

THE SPRING RESEARCH ASSOCIATION

A SURVEY OF SOME PROGRAMMABLE
CALCULATORS

by

M. R. Southward, B.Sc.

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CALCULATORS

SUMMARY

Seven programmable calculators, in the price range £400 - £2300, which have been demonstrated to the Association, are evaluated and discussed in this report. Mention is made of other calculators, having different capacities from those demonstrated, which are produced by the same manufacturers.

All the calculators examined are able to cope with simple spring design problems. Selection of the most suitable machine can only be based on a careful examination of the user's requirements.

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1. INTRODUCTION

Some three years ago, the Association carried out a survey of programmable calculators which could be used as an aid to spring design⁽¹⁾. Since that time, technological advances and improved flow of information between user and manufacturer have resulted in lower costs together with improved facilities.

This survey covered calculators in the price range of £400 to £2300 - lower than the range covered by the previous report. The aim was to examine calculators of both the portable and desk-top types, which were capable of executing a simple spring design. Most of the calculators are considered in their basic form but mention is made of optional extras and peripheral equipment that are available.

2. CALCULATORS EXAMINED

Below is a list of the seven firms which offered programmable calculators in the price range covered. Some of the companies produce more than one calculator falling within the scope of the survey. In these cases, the particular machine examined and discussed in the survey is at the head of the list, the other models being listed in brackets below.

- i. Diehl certatronic £1098
(alphatronic £1595)
Available from:- Diehl Calculating
Systems Ltd.,
St. Michaels House,
Norton Way South,
Letchworth.
Herts. SG6 1PE
Tel. 04626 73991
- ii. Hewlett-Packard HP 65 £410
(9810A £1212)
Available from:- Hewlett Packard Ltd.,
224, Bath Road,
Slough.
Bucks. SL1 4DS
Tel. 0753 33341
- iii. Monroe 1830 £1395
(1880 £1495)
Available from:- Litton Business Systems
Ltd.,
Litton House,
27, Goswell Road,
London. E.C.1
Tel. 01-253 3090
- iv. Olivetti P 652 £2290
(P 602 £1889)
Available from:- British Olivetti Ltd.,
30, Berkeley Square,
London. W1X 6AH
Tel. 01-834 6526
- v. Sharp CS 364P III £800
(CS 363P £628)
(CS 421 £1150)
Available from:- Bosco Ltd.,
8, White Hart Parade,
Sevenoaks.
Kent.
Tel. 0732 53923

- | | | |
|------|---------------------------|----------------------------------------------------------------------------------------------------------------|
| vi. | Sumlock Compucorp 324/344 | £350/£430 |
| | (326) | £665) |
| | (325) | £895) |
| | Available from:- | Sumlock Comptometer
Ltd.,
Anita House,
Rockingham Road,
Uxbridge,
Middlesex.
Tel. 0895 51522 |
| vii. | Wang 600 | £1295 |
| | Available from:- | Wang Electronics Ltd.,
1, Olympic Way,
Wembley Park,
Middlesex.
Tel. 01-903 6755 |

The principal features of the calculators demonstrated are discussed below.

2.1 Diehl certatronic

This calculator, which is a scaled-down version of the very powerful alphasatronic, has only just been introduced on to the market. Consequently, it can not be supplied with the peripheral equipment available for the alphasatronic but it has been designed to accommodate such equipment at a later date. A noteworthy feature of this machine is its automatic indication of programming errors, whereby an error code and the respective step number are printed, which enable the source of the error to be determined.

2.2 Hewlett-Packard HP 65

This calculator is a pocket model and hence has only a small display unit. The physical size and the limit of 100 programme steps give a false impression of the power of this calculator, since it possesses many of the facilities of larger calculators together with a quadruple register display. In this latter, one number is

displayed while the others are held in a vertical stack; another number from the stack can be obtained by raising or lowering it with a key. Performing any operation automatically lowers the stack. The calculator also has five keys which can be programmed to the user's own requirements. During programming, the key pressed is defined on the screen by two numbers indicating the row and column position of the key on the calculator.

2.3 Monroe 1830

This calculator has 13 user-definable keys that can be programmed to execute specific functions. It is very similar to the Model 1880 which is described as a scientific calculator because of the difference in pre-programmed keys.

The capacities of both these machines given in the Tables are those of the basic models which can be extensively increased at any later date by the addition of internal units.

2.4 Olivetti P 652

This is a very powerful calculator, which can call a virtually unlimited number of sub-routines from the main programme. There is a large selection of peripheral equipment; up to four items can be connected at one time, in addition to a random access memory.

2.5 Sharp CS 364P III

This calculator has 144 main programme steps and 288 sub-routine steps. Both the main and sub-routine can be divided into nine groups and the sub-routine facilities can be used either to carry out repetitive calculations in a programme or to extend the main programme to 432 steps. The paper required for the printer is of a special, electro-sensitive type and costs slightly more than normal paper.

2.6 Sumlock Compucorp 324/344

Two versions are available of the basic programmable calculator produced by Sumlock; the Scientist (324); and the Statistician (344). The difference between the two lies in certain pre-programmed keys relevant to the particular topic. There are 160 programme steps, split into two equal parts, two programme steps being necessary to put a number into store. The disadvantages of the machine are that it possesses no external store and thus has to be programmed manually, and errors cannot be corrected as the machine is being programmed.

Larger versions of this machine have recently been introduced: the 326 model, which stores the programme on magnetic tape cassette; and the 325 model, which has a larger memory and both printer and visual display.

2.7 Wang 600

This is a powerful machine with 16 user-definable keys. The external store (magnetic tape) is an optional feature of the model and many peripheral items are available, including a disc store. There are also two statistics options, which are plug-in, 'read-only memories', which provide extensive additional calculating power.

3. GENERAL FEATURES

Each of the above calculators has its merits and disadvantages and no direct comparison can be made between them in view of the wide price range. The basic differences between the calculators are discussed below and are summarised in Table I. Table II gives details of other calculators offered by the same manufacturers, which were not included in the survey.

3.1 Display Units

The output can take the form of either a visual display or a permanent record on a tally roll. On the portable

calculators, only visual display is used. The desk-top machines are supplied with one type of display, the other being offered as an option.

3.2 Programme Stores

This is a most important factor to be considered before buying a calculator. The storage capacity of some calculators can be increased at a later date, but it may be more economical to purchase a larger machine in the first instance. Calculator storage capacity is usually indicated by the number of data registers. One data register will store a number or several programme steps, the latter varying from machine to machine. The number of programme steps available on a calculator can be very misleading and must only be regarded as an estimate of its programming ability. The number of steps required to perform a calculation will depend on the number and type of pre-programmed keys. The use of much storage space reduces the number of programme steps in some calculators. Another factor to be considered is the number of steps required to complete an operation; for example, some machines require two steps to place a number in store or to retrieve from store, while other models use only one programme step.

The simple spring design programme described in the previous survey⁽¹⁾ takes approximately 120 steps and can be performed on all of the calculators examined in this survey.

There are various types of external store, usually in the form of either magnetic or punched cards; however, magnetic disc stores are available for the Wang 600, and marked sense cards for this and other machines. The latter type of card is similar to the punched card, except that it is marked with a pencil instead of holes being punched, thus enabling errors to be corrected more easily.

The use of the external store facility enables calculators to perform programmes larger than the capacity of the basic machine by completing sections of the programme individually, re-programming the calculator before each section. Magnetic tape units enable this to be a continuous operation but magnetic cards have to be inserted before every section of the programme.

3.3 Peripheral Equipment

Only with the desk-top calculators can ancillary equipment be added to the basic machine. Not all the machines offer the same peripherals and when studying the Tables it must be remembered that, when a machine is first introduced, the peripheral equipment may not yet be available. Common peripheral equipment supplied includes: typewriters; X-Y plotters; and magnetic tape units, the latter being used mainly for increasing the capacity of the calculator. This equipment is best added at a later date, though the machine purchased should be powerful enough to meet the immediate calculating requirements.

3.4 Library of Programmes

The majority of suppliers have available a large library of programmes. The programmes cover many topics and have been built up from solutions to standard problems or written to suit individual requests.

4. DISCUSSION

The smaller calculators, although unable to accommodate large, versatile programmes, cope quite adequately with simple spring design programmes.

As mentioned earlier, calculators vary from one to another and only the major differences have been mentioned. Differences in pre-programmed keys have not been discussed

in detail because of the great variation from machine to machine.

Other considerations to be taken into account when selecting a machine are that some machines can be rented rather than purchased and that, in all cases, an annual maintenance charge is payable over and above the initial cost of the machine.

This report does not cover all the programmable calculators available, but it is hoped that the report will be of assistance to Members in their machine selection. The Association will be pleased to advise any Member regarding the selection of a suitable machine and would also be prepared to write programmes for any machine if requested.

5. CONCLUSIONS

All the calculators demonstrated performed satisfactorily. The choice of calculator depends upon individual requirements and funds available.

Among the smaller calculators, the HP 65 was found to be a very powerful calculator for its size, though initially more complex to operate than the others and having only a small visual display.

None of the larger calculators can be singled out as they all performed equally well and have similar facilities.

6. REFERENCE

1. Wilkinson, A. H. "A Survey of some Programmable Calculators Which Can Be Used to Aid Spring Design" SRA Report No. 201

KEY TO MAIN PERIPHERALS AVAILABLE

(see Tables I and II)

AM	Auxiliary Memory
D	Disc Unit
MC	Magnetic Card Unit
MSC	Mark Sense Card Unit
MT	Magnetic Tape Unit
PC	Punched Card Unit
PT	Paper Tape Unit
T	Typewriter
XY	X-Y Plotter

TABLE I CALCULATORS INCLUDED IN THIS SURVEY

Calculator	Price	Internal Store	External Store	Display	Main Peripherals	Power Source
i Diehl certatronic	£1098	100 Data reg. 10 prog. steps per reg.	Magnetic card (optional)	Printer (visual optional)	MC, MSC	Mains
ii Hewlett-Packard HP 65	£ 410	100 prog. steps 9 storage reg.	Magnetic card	Visual	N/A	Battery or Mains
iii Monroe 1830	£1395	512 prog. steps 74 storage reg.	Magnetic card	Printer	MSC, PC, XY	Mains
iv Olivetti P 652	£2290	240 data reg. 5 prog. steps per reg.	Magnetic card	Printer	AM, MSC, T, XY, PT	Mains
v Sharp CS 364P III	£ 800	144 prog. steps 12 storage reg.	Magnetic card	Visual (printer optional)	None	Mains
vi Compucorp 324 Scientist 344 Statistician	£ 350 £ 430	2 x 80 prog. steps 10 storage reg.	None	Visual	N/A	Battery or Mains
vii Wang 600	£1295	Varies but min. is 55 storage reg. or 312 prog. steps	Magnetic tape (optional)	Visual (printer optional)	D, MSC, T, XY, PT, AM	Mains

TABLE II OTHER CALCULATORS OFFERED BY FIRMS MENTIONED IN THIS SURVEY

Calculator	Price	Internal Store	External Store	Display	Main Peripherals	Power Source
Diehl alphatronic	£1595	160 Data reg. 10 prog. steps per reg.	Magnetic card (optional)	Printer	MC, MT, T, XY	Mains
Hewlett- Packard 9810A	£1212	500 prog. steps 51 storage reg.	Magnetic card plug in modules for 15 user-definable keys	Optional	PC, T, XY, PT, MSC, AM	Mains
Monroe 1880	£1495	512 prog. steps 74 storage reg.	Magnetic card	Printer	MSC, PC, XY	Mains
Olivetti P 602	£1889	384 prog. steps 9 storage reg.	Magnetic card	Printer	AM, PT, T, AM	Mains
Sharp CS 363P	£ 628	144 prog. steps 7 storage reg.	Magnetic card	Visual	None	Mains
Sharp CS 421	£1150	144 prog. steps 12 storage reg.	Magnetic card	Visual (printer optional)	None	Mains
Compucorp 326 Scientist	£ 665	160 prog. steps 12 storage reg.	Magnetic tape	Visual	N/A	Battery or Mains
Compucorp 325 Scientist	£ 895	416 prog. steps 12 storage reg.	Magnetic tape	Visual and Printer	None	Mains