of a fairly simple calculator keyboard probably just like our current ones. Touch the keys and a section at the top will act as a display.

When you've finished adding up the groceries touch the top again and you revert to our prime index.

Now let's try *Scientific.* Instead of a scientific keyboard we'll be looking at a subsidiary index giving us further choices enabling us to use programs or make simple calculations.

Choosing *Diary* we'll be able to look at several pages of information and by touching a portion of the display, we'll be able to bring up an alphabet to 'type' in our new information.

Memory aid will enable us quickly to search through hand written notes: to enter these write on the surface with a pen and the impression will be remembered. (We do not see hand written character recognition in five years but a reproduction of your own handwriting isn't too hard.)

Selecting *Teletext* will display for you a choice of Ceefax 1, Ceefax 2 and Oracle (It takes more than ETI's crystal ball to predict an Oracle.). Selecting these will bring up the index page instantly and you'll be able to work your way through the various indices to find the news, TV programmes, share prices etc.

This calculator will be small and will probably need rather an efficient aerial but it will update every page in its own memory whenever the signal strength is high enough and will continually correct any errors. Everything will be stored in the calculator's own memory so take it to Central Africa and it'll show you for ever the last data it picked up.

In our discussions on what a calculator might be like some of the contributors suggested central plug-in points where batteries can be recharged and new data entered. Most thought that this is unlikely as whenever national standards, let alone international standards, are concerned that things have to wait for a decade or more.

By this time many readers will have their own mini computers and a battle will be raging as to whether it's best to have a good pocket calculator (though we doubt if they'll be called that) or a home computer.

In writing this piece we have to admit to a certain feeling of being ill-at-ease. We came across a copy of Strand magazine of 1905 which had an apparently serious feature on what aircraft would be like in 50 years time — there was a drawing of ladies (in fashions which to our eyes look no different from 1905) playing tennis on the wings of an almighty flying machine! We hope we're not that wrong but if we are this will make an amusing article to reprint in ETI in five years time! □