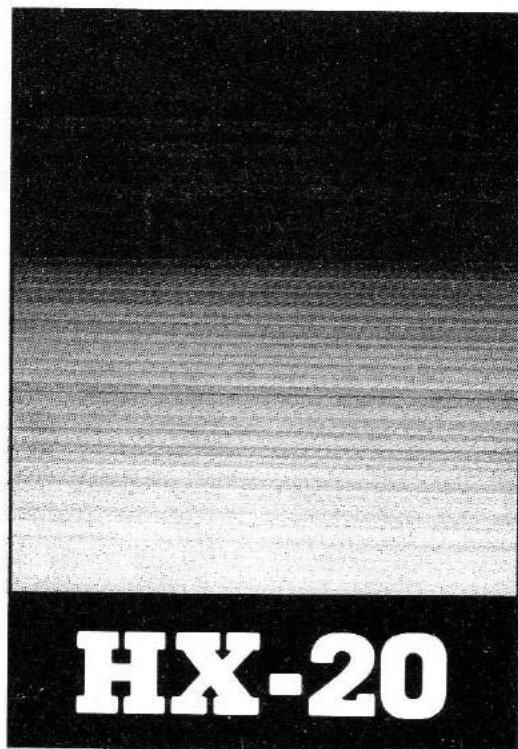# HX-20

## EPSON CALC

EPSON

**Extraordinary product.
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# SECTION 1
# INTRODUCTION

**ECALC** is a "spread sheet calculator" program designed for the entry, storage, retrieval and analysis of data by the use of a two-dimensional work area organised into rows and columns.

Although **ECALC** has the ability to produce extremely complex financial models and forecasts, the inexperienced user will find it easy to achieve very simple and rapid transformations of data within the matrix. For example, the price of a range of products dependant on currency exchange rate may very quickly and accurately be recalculated in one step by simply changing the value of the conversion rate.

**ECALC** is a specially written version of the more popular calculator programs on the market today, incorporating all the most useful commands and allowing flexible and rapid manipulation of data in a form easily tailored to the user's own needs.

The **ECALC** Manual is laid out for the newcomer to spread sheet analysis on the HX-20, but should provide easy reference for more experienced users.

The Manual is divided into seven main sections, with two appendices and an index.

# CONTENTS

# SECTION 2
# STARTING UP

Turn on your HX-20 computer with the Micro Cassette Drive fitted. Adjust the viewing angle of the display and select option 2 BASIC of the Menu.

## 2.1 Loading ECALC from cassette

Ensure that all the memory locations of the HX-20 computer are cleared by typing **CTRL** then **@** together. In response to the "MMDDYYHHMMSS" prompt type the current date and time.

Insert the **ECALC** cassette into the microcassette drive and rewind by pressing the **CTRL** then **PF1** (cassette) keys together, and subsequently the **PF4** key (or type **WIND** **RETURN** ).

The tape counter now visible in the top right hand corner of the display may be set to zero by holding down the **SHIFT** key and pressing key **PF1** .

Return to **BASIC** with the **PF5** key and type **LOAD "ECALC"** then **RETURN** .

The prompt $\geq$ will be shown after the computer has found and loaded **ECALC**, and RUN can be typed when ready.

If a previously stored data file is required, see Section 5.4 on file loading.

## 2.2 Loading ECALC from ROM

If **ECALC** is to be loaded from a **ROM** cartridge, fit this to the HX-20 then type **LOAD "PAC0 : ECALC"** and **RETURN** .

Before any tape access is required, remove the **ROM** cassette and replace with the microcassette drive.

## 2.3 Inserting ECALC into the HX-20 MENU

Once **ECALC** is stored in HX-20 memory, it will remain there permanently until erased (or overwritten). To facilitate subsequent use of the program it can be entered into the HX-20 **MENU** by typing **TITLE "ECALC"** and **RETURN** .

**ECALC** will now be a numbered option to be selected directly from the **MENU** for automatic execution.

*8089 bytes*
*2.51*

# SECTION 3
# THE SPREAD SHEET AND HOW IT WORKS

3.1 Introduction

In **ECALC**, numeric and textual information is written and stored in a two-dimensional area called the spread sheet or matrix which is organised for the 16k version into 15 rows by 14 columns, giving a total array size of 210 cells. On machines with an expansion unit fitted the matrix is 35 rows by 26 columns – see APPENDIX II for details of expansion unit use.

Every cell has a maximum memory allocation of eight alphanumeric characters.

Every cell can also contain a formula, for the calculation and recalculation of the cell value, and the maximum memory available allows for eight formula characters in every cell (i.e. if all cells contained a formula). However, since it is unlikely that all or most cells will contain a formula, an absolute maximum of 20 formula characters per cell is possible, providing that the overall available memory is not exceeded.

On the computer display screen the matrix rows are numbered 1 to 15 and the columns are lettered A to N. Each cell is identified by a unique letter plus number combination which form the cell's coordinates, e.g. A1, C9, H6, or N15.

3.2 The display **window**

The HX-20 liquid crystal display screen is 20 characters across by four lines down, with the result that only a section of the spread sheet is visible at any one time, which is termed the **window** . This consists of any four of the array cells, the top left hand one being the current working cell.

The **window** showing four cells at a time can be moved about over the whole data matrix by three methods:

i) The two cursor keys found on the right hand side of the keyboard marked with right and left arrows, shifted for up and down, can be used to move the window one step at a time in any direction.

ii) Movement directly to the required cell by use of the ( **SHIFT** ) **>** key, which produces the response "GO TO ?" and the destination cell should be typed in. e.g. **N15** ( **RETURN** ).

iii) Movement straight back to the home cell (cell A1) using the ( **SHIFT** ) **HOME** key.

3.3 Data Entry

Data entry into the matrix is achieved by locating the **window** so that the desired cell is positioned in its upper left hand corner (the current working site – by use of the **GO TO** ( **>** ) or cursor keys) and typing in the relevant values or text, before moving on to the next position.

**Note**

When entering data, any more than eight characters per cell including decimal point, will overflow and overwrite the adjacent cell.

This is a useful feature for long headings and underlinings, but care must be taken when entering individual data values not to overwrite the next cell accidentally.

Figures may be entered in exponential form to overcome this limit. For example, the number 432,100,000 could be entered as 4.321E8, and 0.0001234 as 1.234E–4.

Whilst numbers are being entered into a cell, the delete key **DEL** will erase errors. After any other operations have been performed, such as moving to the next cell and back, the cell value can be erased or altered either by means of the **CLR** key and retyping, or simply typing over the current cell contents.

## 3.4    Calculations with **ECALC** – use of Formula Mode

### 3.4.1  Introduction

Whether or not data has been entered into the matrix, calculations can be performed and new data created by means of the **ECALC** formula mode.

There are three simple stages to calculation with **ECALC** : positioning the window at the cell required to be calculated, entering into this cell the desired formula i.e. the arithmetic procedure to be performed to create the new cell value, and completing the computation just by typing **RETURN** .

### 3.4.2  Construction of **ECALC** formulae

An **ECALC** formula consists of operands and arithmetic operators.

An operand can be either a number or the name of a spread sheet cell which contains a numeric value. Cell names must be specified by the letter and number coordinate which describes their position on the work sheet i.e. column letter plus row number.

A maximum of 20 characters may be used in any one formula.

In calculations involving the current cell contents of the cell to be calculated, e.g. adding the current value of the cell to that of another cell, the name of the cell itself must be included in the formula.

For example, for cell B1 to be calculated as its own current value plus that of A1, the formula entered into B1 would be B1 + A1, NOT simply + A1.

The arithmetical operators available are:

| Operator | Function |
|---|---|
| + | Addition |
| – | Subtraction |
| * | Multiplication |
| / | Division |

### 3.4.3 Order of computation in a complex formula

In a formula with more than one operation, e.g. B1+A1*2, the computation in **ECALC** proceeds from the first operation on the left to each successive operation in strict order. It does not follow the normal hierarchical rules of computation; in the example B1+A1*2 the addition would be performed first, followed by the multiplication.
Brackets may not be used in an **ECALC** formula.

If the formula entered contains invalid elements, e.g. cell A50 or a mathematically impossible argument, the computer will return zero in the cell.

### 3.4.4 Formula entry – pointing at cells to create a formula.

To perform a calculation, the required formula can be simply typed into the cell to be computed, e.g. to type into cell C1 the formula A1/B1*1.5+H5 after selecting formula mode.

However, since only four cells are visible in the window at one time, which includes the current work cell to be calculated, it may not always be possible to remember which other cells contain the necessary values for the formula.

Consequently, **ECALC** has the very useful feature of being able to "point at" the cells to be included in the formula, allowing their contents to be checked, by means of the cursor and ▪@▪ keys.

To "point at" a cell whilst entering a formula (after selecting formula mode – see below, section 3.4.5), use the cursor keys to move to this cell, then type ▪@▪ and that cell name will be added to the formula. See section 3.4.7 Example 2 for an example of this feature.

### 3.4.5 Performing the calculation

Calculation in **ECALC** is by three straightforward steps:
location of the cell to be calculated in the work position, selection of formula mode and formula entry, and performing the calculation.

i) Location of cell to be calculated
The cell to be calculated or created should be located in the current working position at the top left of the display window either directly by use of the **GO TO** (▶) key followed by desired cell coordinates or by cursor movements.

ii) Selection of Formula Mode
Formula mode is selected by pressing the ▪@▪ key at this cell position.
An asterisk will appear in the top left hand corner of the screen as an indication of this mode, and the desired calculation formula can be entered at the bottom of the screen.

To be able to check the contents of cells to be used in a formula, these can be "pointed at" after selecting formula mode in the cell to be

calculated. The cursor keys should be used to locate these cells, then **@** typed to include their cell name in the formula.

Note that the formula specified applies only at the cell position from where formula mode was selected; subsequent moving of the window after pressing **@** and before typing in the formula does not alter this.

Formula mode selected from the wrong cell can be corrected simply by typing **RETURN** before entering a formula; the asterisk will disappear to show that it has been cancelled.

iii) Completing the calculation

Typing **RETURN** performs the calculation on the work cell, where the result is subsequently entered. The formula used to generate it will remain visible at the bottom of the window when that cell is in the working position.

Clearing the contents of a cell using **CLR** also erases an attached formula. To alter or erase just the formula, enter formula mode by typing **@** in the relevant cell, and use the delete key ( **DEL** ).

### 3.4.6 Numbers of significant figures per cell – format control

Numbers produced by calculation can be in either of two formats, decimal or integer.

Integer format rounds a value to the nearest whole number, decimal format rounds to two decimal places.

Format control is in an option of the **ECALC** Menu, which is obtained by holding down the **CTRL** key and typing **C** .

```
(S)ave      (L)oad
(P)rint     (T)ape
(R)eplicate
(F)ormat    (E)xit
```

From the **ECALC** Menu, type **F** , then respond to the prompt:

```
(I)nteger    or
(D)ecimal ?
```

with either **I** or **D** .

A symbol in the top right corner of the display shows which format mode is in operation:

> Integer mode –   **a**
> Decimal mode –   **£**

If the result of a calculation in decimal format is a value with more than five significant figures to the left of the decimal point, it will be entered into the cell in exponential form with one digit to the left of the decimal point and two decimal places, e.g. 150,000,000 as 1.50E+08.

In integer format, numbers of more than six significant figures are converted to exponential format.

Note that the maximum allowable value in **ECALC** is $1E+25$; any larger value will generate an overflow error.

### 3.4.7 Examples of simple calculation with **ECALC**

Example 1.

Cell A1 contains the value 2.1, and it is required to calculate the value of B1 as B1=A1*2. The display shows:

```
      A       B    £
1 2. 1_
2
```

The window is moved to the cell to be calculated, B1, by the right cursor, and then formula mode selected by pressing **@** . The formula A1*2 is entered. The window now shows:

```
*     B       C    £
   1
   2
A1*2
```

Pressing **RETURN** produces the result:

```
      B       C    £
        4. 20
1 _
2
A1*2
```

Calculations can be performed on any cell and include the value of any other cell or cells in the formula.

The formula, in this case A1*2, remains active for the cell in any subsequent recalculation (see section 3.5 for recalculation) until it is erased or altered.

In calculations involving the cell contents themselves e.g. adding a number to the current cell value or multiplying it by another cell value, its own cell number must be specified in the formula.

Example 2. Calculations including current cell contents.

Continuing from Example 1, the value of C1 has been entered as 1.0 and it is required to add to this 10 plus the value of B1.

As in Example 1, the cell to be calculated, C1, is located in the work position and **@** pressed to select formula mode. However, this time it is required to check the contents of cell B1 before entering it in the formula, so just the first part of the formula is entered:

```
*     C       D    £
   1   1. 0
   2
C1+10+
```

The left cursor key is used to move to cell B1, and having decided its value to be the one required, @ is typed again which adds "B1" to the formula. The current display shows:

```
*      B      C     £
  1      4. 20   1. 0
  2
C1+10+B1
```

Pressing RETURN gives the result:

```
       C       D     £
  1      15. 20
  2
C1+10+B1
```

## 3.5   Recalculation using **ECALC**

When the values of cells are changed and these cells are used in the calculation of other sets of cells, recalculation of a new generation of the derived cell values can be performed by selection of recalculation mode; typing CTRL and then R together. This mode has the option to operate on either just the current cell from where the mode was selected, or on the whole work sheet. Pressing CTRL and R produces the question:

```
All or Current cell
(A/C)
```

The relevant letter ( A or C ) should be typed in and the computer will perform the recalculation.

Example 3. A simple example of recalculation with **ECALC**

Continuing from Example 2, the current work sheet for cells A1 to C1 is:

```
      A      B      C
  1  2. 1    4. 20   15. 20
  2
        A1*2   C1+10+B1
```

(on the computer only four cells and one formula can be seen at one time).

If the value of cell A1 was changed to 3.1 and a recalculation of B1 and C1 were required, CTRL and R then A option would be selected to give the following results:

```
      A      B      C
  1  3. 1    6. 20   31. 20
  2
        A1*2   C1+10+B1
```

## 3.6 Row and Column totals

Row and column totals are produced by means of **CTRL** and **A** , and **CTRL** and **D** respectively, followed by subsequent recalculation using **CTRL** and **R** and **A** option. They can be selectéd at any point along the row or column for which the total is required, but always sum the values of the whole line.

When in operation, total calculation mode is indicated by the following symbols:

Row total    ( **CTRL** + **A** ) by > in the work cell.
Column total    ( **CTRL** + **D** ) by ↓ beside the column heading letter.

The row total is displayed in the last column of that row, and the column total in the last row of that column.

Totalling can be removed by subsequent use of **CTRL** and **A** or **CTRL** and **D** .

## 3.7 Replication of numbers and text

### 3.7.1 Introduction

Replication is an important function which not only allows duplication of numeric values and text from one cell to any number of others, but more importantly gives the ability to replicate formulae so that, for example, a whole column or row of figures can be generated as a product of one or more other columns and/or rows.

This section deals with straightforward duplication of cell contents; section 3.8 will deal with replication of formulae.

### 3.7.2 How to replicate numeric and textual information

To replicate a numeric value or text:

i) Locate the desired cell to be replicated with **GO TO (>)** or the cursor keys.

ii) Select replication mode by pressing the keys **CTRL** then **C** together to first display the **ECALC** Menu. The other options of the Menu will be discussed later (see section 5).

```
(S)ave      (L)oad
(P)rint     (T)ape
(R)eplicate
(F)ormat    (E)xit
```

Select the **R** option from the Menu from this cell position.

iii) Specify the cells into which the replicas should be inserted by either:
a) In response to the display prompt **"FROM"** and the cell number, enter the coordinates of the cell where the first duplicated value should be inserted and type ■ followed by **RETURN** .

The display will now move to this cell and contain the words "FROM" the current cell number "TO" the current cell number.

Type in the destination cell code number for the final duplicate of the set and then **RETURN** .

or

b) As in a) above but using the cursor keys to move the window and "point to" the cells where replication should start and end.

From the display prompt **"FROM"** move to the first duplicate destination, type **■** then move to the last destination and type **RETURN** .

Note that the start and finish positions for any one set of replicas must be in the same dimension, i.e. either across a row or down a column.

3.7.3 Example 4. Replication of numeric values or text with **ECALC**.

Cell A1 contains the text **"DAY"** and it is required to replicate this in A2 to A3 also. The Menu is obtained with **CTRL** and **C** and option **R** selected for replication mode. The window now appears as:

```
     A        B      £
1 DAY
2
FROM A1
```

The first cell where a replicate is required, **A2** is typed in followed by **■** , when the window will move to cell A2. The final destination cell, **A3** is then typed to produce:

```
     A        B      £
2
3
FROM A2 TO A3
```

Pressing **RETURN** will now replicate the text in the desired cells.

Text replication is particularly useful for operations such as underlining.

The same method can be used for duplication of numeric values.

3.8    Replication of Formulae

3.8.1  Introduction

Up to this point, calculations in **ECALC** have only been described for the computation of one cell value from a formula which could contain one or more values of other matrix cells.

However, it is often necessary to compute one set of data using a particular formula, for example, to construct from a column of product prices in Sterling a corresponding set in US Dollars.

**ECALC** has the very useful ability to replicate formulae, not only as identical duplicates, but also relatively i.e. relative to the position of the cell to be calculated. As a formula is replicated, it is also computed, and the new value is entered in the appropriate cell.

Formulae often contain cell coordinates, i.e. calculating a cell using the value of another cell, e.g. $B1=A1*2$. To calculate a row or column of data using the values of another row or column, each derived cell must contain the formula linking itself to the relevant cell in the original data set.

For example, to calculate the column B from the column A, if $B1=A1*2$ then $B2=A2*2$ and $B3=A3*2$ and so on.

Thus the formula for each cell needs to be relative to its position in the set of data to be created, and **ECALC** relative formula replication will insert the correct cell coordinates at each position.

The above example of currency conversion will illustrate this further.

In column B (cells B3 to B12) there is a list of prices of certain products in Sterling and it is required to calculate column C (cells C3 to C12) as the same products priced in US Dollars.

The first step would be to construct the formula containing the current exchange conversion rate and enter this into the first cell to be calculated, cell C3. Having calculated C3, the formula would be replicated relatively in the cells C4 to C12 by an **ECALC** replication mode command, and each new cell value calculated as its formula was created.

For the complete working of this example, see section 3.8.3, Example 5.

If a formula to be replicated contains more than one set of cell coordinates, e.g. $C1=A1*2+B1$, then **ECALC** replication mode allows for each one to be either relative or not to change.

### 3.8.2 How to replicate a formula

Formula replication follows basically the same procedure as numeric or textual replication, but with the additional option of relative replication.

i) Enter the desired formula in the appropriate cell (see section 3.4) to perform the first calculation of the set, or locate the cell which already contains the formula to be replicated with the **GO TO (>)** or the cursor keys.

ii) Select replication mode from the **ECALC** Menu ( **CTRL** then **C** ), option **R** , from this cell position.

iii) Specify the cells into which the replicated formulae (and their computed products) should be inserted by either:

a) In response to the prompt **"FROM"** with the current cell co-ordinates, type the coordinates of the cell where the first replicated formula should be inserted. Next type ■ and the display will show this first cell.

The prompt **"TO"** refers to the cell where the last replicated formula of the series should go, and these coordinates should be typed in followed by **RETURN** .

or

b) As in a) above but instead of typing in the start and finish locations for the replicated formula, these can be "pointed to" by movements with the cursor keys.

From the first prompt **"FROM"** move to the cell where the first replicated formula should be entered, then type **■** , move to the cell where replication should finish and press **RETURN** .

Note that the cell which contains the original formula to be replicated must not be included in the set of destinations for replicated formulae, as it would then be erased.

iv) If the formula being replicated contains any cell coordinates, the computer display will next prompt:

```
(R)el or (N)o change
    ?
 A1
```

together with the cell coordinates to which it is referring from the formula. If the formula contains more than one cell name, the above prompt will appear for each in turn, after each of your responses. The response should be **R** if the cell in question should vary relatively with each replication of the formula, and **N** if it should not change. Replication of the formula and computation of the new cell values will then proceed.

### 3.8.3 Example of replicating a formula with **ECALC**

Example 5. Currency conversion – calculating a column of data by formula replication.

This example illustrates the use of replication in currency conversion as in the instance used in section 3.8.1, converting a set of prices from Sterling to US Dollars.

It is also relevant to a wide range of other common computational requirements, such as prices after a fixed percentage discount, price rise, including and excluding V.A.T. or postage, and many more.

In this example, the new prices are computed from one column and inserted in another, but this could equally well be performed from row to row.

The set of prices to be converted are in column B, rows 3 to 12, with the column title in row 1, underline in row 2, and product names in column A.

The full display or printout (shown as it would be on an external printer for clarity) contains:

```
   :  A    :  B    :  C    :
 1 PRODUCT £PRICE  *PRICE
 2 -----------------------------
 3 GROMMET 10.50
 4 BRADAWL 12.75
 5 SPOKE    3.2
 6 WHEEL    7.58
 7 WIDGET  98.46
 8 KEY      4.67
 9 PLUG     7.15
10 WASHER   0.78
11 LINK     1.76
12 SHIM    19.95
```

First, the formula must be constructed and entered into the first cell to be calculated, C3. Cell C3 is first located by the command **GO TO ( > ) C3**. Formula mode is entered by the **@** key and the formula B3*1.75 entered. Pressing **RETURN** produces the result:

```
         C            D      £
 3 _   18.38
 4
B3*1.75
```

From this cell where the formula was entered, C3, replication mode is selected via the **ECALC** Menu ( **CTRL** then **C** ), option **R**

The first cell into which a replicated formula should be entered is typed in, C4, followed by **.** . The display now shows:

```
         C         D      £
 4
 5
FROM C4 TO C4
```

Next the final destination cell for the replicated formula is typed in, C12, followed by **RETURN** . The display prompts:

```
(R)el or (N)o change
  ?
B3
```

showing the cell name, B3, which in this case needs to be replicated relatively, so **R** for relative replication is entered.

Replication is then executed, the display being returned to the last cell C12:

```
         C         D      £
12_   34.91
13
B12*1.75
```

The final state of the price list is:

```
/   :   A    :   B    :   C    :
 1  PRODUCT  £PRICE  $PRICE
 2  ---------------------------
 3  GROMMET  10.50      18.38
 4  BRADAWL  12.75      22.31
 5  SPOKE     3.2        5.60
 6  WHEEL     7.58      13.27
 7  WIDGET   98.46     172.31
 8  KEY       4.67       8.17
 9  PLUG      7.15      12.51
10  WASHER    0.78       1.37
11  LINK      1.76       3.08
12  SHIM     19.95      34.91
```

Each of the cells C3 to C12 now also contains its relatively replicated formula, not shown here.

# SECTION 4
# CONSTRUCTING A SPREAD SHEET
# WITH ECALC – AN EXAMPLE

Before entering data into the **ECALC** spread sheet for calculations, spend some time planning the structure of the data layout and the formulae necessary to perform the computation.

Row and column headings are helpful so that the location of each set of data is always clear.

The following example illustrates how to set out and perform calculations in a simple spread sheet.

Example of spread sheet construction – Personal finance

Mr. D.H.Somerset wishes to construct a plan of his month's financial expenditure and receipts to be better able to predict his future spending.

He first defines his list of outgoings for each week of the month, and decides that he needs a weekly expenditure total as well as each week's balance.

Constructing the spread sheet

See Figure 1 of the completed spread sheet to help in following this example.

| x | A<br>K | B<br>L | C<br>M | D<br>N | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | WEEK 1 | WEEK 2 | WEEK 3 | WEEK 4 | | | | |
| 2 | | | | | | | | | | |
| 3 | RENT | | 25.00 | 25.00 | 25.00 | 25.00 | | | | |
| 4 | RATES | | 7.00 | 7.00 | 7.00 | 7.00 | | | | |
| 5 | FOOD | | 17.00 | 19.00 | 13.00 | 9.00 | | | | |
| 6 | ELECTRICITY | | 1.750 | 1.60 | 2.70 | 1.34 | | | | |
| 7 | PETROL | | 5.00 | 7.00 | 4.50 | 15.00 | | | | |
| 8 | ENTERTAINMENT | | 1.60 | 3.00 | 17.00 | 3.75 | | | | |
| 9 | | | | | | | | | | |
| 10 | WEEKS TOTAL | | 57.35 | 62.60 | 69.20 | 61.09 | | | | |
| 11 | | | | | | | | | | |
| 12 | | WAGES | 85.00 | 85.00 | 85.00 | 85.00 | | | | |
| 13 | | | | | | | | | | |
| 14 | WEEKLY BALANCE | | 27.65 | 22.40 | 15.80 | 23.91 | | | | |
| | | | | | 89.76 | | | | | |
| 15 | | | | | | | | | | |

Figure 1

First the **ECALC** Menu is selected ( **CTRL** and **C** ) and format mode (option **F** ) set to decimal format ( **D** ). The titles are next typed in, which establishes the destinations for each data set and avoids any confusion when entering data. The raw data of the set, the six expenditure categories plus the weekly income in each of the four weeks, is then entered week by week (column by column).

The two formulae, one for weekly expenditure total and the other for overall weekly balance, need only be entered for the first week then replicated into the other three.

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First the weekly expenditure formula is entered by locating the cell for its insertion, here C10, typing **@** to enter formula mode, typing in the formula which adds the data in this first column (see below), and pressing **RETURN** . Here, the formula would be C3+C4+C5+C6+C7+C8.

This formula is then replicated relatively into the other three columns by entering replication mode via the **ECALC** Menu and specifying these three other cells.

In this case, the sequence of commands for replication of the formula is:

Locate cell C10 in the working position.

Type **CTRL** and **C** – **ECALC** Menu, then the **R** option.

Beside the prompt "FROM", type **D10 ▪** then **F10,** these being the start and finish locations for the replicas.

In the following sequence of prompts, type **R** for relative for each cell coordinate in the formula.

Thus, cell D10 would now contain the formula (and computed result of) D3+D4+D5+D6+D7+D8, and so on for cells E10 and F10.

The four weekly expenditure totals would now have been calculated.

To compute the four weekly overall balance totals, the formula to subtract each week's expenditure from the week's salary is entered into cell C14, after selecting formula mode there with **@** . The formula is C12–C10. Pressing **RETURN** computes this first week's balance, and the formula can be replicated into cells D14 to F14 by the following steps:

Locate cell C14 in the work position.

Type **CTRL** and **C** – **ECALC** Menu, then **R** for replication.

Beside the prompt "FROM" type **D14 ▪** then F14, these being the start and finish locations for the replicas.

Two sets of prompts will follow, both of which are answered by **R** for relative replication.

Thus, cell D14 would now contain the formula (and computed result of) D12–D10, and so on for E14 and F14.

Now the spread sheet contains the two sets of weekly totals, and the overall monthly balance can be calculated by selecting **CTRL** and **A** for a row total in row 14, which sums the four weekly balances and displays this value in cell N15 (in the **ECALC** 16k version).

The completed spread sheet is shown in Figure 1, as it would appear on an externally attached printer (printing the spread sheet is discussed later, in section 5.5).

# SECTION 5
# STORAGE AND OUTPUT OF ECALC DATA

5.1 Introduction

Information from an **ECALC** spread sheet can be stored on microcassette for future use, and all or part of the information can be printed out, either on the HX-20 internal microprinter or on an externally attached printer. The **ECALC** Menu ( **CTRL** and **C** ) provides the access to save, load and print modes.

The **ECALC** Menu displays the following options:

```
(S)ave       (L)oad
(P)rint      (T)ape
(R)eplicate
(F)ormat     (E)xit
```

The **F** format option was described in section 3.4.4 and the **R** replicate option in sections 3.7 and 3.8; sections 5.2 to 5.6 deal with the other five options.

5.2 Tape control

Before saving or loading **ECALC** data files, the required microcassette tape can be rewound or wound to a desired tape counter number by tape control mode.

5.2.1 Use of tape control mode

i) The **ECALC** Menu should be obtained by **CTRL** then **C** keys together, and the **T** option selected. The display will indicate the current tape counter number by **"TAPE COUNT="** and the prompt **"WIND TO NO. ?"**.

```
TAPE COUNT= 0
WIND TO NO. ? _

   (<CR>) FOR START)
```

ii) A required number can be typed in followed by **RETURN**. Typing just **RETURN** will default the number to zero, the start of the tape (hence the display "((CR) FOR START)").

5.2.2 Rewinding the tape before any input or output

Before the first save or load after inserting a cassette, the tape should be rewound either by entering **O** **RETURN** or just **RETURN** in tape control mode.

5.2.3 Tape control before saving files

Before saving data files, the position where tape saving should begin can

be set via tape control mode. The tape should be rewound when first inserted, and then the required tape counter number entered. If a set of files are to be saved consecutively the tape counter need not be set between each save; the files will be abutted to the previously saved file.

### 5.2.4 Tape control before loading files

Before requesting a file to be loaded from tape, the cassette should be rewound via tape control mode. If the tape counter location of the file is known, the tape should be wound to this position by tape control mode (after rewinding the tape) prior to requesting the file load, to reduce the time of file location.

## 5.3 Saving **ECALC** data

Data from the **ECALC** spread sheet can be saved on tape by the HX-20 microcassette drive.

i) Before saving data set the cassette tape to the desired position with tape control mode (see section 5.2).

ii) Obtain the **ECALC** Menu with **CTRL** then **C** keys together, and select the **S** option.

iii) The prompt "**ENTER FILENAME**" should be answered by typing in a unique filename of up to eight characters then **RETURN** . A filename must begin with a letter but may contain numbers e.g. DATA01 or CASH05.

iv) The filename, tape counter number and date will be printed on the internal printer (whether switched on or off) before the data is saved and the window returned to the spread sheet.

The spread sheet data can also be saved before exiting from the **ECALC** program by selecting the **E** exit option from the **ECALC** Menu – see section 5.6.

## 5.4 Loading **ECALC** data from tape

To load a previously saved **ECALC** data file from tape:

i) First select tape control mode from the **ECALC** Menu to rewind or position the required cassette at the desired file location (see section 5.2).

ii) Obtain the **ECALC** Menu by **CTRL** then **C** keys together and select option **L** load.

iii) Enter the required filename when the "**ENTER FILENAME**" prompt appears, followed by **RETURN** . The file will be loaded and the spread sheet window set at cell A1.

## 5.5 Printing **ECALC** data

### 5.5.1 Introduction

Data from the **ECALC** spread sheet can be printed out either on the HX-20

internal printer or on an externally attached printer, and a specific set of cells can be selected for output.

For both types of printer, print mode is selected via the **ECALC** Menu, and then the required cells specified. Where an external printer is in use, **ECALC** will ask for the print control settings to be confirmed when the first printing is requested.

### 5.5.2 Printing with the internal printer

To print out a set of cells:

i) From the **ECALC** Menu ( **CTRL** then **C** ) select the **P** option.

```
(I)nternal   or
(E)xternal  PRINTER
```

Select the option **I** for internal printer.

ii) The display will now contain the current cell, the prompt **"FROM"** and the cell number. The coordinates of the cell to be printed first should be typed in over this number, followed by ■ and the display will move to this cell.

iii) The display will now also say **"TO"** with the current cell number repeated. Enter the coordinates of the last cell required to be printed and **RETURN** .

The computer will print out the data in the format:

```
     A          B          C          D
1   0          0      1   0          0
2   0          0      2   0          0
3   0          0      3   0          0
4   0          0      4   0          0
```

The cell contents will be printed out, not any associated formulae. After printing, the display returns to the last cell which was printed.

### 5.5.3 Printing with an external printer

To print out a set of cells:

i) From the **ECALC** Menu ( **CTRL** then **C** ) select the **P** option. Select the option **E** for external printer.

ii) The display will now contain the current cell, the prompt **"FROM"** and the cell number. Type in the coordinates of the cell to be printed first, followed by ■ ; the display will move to this cell.

iii) The display will now also say **"TO"** followed by the current cell number repeated. Enter the coordinates of the last cell required to be printed and **RETURN** .

The print format of the output on an external printer is as shown in section 6; the whole spread sheet is shown as one area.

iv) The first time the external printer is requested, the computer will ask you to confirm the printer control settings with:

```
Confirm printer
controls (67E13) Y/N

    (Refer Manual !)
```

The characters "(67E13)" refer to the printer settings of the RS-232C port (BLPSC), where:

B = Baud rate (4800 bps)
L = Word length (7 bits/character)
P = Parity (Even)
S = Stop bits (1)
C = Control line information

See the HX-20 Reference Manual (Section 3-46) for more information.

If the values of these parameters correspond to those of your printer settings then type: **Y** . Printing will then commence.

If your printer requires different interface conditions type **N** .

```
ENTER PRINTER PARAMS
(BLPSC)? _
```

The display will then request the correct parameter values to be entered in the same order as above in brackets i.e. (BLPSC) followed by **RETURN** , before printing can commence.

## 5.6  Exiting from **ECALC**

The exit option of the **ECALC** Menu allows you to both return from the **ECALC** Menu back to the spread sheet, if no Menu option is required, and to exit from **ECALC** to the HX-20 Menu.

Note that the **ECALC** spread sheet is cleared by an exit to the HX-20 Menu, therefore before the exit is completed there is a check prompt which asks if data should be stored on cassette.

To exit from **ECALC** select the **ECALC** Menu ( **CTRL** then **C** together) and the **E** option. The display will then read:

```
SAVE DATA ? (Y/N)
    or (R)eturn
```

For a return to the spread sheet type **R** .

If no data is required to be saved, type **N** and the exit will be completed, returning the HX-20 Menu.

If data storage is required, type **Y** . The prompt **"ENTER FILENAME"** will appear and the instructions for file storage should be followed as in section 5.3(iii).

# SECTION 6
# SPREAD SHEET APPLICATION EXAMPLE USING ALL THE ECALC FEATURES – CASH FLOW ANALYSIS

This example of a spread sheet application illustrates the use of a wide range of **ECALC** features.

The spread sheet contents are shown as they would be on an external printer output for clarity in this example.

The Big Bang Firework Co. – cash flow analysis with **ECALC**

Mr. Fawkes, proprietor of the Big Bang Firework Co., has a very seasonal trade; now in December he needs to calculate his overdraft requirement for the next year.

He has the following information about his business:

Rates are £250 per annum, payable in January and July. Rent is £3000 per annum, payable monthly.
His electricity bill will be £255 in four quarters of £75, £60, £50 and £70. The gunpowder and other materials cost £6000 per annum and are purchased evenly over the year.
Mr Fawkes pays £900 per month in wages.

Using his HX-20, Mr. Fawkes firstly creates a spread sheet showing his monthly costs, which he totals in row 8, as shown below. Notice how the irregular payments are entered only in some months.

```
x   :  A    :  B    :  C    :  D    :  E    :  F    :  G    :  H    :  I    :  J
    :  K    :  L    :  M    :  N    :
 1     JAN     FEB     MARCH   APRIL   MAY     JUNE    JULY    AUG
SEPT    OCT     NOV     DEC
 2 RATES   125.00                                              125

 3 RENT    250.00  250.00  250.00  250.00  250.00  250.00  250.00  250.00
250.00  250.00  250.00  250.00
 4 ELEC    75.00                   60                      50
        70
 5 MATERIAL500.00  500.00  500.00  500.00  500.00  500.00  500.00  500.00
500.00  500.00  500.00  500.00
 6 WAGES   900.00  900.00  900.00  900.00  900.00  900.00  900.00  900.00
900.00  900.00  900.00  900.00
 7

 8 TOTAL   .1850.00 1650.00 1650.00 1710.00 1650.00 1650.00 1825.00 1650.00
1650.00 1720.00 1650.00 1650.00
```

To this Mr. Fawkes can now add his sales revenue, which is predicted as follows:

| Jan | Feb | Mar | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec |
|-----|-----|-----|-----|-----|------|------|-----|------|-----|-----|-----|
| 200 | 400 | 500 | 500 | 700 | 500 | 800 | 900 | 1000 | 9000 | 4000 | 700 |

Subtracting the cost total from the revenue figure gives a monthly cash balance.

Mr. Fawkes now inserts each month's cash balance into the following month's figures (he starts with £500) to give his true monthly cash requirement or surplus. The surplus for December is his budgeted profit for the year.

```
x      A    /  B    /  C    /  D    /  E    /  F    /  G    /  H    /  I    /  J
       /  K    /  L    /  M    /  N    /
1          JAN     FEB     MARCH    APRIL   MAY      JUNE     JULY     AUG
SEPT   OCT    NOV     DEC
 2 RATES   125.00                                             125
 3 RENT    250.00  250.00  250.00   250.00  250.00   250.00   250.00   250.00
250.00  250.00  250.00  250.00
 4 ELEC    75.00                    60                50
           70
 5 MATERIAL500.00  500.00  500.00   500.00  500.00   500.00   500.00   500.00
500.00  500.00  500.00  500.00
 6 WAGES   900.00  900.00  900.00   900.00  900.00   900.00   900.00   900.00
900.00  900.00  900.00  900.00
 7
 8 TOTAL    1850.00 1650.00 1650.00 1710.00 1650.00 1650.00 1825.00 1650.00
1650.00 1720.00 1650.00 1650.00
 9
10 SALES    200.00  400.00  500.00  500.00  700.00  500.00  800.00  900.00
1000.00 9000.00 4000.00 700.00
11 RESULT  -1650.00-1250.00-1150.00-1210.00 -950.00-1150.00-1025.00 -750.00
-650.00 7280.00 2350.00 -950.00
12 BAL B/F 500.00  -1150.00-2400.00-3550.00-2360.00-2160.00-2100.00-2175.00
-1775.00-1400.00 6630.00 9630.00
13
14 BAL C/F -1150.00-2400.00-3550.00-4760.00-3310.00-3310.00-3125.00-2925.00
-2425.00 5880.00 8980.00-5-950.00
15
```

Mr. Fawkes knows that employing a sales representative will add 20% to his sales, with equivalent rises in his direct costs, and with an extra salary cost of £500 per month.

Use this information to recalculate the spread sheet and see if his profit will increase ,

# SECTION 7
# HINTS FOR NEW ECALC users

7.1    Use of the numeric keypad – the **NUM** key

When entering a continuous set of numeric data it may be found easier to use the "**ghosted**" number pad found on the keyboard at letters **U,I,O,J,K,L** and **M** , which is selected by pressing the **NUM** key. The arithmetic operators **+,-,*** and **/** , and also **,?** and **'** keys are also accessible in numeric mode.

However, note that the keyboard letters are then disabled and prior to entering cell coordinates or text, or requesting lettered options from the Menu, the **NUM** key must be pressed again to switch the keyboard back to alphanumeric mode.

7.2    Use of lower case letters – the **CAPS LOCK** key

Lower case letters may be used as part of text stored in the spread sheet cells, but cell coordinate letters and letters to define Menu options will only be accepted in upper case. It is therefore advisable to maintain the **CAPS LOCK** key in the "locked" position otherwise **ECALC** may appear to die.

7.3    Keyboard buffer

The HX-20 has an eight character keyboard buffer to facilitate faster typing (and this also applies to the cursor keys). It is helpful if care is taken when moving around the spread sheet by cursor means to be precise about the number of cursor movements entered.

# APPENDIX I
# ECALC COMMANDS AND FUNCTIONS

Functions and commands available with main reference:

Summary of use of **ECALC** commands and functions

1.  Cursor keys
    The cursor keys on the right hand side of the HX-20 keyboard are marked with right and left arrows, shifted for up and down.
    Use of the cursor keys in **ECALC** moves the display window one step in any direction over the spread sheet.

2.  **DEL** – delete key
    The delete key, marked **DEL**, at the top right of the HX-20 keyboard is used, in **ECALC**, to correct characters whilst entering data into a spread sheet cell or formula.

3.  **CLR** – clear key
    The clear key, at the top right of the HX-20 keyboard, will remove all data from the current work cell, together with a formula if one exists in the cell.

4.  **HOME** – home key
    The home key, which is the **CLR** key shifted, returns the display window to cell A1.

5.  **>** – "GO TO" command
    The key ( **SHIFT** ) **>** in **ECALC** is used to move directly to a required spread sheet cell.
    The prompt "GO TO" should be answered by typing in the required two-character (letter/number) cell coordinates, then **RETURN**, and this cell will be displayed in the work position.

6.  **@** – formula mode for **ECALC** calculations
    To perform a calculation and create a new cell value, locate the cell to be calculated and select formula mode by pressing the **@** key.
    An asterisk in the top left corner of the display will indicate formula mode currently active.
    Enter the desired formula by either just typing the required characters, or by using the cursors to move to the cells included in the formula and pressing **@** to enter their coordinates. Such "pointing at" cells allows their contents to be checked before inclusion in a formula.
    Type **RETURN** to complete the calculation.

7.  **CTRL** and **R** – recalculation
    To recalculate a cell or cells, having changed the value of a cell or cells used in cell formulae, hold down the **CTRL** key and type **R**.
    The response "**ALL OR CURRENT CELL**" should be answered with the appropriate letter (A or C) dependant on whether the whole spread sheet needs to be recalculated, or just the current cell from which recalculation mode was selected.

8.  Totalling
    **CTRL** and **A** – row totals

To produce a total of all the values in any row, type **CTRL** then **A** keys together at any point along that row. Next type **CTRL** and **R** together, followed by **A** option, to recalculate the whole spread sheet and produce a row total.

The symbol > beside the row number indicates that a row total has been produced in the last column of that row.

To switch off row totalling, type **CTRL** and **A** again.

**CTRL** and **D** – column totals

To produce a total of all the values in any column, type **CTRL** then **D** together at any cell in that column. Next type **CTRL** and **R**, followed by **A** option, to recalculate the whole spread sheet and produce the column total. The symbol ↓ beside the column heading letter indicates that a column total has been produced in the last row of that column.

To switch off column totalling, type **CTRL** and **D** again.

9.  **CTRL** and **C** – the **ECALC** Menu

The **ECALC** Menu has seven options:

i) **F** option – Format of numeric values produced by **ECALC** calculations.

The format option has two possible states, integer or decimal.

Integer mode, selected by **I**, rounds the result of a calculation to the nearest whole number. When in operation the telephone symbol is present at the top right corner of the display window.

Decimal mode, selected by **D**, converts the result of calculations to numbers with two decimal places. This mode is signified by the £ symbol at the top right corner of the display.

In decimal mode, numbers of more than five significant figures to the left of the decimal point are converted to exponential format in the form 1.23E+04 (12300).

In integer mode, numbers with more than six significant figures are converted to exponential format.

ii) **T** option – tape control

Tape control mode allows rewinding of a cassette or positioning to a desired tape counter number.

When a cassette is first inserted it should be rewound with tape control mode.

The display shows the current tape counter number with **"TAPE COUNT="**, and prompts for the desired new tape number with **"WIND TO NO. ?"**

Typing zero or **RETURN** rewinds the tape.

iii) **S** option – saving data files

Tape control mode should be used to rewind and locate the desired tape number where file saving should start before selecting save mode.

The save mode prompts for the name for the new file with **"ENTER FILENAME"** when a unique name should be entered, of up to eight

letters.

This filename, with the date and tape count number, is printed on the HX-20 printer before the file is saved. The tape need not be moved on between consecutive file saves.

iv) **L** option – loading data files

Tape control mode should be used to rewind the cassette before selecting load option, and if the tape position of the file is known this can be located in tape mode also.

After the load option prompt **"ENTER FILENAME"** has been answered, the file will be searched for and loaded.

v) **P** option – printing spread sheet data

The print option allows for the use of an external printer as well as the HX-20 internal printer.

For the internal printer, printer mode option **I**, the cells to be printed must be specified.

Beside the prompt **"FROM"** should be typed in the coordinates of the first cell to be printed, then **.** and the coordinates of the last cell to be printed (then **RETURN** ).

Instead of typing the cell coordinates, these cells can also be "pointed at" by moving to them with the cursor keys and pressing **@** .

External printer use is identical to that described for the internal printer, with the addition of having to confirm or specify the printer control settings – see section 5.5.3.

vi) **R** option – replication mode

Replication in **ECALC** can be both straightforward duplication of cell contents or formulae, or replication of formulae with the cell names contained in them varying in relation to the position of the new replica.

The selection of replication mode must be made from the cell containing the information to be replicated.

Beside the prompt **"FROM"** should be typed the cell coordinates where the first replicate should go, followed by **.** and the coordinates of the cell destination of the last replicate of the set (then **RETURN** ).

Instead of typing in these cell coordinates, they can also be "pointed to" by moving the display to them with the cursor keys.

Replication of a formula follows a similar pattern to that for numbers or text, with the addition of being able to specify whether cells contained in the formula should be replicated relatively (i.e. in relation to the formula's new position) or not to change – see section 3.8 for more detail.

vii) **E** – exit from the **ECALC** Menu

The **E** option allows both exit from the **ECALC** Menu with subsequent return to the current spread sheet (i.e. when no other Menu option is required), and exit from **ECALC** to the HX-20 Menu.

To return to the spread sheet, type **R** .

To exit from **ECALC**, first respond to the data save check prompt. If data saving is required, type **Y** , and the prompt "**ENTER FILENAME**" will start the file saving sequence.

Typing **N** will cause an exit to the HX-20 Menu and clear the whole spread sheet.

10. **■** – the "**TO**" destination key

The key **■** is used when specifying cells for printing or as destinations for replication.

In these modes, after the prompt "**FROM**" has been answered by typing in or moving to a cell coordinate, **■** must be typed before typing in or moving to the final cell location for printing or replication.

# APPENDIX II
## EQUIPMENT REQUIREMENT AND MACHINE CAPABILITIES FOR ECALC

HX-20 16k machine gives a maximum spread sheet size of 14 by 15. (A to N columns by 1 to 15 rows).

Options:

HX-20 Expansion Unit gives total memory of 32k and spread sheet of 26 by 35. (A to Z columns by 1 to 35 rows).

HX-20 Microcassette Drive:

**ECALC ROM** Cartridge.

External printer – minimum 80 columns, serial interface, HX-20 714 cable.

# INDEX