

**Reference
Manual**

INTER- SHEET



ROM-LINK



Computer Concepts

Serial No. 006384

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INTER-SHEET is designed and distributed by Computer Concepts

INTER-SHEET is supplied with two manuals, this Reference and an Introduction Manual.

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The abbreviation BBC Micro for British Broadcasting Corporation Microcomputer has been used throughout this book.

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1. INTRODUCTION

1.1 The ROM-LINK concept

INTER-SHEET is a very advanced spreadsheet package with many sophisticated features, which are explained in this manual. It is the first of a series of ROM-based packages which will form a powerful overall system, sufficiently comprehensive for serious business use as well as in the home. In addition to this spreadsheet program (INTER-SHEET) there is a database (INTER-BASE), a graphics package (INTER-CHART) and a wordprocessor (INTER-WORD). Additional packages may be added from time to time. The complete system will be called ROM-LINK, indicating that any package in the system can communicate with any other through ROM-LINK commands, enabling the transfer of data. Thus, for example, the contents of a database might be displayed as a worksheet, from which graphs or bar-charts could be produced, or which could be transferred to the wordprocessor and incorporated into a document. Details of other ROM-LINK packages which are available or in preparation can be obtained from Computer Concepts.

INTER-SHEET will function perfectly well on a standard Model B BBC Microcomputer, in which the available memory will be sufficient for a wide range of uses. To achieve its full potential, and to be able to use maximum screen resolution at all times, an add-on screen memory board can be used. Examples are the ARIES and WATFORD boards.

1.2 Installation

The box in which this manual was packed should also contain the following items:

- The INTER-SHEET ROM software.
- A printed sheet giving ROM fitting instructions.
- A function key strip.

A quick reference card.
An introduction to INTER-SHEET.
A registration card.

First fit the ROM software according to the fitting instructions, or ask a dealer to do this for you. Check that it is properly installed as detailed in the fitting instructions, and place the function key card under the transparent cover above the keys, ensuring that "Delete column" is directly above **19**.

1.3 How to use this manual

The various sections of this manual are arranged in the order in which the first-time user will normally need them. For example, there is little point in discussing how to save a worksheet before you have found out how to create one! The first two sections (1 and 2) give general information, including an introduction to the various types of command that are available, and where to look for more details if you want them at this stage. These two sections will be enough to let you make a start on a simple sheet, and find your way around it. Once you have worked through these sections, you will hardly ever need to refer to them again.

The remaining sections give full details of all available commands. Section 3 deals with the function keys and section 4 with the main menu - both these are really self-documenting, and after you have used these a few times you will only need to refer back to the text for occasional confirmation of details. Sections 5 to 7 give full information about the other available commands, and these will enable you to get maximum benefit from the many facilities provided. Most of the more complex commands need very little effort of memory, because they require only logical, single-key entries, despite their considerable power and flexibility. After using INTER-SHEET a few times you will probably need nothing more than an occasional brief reminder, and the quick reference card is provided for this purpose.

To help you follow the text the following conventions have been used:

RETURN White-on-black type is used to indicate a particular key.

All, Box, Row or Column? The non-proportionally spaced type used here refers to any text appearing on the screen. It is also used for any commands or data which you type in yourself, and for any references to commands in this manual.

All inputs, including all commands, can be in upper or lower case or any mixture of both. The following commands are all valid:

COUNT (A1:A34)
count (a1:a34)
COunt (a1:A34)

However, all commands in this manual are printed in upper case, in the interests of readability and consistency.

2. STARTING A WORKSHEET

First let us define what we mean by a "worksheet", namely, the actual sheet containing all the detailed information relevant to your particular application. For example, if you are keeping your household accounts in this way, your worksheet will contain all the details of your income, the amount of your mortgage, the food bills and so on. Although many people call this a "spreadsheet", we prefer to reserve the latter term for the program which produces and handles the worksheet - this can avoid possible misunderstandings.

To call INTER-SHEET type ***ISHEET (<number>)**
RETURN. Abbreviations for ***ISHEET** are accepted, down to ***IS..** The argument **<number>** is optional, and defaults to 0. The heading **INTER-SHEET 0** (or whatever number you have used) will appear, followed by a menu. Up to 16 such sheets can be in memory at any one time, numbered 0 to 15, though this number may be reduced if data from other ROM-LINK packages are also in memory. In the unlikely event that you run out of memory see the hints under **Error messages** (section 2.9), also the note at the end of section 5.3.

On entering INTER-SHEET the menu will be displayed. It is deliberately similar to the familiar WORDWISE menu. The menu options will not be needed until a start has been made on producing the first worksheet, and they are discussed in detail in Section 4. Also in WORDWISE style, INTER-SHEET has a Menu mode and a Worksheet mode, using **ESCAPE** to toggle between the two modes. Commands for INTER-SHEET itself and normal BBC operating system commands can also be issued from the menu mode, within certain limits which are discussed at the beginning of section 4.

2.1 Keyboard controls

Most of the keyboard is used quite normally to type data and commands. The only keys which have special uses are the

cursor keys **↑ ↓ ← →**, **COPY**, **DELETE** and **TAB**. Their uses will be described in more detail in the relevant sections of the manual, but for the moment it is sufficient to note that the cursor keys normally move the "box cursor", which shows you which box in the display you are working on. The copy key is used to enter the number of the box at the box cursor into the input line, which often helps to speed up inputs. The **TAB** key forces INTER-SHEET to carry out a complete recalculation of all values on the sheet. You may wish to do this if you have changed some formulae or data, and wish to make sure that full account has been taken of your changes. When operating in 'manual calculation mode', indicated by "Man." on the status line, recalculation will ONLY occur when the **TAB** key is pressed. The **COPY** and **DELETE** keys are used for editing, as might be expected. **ESCAPE** toggles between the menu and worksheet modes, just as it changes between menu and edit modes in WORDWISE.

2.2 The worksheet display

Enter the sheet mode by pressing **ESCAPE**. The display will be in Mode 7 (40 characters per line). The top area is used for displaying box contents, anything typed by the user and a status line. The rest of the screen is divided into rectangular "boxes", identified by their coordinates, which are given by letters along the top and by numbers down the left-hand side. On entry, these will run from A to E and 1 to 17 respectively, indicating the boxes from A 1 (top left) to E 17 (bottom right). A box cursor (a prompt sign '>' in this mode) points to the currently selected box, initially A 1, in the top left hand corner. The letters designating the columns are placed at the right-hand side of the appropriate column in each case.

Above the box area, down the left-hand edge of the screen, there are three colons to indicate the start of three lines on which you will be communicating with the computer. In the present display a space between the top colon and the next below it shows that a total of 80 characters can be displayed here, (40 characters per screen line in this mode). When the sheet is in use the top line will always show the contents of the

box indicated by the prompt, currently A1. This is empty at the moment, so nothing shows on the top line. The second line will carry commands to be executed and prompts for further inputs, which will be generated by the computer when you type in simple command abbreviations. The third line is for your inputs, and for additional prompts, generally for arguments following commands. A normal flashing cursor will appear on this line when input is expected from the user. Your input may be a label, number or formula to be placed in a box, a command or a response to a prompt following a command.

The line immediately above the boxes is the status line, which gives information about various aspects of the sheet. At the far left are the coordinates of the current box (the one at the cursor position). These coordinates will be followed by L if the box is locked - we shall see later how to lock and unlock any box. If no L appears, the box is free. On the remainder of the line will be displayed the calculation mode, **Auto** or **Man.** (ie Manual), and the percentage of memory unused, for example **80% Free**. It is possible to make the box cursor step on automatically after each sheet entry has been made, in which case the direction of step-on is also shown. The step-on message is **Step** followed by one of the following words:

Right to indicate automatic step-on one column right after each entry, **Left** to show automatic left step-on, and similarly **Down** and **Up** to refer to automatic row movements. The function key **F12** controls this facility - see section 3.3.

The order in which the status information is displayed changes slightly in the two higher available modes. The actual percentage of free memory also depends on the display mode in use, which is changed by another function key, **F11** - see section 3.2 for more details.

If auto step-on is not in use, the prompt is moved simply by using the cursor keys, moving it either one box at a time, or continuously by using the normal key repeat feature. As in **WORDWISE** you can use the cursor keys with **SHIFT** to move the cursor to the extreme edge of the sheet in any direction, and **CTRL** to move the cursor one screen width (or height) at a time.

The cursor keys continue to operate normally when auto step-on is in use.

2.3 Filling in the sheet

Try moving the box cursor to box **B3** and typing **143.25**. The number will appear on the input line as it is typed, and will be entered into that box when you press **RETURN**. Now move to box **C3** and enter:

21.34 RETURN

Next move to **E3** and type:

B3+C4 RETURN

You should see **164.59** (the sum of the contents of **C3** and **B3** immediately displayed in box **E3**. Note that the formula you used is displayed at the top of the screen whenever you move the cursor to box **E3**, whereas the **result** always appears in the box on the sheet. This is a very simple formula, but almost any degree of complication is permitted, involving many BASIC-type functions, including the use of the resident integer variables, and even some functions not available in BASIC.

Details are given in section 6. It is also possible to copy formulae (and any other other box contents) from one part of the worksheet to another. These features are discussed in more detail under the **COPY** command (section 5.3).

If you attempt to move the cursor beyond the far right-hand box the sheet will scroll to the left, changing the column headings appropriately. Similarly, moving the cursor down beyond the bottom displayed row causes the sheet to scroll upwards - in this way any part of the sheet can be reached. The screen display is thus a "window" which can be moved anywhere over the sheet. Altogether 16,320 boxes are available, arranged in 255 rows and 64 columns, numbered from 1 to 255 and from A to BL respectively.

Each box displays seven characters by default, but any or all columns can be enlarged if necessary (see section 5.12). Before doing so, try inserting a 14-figure number into any box. A row of asterisks will appear in the box as a warning that the number cannot be displayed, but it is not lost! It will still appear at the

top of the screen whenever that box is selected, and any calculations using it will be carried out on the whole number as far as possible. Remember, though, that INTER-SHEET calculates only to 10 significant figures. It does its own arithmetic, so you will get this high accuracy regardless of which version of BASIC is in your machine. The total number range is the same as BASIC's, namely from 2E-39 to 2E38 (2E38 is "2" followed by 38 noughts and 2E-39 is "2" preceded by 38 noughts after the decimal point. Up to 80 characters (ie letters, numbers, signs etc.) are accepted for any box, and these continue over two screen lines in the 40-column mode. Any asterisks will be replaced by the actual number if you subsequently make the column wide enough to display it in full. If you enter a long label (see section 2.4) the right-hand end will be truncated if necessary. Again it can be seen in full on the top line of the display when the box cursor is at that box.

2.4 Entering labels

In most cases a heading at the top of a column or a label on a row will help to make a worksheet more readable and self-explanatory. These can be entered by preceding each one by a quote sign ("). No quote sign is needed after the label - if one is included it will be printed as part of the label. Go back to your original entries and add **PRICE** in box B1, **VAT** in C1 and **TOTAL** in E1. This makes a lot more sense than the bare numbers did!

2.5 Box references and the use of labels

As we saw above, any box can be referenced (in a formula, for example) by quoting its coordinates. These must always be in the right order, with the column number first, followed by the row number. Thus F29 refers to the box at the intersection of column F and row 29. If both are labelled, however, you can specify the box in a more meaningful way. Suppose column F has the label JUNE and row 29 is labelled SALARY, then this box can be referred to as JUNE SALARY in a formula. If a formula referring to a box by labels is copied to another part of

the sheet, the label references remain unchanged. When a formula is copied referring to a box by co-ordinates, those co-ordinates are changed in relation to the new position on the sheet.

2.6 Correcting mistakes

If you find that the wrong number or an incorrect formula has been entered in any box, the simplest method of editing is to move the cursor to the box in question and simply make a fresh entry - this will take the place of the earlier version, regardless of any difference in length or content. Another method of editing using function key **F10** will be found in section 3.1.

2.7 Alternative display modes

There are three possible display modes available in INTER-SHEET. So far we have only used the one which is most economical in terms of the amount of memory it needs, namely 40-column mode. The widespread use of terms such as "40-column" as a substitute for the longer expression "40 characters per line" is rather unfortunate in the worksheet context, and it is necessary to distinguish clearly between display mode columns, (which tell us the maximum number of characters per line), and the number of worksheet columns displayed. The latter depends both on the maximum number of characters per line, and on the column width, which can be altered. Thus the 40-column display uses the computer's Mode 7, which allows 40 characters per line. With the default column width of 7 characters this gives 5 worksheet columns lettered A to E. In the 80-column display we have 80 characters per line, giving 20 rows each of 10 columns, lettered A to J. This display uses the computer's mode 3. In 105-column mode, 105 characters per line are available, displaying 27 rows of 14 columns from A to N. This uses the computer's mode 0, with a specially re-defined character set.

Try selecting the 80-column mode, then the 105-column mode, by pressing **F11**. You will immediately notice the large difference.

in the number of sheet columns displayed. Much more information can be seen at one time in 105-column mode than in 40-column mode, but the former uses considerably more memory.

2.8 Spreadsheet commands

The commands needed to make full use of INTER-SHEET fall into four main groups. Commands which control the formatting and operating conditions are assigned to function keys, and this group is dealt with next, in section 3.

As in WORDWISE there are also Menu commands, which deal with loading, saving and spooling, and the setting of certain options - these are covered in section 4.

The third group of commands carry out tasks such as moving data around the sheet, replication, locking boxes or sets of boxes to preserve their contents, altering column widths and many other "housekeeping" tasks. These are typed in from the keyboard while using the sheet, and details of each such commands and their function are given in Section 5.

Finally there is a set of commands concerned with the transfer of information between different packages in the ROM-LINK system. These will be found in section 7.

2.9 Error messages

There are various errors that may occur during the use of INTER-SHEET. These are listed in section 8, with a brief explanation of the probable cause in each case. Most are fairly obvious. One which might worry you is the dreaded **No room**. However, this is rarely fatal, and is most likely to happen when you try to copy large areas of a worksheet into similar empty ones, especially in the higher modes (see section 5.3). Moving to a lower mode is often all that is required. If there is no room even in 40-column mode, and you have another worksheet in memory which is not being used, then enter it first, save it (in

case you need it later), and then use **:CANCEL** (section 7.3.2) to delete it, thus clearing some space. The same thing could be done with any other spare ROM-LINK packages in memory, but make sure that no information will be required from them by your present sheet. If there is still insufficient room, then your current sheet is using too many boxes. The number can almost always be reduced by cutting out intermediate results that you don't really need. Avoid the great temptation to include masses of data because it is possible, rather than because it is useful! The length of labels can also be reduced to recover memory for more important uses.

3. THE FUNCTION KEYS

As in WORDWISE the function keys are very simple to use, and do not require the use of **SHIFT** or **CTRL** to perform the functions described in the following paragraphs. They can, in addition, be programmed with user-defined strings, by using the normal *KEY command from the menu. Key strings programmed in this way are produced when both **SHIFT** and **CTRL** are held while the function key is pressed. Examples of this are given in the introductory manual.

3.1 **f0** (EDIT BOX AT CURSOR)

Pressing **f0** leaves the box cursor in its current position, and changes the function of the cursor keys so that they no longer move the box cursor, but can be used to copy the contents of the top line into the command line and, ultimately, into the same or a different box. The delete and copy keys work as normal editing keys. The **f0** key has a toggle action, so that pressing it a second time restores the normal cursor function, allowing another box to be selected. If the string is copied to the command line, **f0** pressed a second time and the box cursor moved to select a different box; when the line is entered by pressing **RETURN**, it is entered into this new box. This makes it very easy to transfer identical or variously edited contents from one box to other(s), while minimising the risk of typing mistakes. A different command (**COPY** - section 5.3) is much more convenient for replicating the contents of one box into a number of others.

3.2 **f1** (SCREEN MODE)

By pressing **f1** it is possible to swap between the three available display modes. The differences between the three

displays, and the meaning of "column" in this particular context was explained in section 2.3 The default screen is displayed in Mode 7, 40 characters wide, with 5 worksheet columns visible at any one time. The box cursor in 40-column mode is the prompt sign (>), but in both the higher modes the box cursor takes the form of reversed video within the box, which appears as a white (or foreground colour) rectangle with any contents in black (or background colour).

The higher modes require more memory, but you need not worry about overwriting the worksheet - if the mode asked for requires more than the free memory available, the next lower mode will be selected automatically. Hence this key may appear not to work at all if a lot of memory has been used by the sheet. The problem does not arise if extra external memory is in use, for example extension RAM boards (see section 1.1).

3.3 **f2** (AUTO STEP-ON)

This key changes the way in which the box cursor moves after an entry has been made. By default it is disabled, and the cursor can only be moved by the cursor keys. On pressing **f2** the cursor will automatically move one box to the right after each entry, and a second press will make it move one row down each time. Further presses produce auto step-left, step-up and auto-step cancel in turn. Note that auto step-on does not occur if **RETURN** is pressed without entering anything in the current box.

It is very common to fill a worksheet either one row or one column at a time, and this step-on capability makes it quicker and easier to work in this way.

3.4 **f3** (JUSTIFY BOX)

By default all labels are centre-justified, that is, placed in the middle of their box. This key allows them to be left- or right-justified, or centered in the box, so that the layout can be adjusted to suit individual needs or tastes. If right-justification

or centering are called for but the label is too long, then the label will be left-justified, and any excess characters on the right-hand end will be truncated.

Numbers may be left- or right-justified using this function key, but cannot be centred. The default is right-justified, and an attempt to centre a number will be treated as a right-justify command.

3.5 **f4** (RECALC. AUTO/MANUAL)

When a number is entered into any box the whole sheet is recalculated, using the formulae already entered. The calculation starts from the top left corner and works from left to right along each row in turn. It is most important to remember this order of calculation when setting up formulae. While recalculation is in progress the row being worked on appears in place of the normal box number on the sheet, and the changing number reassures you that no hang-up has occurred. Only on very large sheets will you glimpse more than a passing flicker!

However, if the sheet is large and complicated, frequent recalculation can take a significant total time, and recalculation at every entry may not always be necessary. By default, calculation is automatic (this is a fail-safe feature), but it can be inhibited by pressing **f4**, after which a recalculation will only be carried out if and when **TAB** is pressed. Pressing **f4** a second time restores auto calculation.

3.6 **f5** (DELETE BOX)

Deletes the box at the current cursor position. Any previous contents, whether numbers, labels or formulae, are destroyed, and this function should be used with care. If the box is locked (Section 5.8) a message to that effect is given and the box is not deleted.

3.7 **f6** (INSERT ROW)

This command allows a row of data to be inserted into a partially completed sheet. It is particularly useful if the need for

more information arises during sheet development, or has simply been forgotten. The effect is to move all information below the row containing the box cursor down by one row, leaving the row at the cursor blank. At the same time any formulae affected by the change will be adjusted automatically. The total number of rows on the sheet does not change, and the command cannot be used if any box on the bottom row is already occupied, since data would then be lost. Since there are 255 rows, there should be no difficulty in leaving a number of blank rows at the bottom to allow for possible row insertions.

3.8 **f7** (DELETE ROW)

Has the opposite effect to the previous command. All the boxes on the row at the cursor are deleted (with the loss of all information), and lower rows are all moved up one position, relevant formulae being automatically adjusted. Before using this command check that every box on the cursor row is redundant, and in particular that none contains a formula which, if lost, will cause other data to be invalidated. If the row, or any individual box in the row, has been locked (Section 5.8) an error message will be given and the row will not be deleted.

3.9 **f8** (INSERT COLUMN)

This has an effect exactly similar to that of **f6**, but applies to a column. The column containing the cursor is cleared by moving all columns to the right of the cursor one position right. All affected formulae are altered automatically, and the last column BL must be empty.

3.10 **f9** (DELETE COLUMN)

The action of **f9** is similar to that of **f7** except that it is the column occupied by the cursor that is deleted, and remaining columns to the right of the cursor all move one place to the left. All previous contents of the deleted column are lost, and the corresponding precautions should be taken before pressing the key. A locked column or one containing a locked box (Section 5.8) cannot be deleted.

4. THE MENU

When a new worksheet has been created, you will need saving and printing options, plus load options for use at a later date. These are provided directly from the menu. When in menu mode, access can be obtained to the ROM-LINK commands which enable INTER-SHEET to communicate with any other ROM-LINK packages fitted in your machine. In this way data can be exported from one package and imported by another.

It is also possible to issue the normal operating system commands from Menu mode, prefaced, as usual, by *. Care must be exercised in using this facility, since a number of system commands can be fatal. Examples are disc copying or compacting, attempting to use certain ROM utilities - in fact anything which overwrites any part of memory. Among the commands which are usually safe and useful are:

- *DISC
- *TAPE
- *CAT
- *DRIVE
- *INFO
- *WIPE
- *TV
- *FX commands to set filing and printing options.

Using BASIC is fatal except for some commands in immediate mode, which do not alter memory, such as VDU control commands specifically addressed to the printer, or commands to carry out immediate calculations. Note that some VDU commands are also fatal, even in immediate mode. Creating variables will also usually prove fatal to any spreadsheet data.

The menu options are:

4.1

1) Save entire worksheet

After prompting for a filename the whole worksheet is saved, but in an intelligent manner to avoid wasted storage space. All

essential sheet parameters (column widths, screen mode, cursor position, options in use and so on) are saved, together with the contents of all boxes that actually have data in them, including labels and formulae. The currently selected filing system is used - this can be changed if required (see previous paragraph). When saving to disc, if the filename given already exists, the warning message **Replace old file? (Y/N)** is given. Only pressing **Y** replaces the old file by the current one.

4.2

2) Load new worksheet

The specified worksheet is loaded from the filing system, but only if it was originally saved using Option 1. The sheet parameters will have the same values as they had when it was saved. If there is already a worksheet in use the warning **Are you sure? (Y/N)** will be given, since any boxes currently in use will be cleared. If the computer "bleeps" when the Menu mode is restored after the screen has cleared, a bad file is indicated, that is, a file of which the computer cannot make sense. This would apply to a file created by Option 3. The sheet would remain empty.

4.3

3) Export worksheet

Used to save only the boxes in the area asked for by the prompt. These can later be loaded into another ROM-LINK package - hence the term "Export". The area is specified as usual by the top left and bottom right boxes. If **RETURN** is pressed in response to the prompt, then the default area (as specified in Option 5) will be saved. You are then prompted **Export results or contents? (R/C)**. If you press **R** then the contents of the boxes will be saved as they appear on screen. Long labels will remain truncated, and only the results of formulae, rather than the formulae themselves, will be exported. If you answer **C**, then formulae, numbers and labels, as appropriate, will be exported at full

length. In very general terms the results are likely to be more useful if exporting raw data to INTER-GRAPH (for graph plotting) or to a word-processor for inclusion in a document. The contents, on the other hand, will probably be needed when exporting to another worksheet. A filename is requested, and confirmation is required before overwriting an earlier file of the same name. The sheet parameters will not be saved. For technical details about the special format used by this command, and its use in connection with wordprocessors, see the Appendix (section 9).

4.4

4) Import to cursor

This option can only be used with worksheets which were saved using option 3, or with data saved in the correct format from other ROM-LINK packages – hence the term "Import". It cannot be used for worksheets saved with option 1. The saved boxes (or data items) are loaded into the current sheet, starting with the cursor box and covering the appropriate area to the right and downwards from the cursor box. The effect resembles an overlay, in that a new box which contains data will overwrite the original whether it contained data or not, while original data will remain if the corresponding new box is empty. The resulting sheet will contain all the new information, plus any earlier information that has not been overwritten by new. Any formulae loaded into the area will be adjusted automatically to take account of their changed physical locations. Used in conjunction with Option 3 this allows a section of a sheet to be copied from one area to another on the same, or a different, worksheet. In the former case the COPY command (section 5.3) may be more convenient. For more technical information, and examples showing how a word-processor can be used to produce data sets in the correct format, see the Appendix (section 9).

4.5

5) Set worksheet options

On selection this option will produce the following list, with the first item highlighted in white:

Option	Current value
Default sheet area.....	
Pound sign.....	35
Foreground colour.....	7
Background colour.....	0
Number format (E/F/G).....	F
Number of digits.....	2
Justification.....	C
Print borders (Y/N).....	Y

Press ESCAPE when finished

The settings shown are the defaults which will apply to various aspects of the worksheet. Options such as number format will affect a box as it is created, but only after it has been created can the 'slash' commands be used to change the format of the box. Normally they can be over-ridden at the point of use, as described under the relevant commands, but it may be convenient in many cases to change the default values. To do so, use **F1** and **F2** to highlight the option to be altered, and type in the required values. When you are satisfied with all the values **ESCAPE** will return you to menu mode.

Some explanation is needed for the first two of these options. The default sheet area has been left blank. What this means in practice is that if you press **RETURN** when using Menu Options 6 or 8 (or commands which require the area to be specified), then the area used will simply be that defined by the outer limits of the boxes you have used (i.e. all of the boxes used). To use a different area, type the limits as usual (e.g. A1:L20). To revert to the blank condition, replace the default area with spaces.

Printers differ widely in the codes needed to produce a pound sign, and it is sometimes necessary to send a series of ESC codes to do this. Here the pound sign defaults to ASCII character 35, which is one of the more popular codes. If this does not work in your case, the correct sequence should be given in your printer manual. A sequence must be entered as decimal numbers separated by commas. In most cases, only a single decimal number will be required.

4.6

6) Print worksheet

Asks for the area to be printed, as defined by the top left and bottom right boxes. If **RETURN** is pressed, the default area defined in Option 5 is used. The worksheet can be printed with or without the alphanumeric borders, as defined in Option 5. The text width provided by the printer will usually determine the size of the area to be printed, but a large worksheet can be printed in suitable sections. Using the /P command allows output of codes to set the printer into condensed mode, etc. If your printer is capable of condensed print, this will allow a larger area to be printed.

4.7

7) Print formulae

A printout will be produced of all the boxes containing formulae, given in row order A1, A6, B2, C6, C9.... This is the same order as is used for calculation.

4.8

8) Spool worksheet

This option spools the worksheet in ASCII (without special control codes) as in Option 6 (section 4.6), except that spooling is to a named file rather than to a printer. It asks for the area to be spooled, and for a filename; a **Replace old file?** (Y/N) warning is given if the file already exists. Only the results are spooled as they appear on screen. The borders may or may not be included, as set by Option 5. No **TAB** separators are included, as they are in Option 4.3, only spaces.

This Option enables the worksheet to be loaded into word-processors including any of the WORDWISE versions, and VIEW. It is particularly useful with certain word-processors in which the **TAB** character (used in Option 4.3) might cause problems. Transmission of worksheets by electronic mail is another likely application.

5. WORKSHEET COMMANDS

5.1 General

As indicated in section 2.5 a number of commands can be entered directly in worksheet mode. To distinguish these from labels they must be preceded by a / character. It is only necessary to enter an easily remembered "key" letter for each command, the full command wording being supplied automatically by the computer on the second line at the upper left of the screen. All these commands also require arguments, but you will be prompted for them on line 3 of the screen, so they do not have to be memorised or looked up each time. Once again you need only type the first letter of the argument. In nearly all cases just these two keystrokes will be all that is required, and no **RETURN** is necessary. In one or two commands a second prompt (on line 3) will ask for a number, and after you have given this you must press **RETURN**. When you are familiar with the commands you need not wait to read the prompts from the screen – just type in the letters required. The implementation of these commands makes them exceptionally easy to use.

IMPORTANT NOTES

1. All these commands act at, or starting from, the current cursor position. If a row is involved, it will be the row which includes the box occupied by the cursor, and similarly for a column. It is essential to check that the cursor is correctly positioned before issuing such commands.
2. As in most spreadsheets all these commands affect only those boxes which actually contain something when the command is

issued. This has some important implications. For example, when all boxes are locked (or a row or column is locked), all empty boxes in these areas remain unlocked, and entries can subsequently be made in, changed or deleted from these boxes individually. On the other hand there is a safety net in that no locked boxes can be modified or deleted in any way without first unlocking them.

Note also that all boxes which were empty when any formatting command was issued will retain their default values. Thus, for example, if the whole sheet is set to left justification, with fixed format and 3 places of decimals, these conditions will only apply to the boxes which were occupied at the time the commands were issued. Any subsequent entries will be subject to the default conditions.

If most of the worksheet is to be in a common format other than the standard default, then the obvious course is to change the defaults (Menu option 5). It is also a simple matter to replicate zeroes into a particular set of boxes, which can then be formatted as required for future use, leaving the remaining empty boxes with default status.

Details of the commands are given in the following sections. Each command is called by a single letter, which also acts as a mnemonic. This is given first, followed by the command itself. The parts of the sheet to which the command can be applied follow on the next line. Examples give details of what actually appears on screen.

5.2 /B Blank

Can apply to: All, Box, Row or Column.

This command will remove the contents of a single box, a row or column of boxes, or every box on the sheet. The latter case is very drastic, and you will be asked **Are you sure? (Y/N)**. Pressing **Y** deletes all boxes – any other response will abort the command. Note that the emptied box, row or column remains on the sheet – it is simply cleared of its contents. All defaults remain unaltered, unlike the ZAP command (section 5.13). This command differs from the apparently similar function key equivalents, in that it empties the selected boxes of their contents (except for any that are locked), but does not move the contents of adjacent rows or columns to fill up the resulting gaps, as the DELETE commands do. If an area is to be blanked, e.g. A1 : C3, then this may be achieved using the COPY command by copying an empty box into the area.

Bear in mind that any formulae in the affected boxes will also be deleted, and you must make sure that any necessary adjustments are made to take account of this, otherwise you may find errors occurring that are difficult to trace.

Examples:

/BB Empties the box at the cursor.

/BC Empties the column at the cursor position.

5.3 /C Copy

Can apply to: Box to box, box to area, or area to area.

This is the most powerful command, and probably the most used when creating a sheet. Basically the copying procedure will always copy from a source to a destination. There are two main types of copying allowed. Firstly, the contents of a single box may be copied into an area, this area can be a row or a column. In this case the source is a single box and the destination is an area. Secondly, an area may be copied into an area. This allows a whole section of the sheet to be moved from one place to another and also allows several copies of a row or column to be made.

In all cases the computer will prompt for the next bit of information, but because the prompts depend on what the previous question was, the details of these are not given here.

After typing /C the computer will ask whether you want to copy from one box or from an area.

If copying from one box, then after having entered the source box, it will ask for the destination area. As usual this destination area can be either a row or column, the user simply types the top-left and the bottom right co-ordinates of the destination area.

If copying from an area, then after having entered this source area, the computer will ask for the destination area. Note that usually it is not necessary to specify the destination area as an area, you can type in just the co-ordinate of the top-left corner of the destination area, the computer will then fill from this corner.

There are a few special cases that allow the copying of a row into a number of rows, or a column into a number of columns. In both cases the source is given as the area, i.e. the start and end box of the row or column. The destination is also an area but should always be a row or column.

A few examples should make it clear what can be done with this command.

1) If you wish to copy the contents of a single box A1 into part of row 10, say, from B10 to Z10, then the source is the box A1 and the destination area will be given as B10:Z10.

2) To copy a whole section from one place to another would involve the copying of a source area to a destination area. So, for example, to copy the area A1:F10 down the worksheet so that it starts at position A100, would require the source area to be specified in full A1:F10. The destination area need only be specified by the top-left corner, in this case A100.

3) To copy one row into a number of rows. In this case both the source and destination areas have to be given in full. To copy part of the top row, say A1:Z1, into a number of rows down the sheet, would require the source area to be specified as A1:Z1. The destination area in this case would be a column, the whole source row being copied into each row of the destination column. If you wished to copy the above row (A1:Z1) into the rows 95 to 100 directly below, then the destination is given as A95:A100.

Experiment with this command; it is well worth while being totally familiar with it as its operation is so important when creating worksheets.

Remember that all copying that involves the movement of formulae will change all box references in the formulae relative to its new position. So if you are summing part of column A and you copy the formula to a new position, it will now sum the new column rather than column A again. If you do not want box references to be automatically changed like this (normally you would) then use the BOX function.

Another important point, is that copying an empty box into a new position will delete the contents of the box at the new position. This is actually useful if you want to delete an area - simply copy an empty box into the area.

5.4 /D Set number of digits

Can apply to: All, Box, Row or Column.

The effect of this command depends upon the format being used to display numbers on the sheet. The first prompt asks you for the area to which the command should apply. Next you will be asked for a number of digits, which can be any number from 0 to 9 inclusive – let us call this number *n*. The way in which *n* is used will depend on the number format you are using (see the next section and the User Guide, page 326), as follows:

Fixed format.....*n* specifies the number of places following the decimal point.

General format.....*n* specifies the number of significant figures shown.

Exponential format..*n* specifies the number of figures displayed before the exponent *E*, but not counting the figures following the exponent (there can be up to two, preceded by a minus sign for quantities less than zero).

Note that numbers will be rounded up or down as appropriate if they contain more than the specified number of digits. Since the majority of worksheets are concerned with financial matters, the default is Fixed format, with two digits after the decimal point. (See also Menu Option 5, section 4.5).

Example:

The number 23.4568 would be printed as follows when *n* = 3:

Fixed format – 23.457

General format – 23.5

Exponential format – 2.35E1

5.5 /F Change number format

Can apply to: All, Box, Row or Column.

Numbers can be printed in one of three formats, namely Exponential (or "scientific notation"), General or Fixed. The latter is commonly used on worksheets, being in decimal form with a specified number of figures following the decimal point. When used in a list, the decimal points are vertically aligned.

For a fuller explanation of number formats see the User Guide, page 326. Note particularly that General Format may be displayed either in decimal or in exponential notation, depending on the sign and magnitude of the number, and will print whole numbers with no decimal point.

With this command the format for any box, row, column, or the whole sheet can be changed at will. The default is Fixed Format, but this default can be changed if necessary, using Menu Option 5. Changing a format does not in itself affect the number of digits displayed – these must be altered independently, if required, using /D (section 5.4).

Should you require numbers displayed as integers, simply use Fixed Format and /D0, i.e. no digits after the decimal point. The decimal point will not be printed.

Only boxes which currently contain a value will be affected by this command, boxes filled at a later date will follow the defaults set at that time.

Example:

Suppose 1572.077 is to be placed in a box. Two possible display forms are:

Using standard defaults – 1572.08

After /FBE: 1.57E3

5.6 /G Go to Box

Can apply to: box

When using a large sheet, it is often necessary to move quickly from one place to another. This command will prompt for a box reference and move the sheet display directly to the chosen box.

Example:

/G Z99

Will move the cursor directly to box Z99.

5.7 /H Hold at cursor

Can apply to: Row or Column

This is equivalent to the "windowing" command found in other spreadsheets, but is much more flexible. It is extremely useful when you want to "fix" labels along the top or edge of the screen, or you are working on a part of the sheet, and wish to keep track of the outcome in another area which is not on screen. Using this command you can do both at the same time. For example, you may be putting cost data into the top left corner of the sheet, while the results in terms of total costs may be in row 50. Using /H, row 50 can be displayed in place of (say) row 17 (the actual number will probably depend on the mode in use, because /H is mostly used around the screen edges). If you scroll the screen, row 50 will remain in the same position on the screen while other rows scroll under it. The same facility can be applied to a column, and indeed to any number of both rows and columns, though there are obvious practical limitations in holding more than a few at a time. In this case, assuming there are labels in column A and in row 1, you can arrange to hold row 1 in row 1, and column A in column A.

The command /H, will prompt Row or Column at present position?. Entering R will prompt Enter which row?. The number given by you will be the row which is to be displayed at the current cursor position.

Example:

/HC AB **RETURN** will hold column AB at the present cursor position.

5.8 /J Change justification

Can apply to: All, Box, Row or Column.

Controls the justification of labels and numbers within boxes. It is similar to the function key **F3**, but the latter acts only on the current box (for which purpose it is quicker in use). This command is used to change the justification of a complete row or column (or the whole sheet). The prompts are All, Box, Row or Column?, and Enter justification (L/R/C). If C is entered, labels will be centred, but numbers will be right-justified. Both labels and numbers can be left-justified. By default numbers are right-justified and labels are centred.

Example:

/JAL left-justifies every entry on the sheet.

5.9 /L Lock

Can apply to: All, Box, Row or Column.

It makes sense to protect any boxes which contain vital information against accidental deletion or over-writing, particularly when the data in question may prove tedious, if not impossible, to recover. This command allows any boxes to be locked. While locked the contents of boxes cannot be deleted or overwritten until they are unlocked again, using the /U command (section 5.12). It is the actual content of the box that is locked, so, if the box contains a formula, the number displayed in it may vary, but the formula from which it was calculated cannot. The format is also locked, and this can be useful should you want one format (say integers, left justified) to be protected in specified boxes while other formats are changed.

When the current box is locked, a letter "L" appears after the box number displayed at the far left of the status line. For instance, "A1 L" indicates that the current box, A1, is locked.

5.10 /N Change negative sign

Can apply to: All, Box, Row or Column.

Most people use the ordinary minus sign to indicate a negative number, but some prefer to enclose negative numbers in brackets without a minus sign. This option lets you choose which system to use. As usual it can be applied to one box, a row, a column or the complete sheet. It may be worth noting that brackets take up one more character space than a minus sign.

5.11 /P Print

This command is used to send a string of characters, including control codes, direct to the printer. Strings of characters to be output should be specified within quote marks "". Control codes may also be specified by decimal value. Mixtures of control codes and literal strings may be used, in which case each is separated from the next by a comma. A carriage return is issued at the end of the specified string or sequence, unless the line ends with a semi-colon ';' character (as might be used when sending just codes).

Examples:

/P 14, "HEADING" RETURN

Would send the ASCII code 14 to the printer, followed by the word 'heading' and a carriage return. On an Epson printer, the code decimal 14 will invoke enlarged print for that line.

/P 15;

This would send just the ASCII code decimal 15 to the printer, and no carriage return. On an Epson printer, code 15 will select condensed printing until cancelled by code 18. Condensed print will allow a much larger sheet to be sent to the printer.

5.12 /R Release

Can apply to: Row or Column.

This has the opposite effect to /H (section 5.6). When it is no longer necessary to hold a particular row or column within the working window, this command releases it to its normal position on the sheet.

5.13 /U Unlock

Can apply to: All, Box, Row or Column.

The opposite of /L (section 5.8). Any previously protected box can be freed by this command, after which it can be deleted or overwritten. The two commands need not refer to exactly the same areas of the sheet - for example, if Row 26 has been locked, box F26 can be unlocked without unlocking any other box in that row. This command should be used with care, bearing in mind, for example, that if a column is unlocked then every box in that column can potentially be over-written - including the vital one you have forgotten because it is temporarily out of sight!

5.14 /W Set column width

Can apply to: All or current column.

The default column width of 7 characters will be sufficient for many uses, but you may sometimes wish to display longer numbers. Labels, in particular, often need more than 7 letters to avoid ugly abbreviations. Extra width up to a total of 31 characters can be obtained in one or more columns, using this command. Wide columns will reduce the extent of the worksheet which is visible through the screen "window". For this reason it may be preferable to expand one column and place longer titles one below the other in it, rather than placing them side by side as column headings. The minimum column width is 3 characters. No extra memory is needed for wider columns - only for any long words you may put in them!

5.15 /Z Zap sheet

Applies to entire contents.

The results of this command are so drastic that you will be asked for confirmation:

Are you sure? (Y/N)

If you reply **Y** everything on the entire sheet will be deleted, and every default will be reset. There is no way in which data can be recovered subsequently. Any other response to the confirmation request will abort the command.

6. FORMULAE

6.1 General

How to use them

An important feature of any worksheet is the ability to place in any box the result of a calculation carried out on one or more other boxes. At the simplest level we might put total income into box **A1**, and total expenditure in box **B2**. If the formula **A1-B2** is now entered in box **C3**, the latter will always contain the amount we have surplus (a negative number if we are in debt!).

As explained earlier, we can use any formula, however complicated, provided that it employs the mathematical functions provided by INTER-SHEET, and that it can be expressed in a total of not more than 80 characters. Even the latter qualification could be evaded by doing the calculation in two parts and storing the intermediate answer in another box, but it is highly unlikely that this would ever be necessary!

Of the functions provided, 16 are exactly similar to their BASIC namesakes, and are used in the same way, while the remainder are described below.

Which functions can you use?

The most obviously allowable BASIC-type functions are those provided for use in ordinary arithmetic - add, subtract, multiply, divide, and raise to a power. You can also use any of the following commands:

ABS (absolute value)
ACS (arc-cosine)
ASN (arc-sine)
ATN (arc-tangent)
COS (cosine)
DEG (converts radians to degrees)
EXP (e raised to a power)

INT (integer)
LN (natural logarithm)
LOG (logarithm to base 10)
PI (value of pi)
RAD (converts degrees to radians)
SIN (sine)
SQR (square root)
TAN (tangent)

No other BASIC commands are accepted – for example, you may not use string commands to manipulate labels.

Order of calculation

There are two aspects to this. As far as the formulae themselves are concerned the normal BASIC operator precedence applies, and the free use of brackets is recommended where there is any possibility of ambiguity. Within the worksheet it must be remembered that calculation always proceeds from left to right and from top to bottom, so care must be taken over forward references. If you enter any formula that contains one, the warning message **Forward Reference** will be given on the second line down, together with the box number. This will be the current box number if it contains the only forward reference. If more than one box contains a forward reference, the message will quote the last such box (in order of calculation), thus warning you of multiple forward references. This is not an error message, and it will not stop you from using the forward reference. To see why a warning may be useful, try the following:

Set **AUTO/MANUAL CALC.** to **auto**
Enter **20** into box **C2**.
Enter **10** into box **D1**.
Enter **40** into box **A6**.
Set the cursor to **B5**.
Enter **A6+E9**. **RETURN**

The warning **Forward reference at box B5** should now appear.
Move the cursor to **E9**.
Enter **C2-D1** **RETURN**

Check that all the entries are as you would expect, with **50** in box **B5**, and **10** in box **E9**.

Set the cursor to box **C2**.
Change its contents to **60** by entering the new value.

The sheet is automatically recalculated after your last entry. **B5** will be recalculated first, and will not change, because neither **A6** nor **E9** have altered. But the contents of **E9** will be changed to **50** (by the second formula) when it is reached, leaving an incorrect value in **B5**. This may not be what you wanted! If you press **TAB** to force a recalculation, the relationships will again be correct.

The conclusion is that forward references may be valid and useful as long as you check carefully that they will always do what you expect, perhaps after a forced recalculation, which the warning message can remind you to do.

It is also possible to set up "loops" by forward and backward references involving a common box. Loops of this kind can be spotted by forcibly recalculating the sheet several times in succession. If one or more numbers change at each recalculation then there is a loop, which should be traceable from the formulae in the boxes concerned.

6.2 Additional mathematical functions

A number of functions are provided that are particularly useful in the context of worksheets, but are not available in BASIC. These are extremely versatile and powerful commands. Each takes as an argument a list of items to which the command applies, and any or all of the following can be included in the list:

An ordinary number
The content of a single box (give the box reference)
All or part of a row or column (give the start and end box references)

An expression, which can include the normal mathematical functions, numbers, box numbers or box ranges

The whole list is enclosed by brackets, and individual parts of the list are separated by commas. Where a range of boxes is used, the start and end boxes must be specified separated by a colon.

NOTE: No prompts are issued for the lists.

6.2.1 SUM <(list)>

This finds the sum of the numbers held in the boxes defined by the (list) parameter. If any of the boxes contains a label it will be ignored, but empty boxes will return zero as their content.

Examples:

SUM(A6:A90) Finds the sum of the contents of boxes A6 to A90 inclusive.

SUM(A6:A90,B10:B50) Finds the sum total of the ranges A6 to A90 and B10 to B50.

SUM(R5:R10,A49,56,27*B6,C3*C6/100) Finds the sum total of:

The contents of boxes R5 to R10,

The contents of box A49,

The number 56,

The number 27 multiplied by the contents of box B6 and

The contents of box C3 multiplied by the contents of box C6 divided by 100.

6.2.2 MAX <(list)>

Finds the maximum value contained in the specified list without regard to which particular box it is in. Labels and empty boxes are treated as in SUM.

Example:

MAX(D7:D23) Finds the maximum number stored in the boxes D7 to D23 inclusive.

6.2.3 MIN <(list)>

Similar to the previous command, but returns the minimum value in the specified list. If one of the boxes in the specified range is empty, zero is returned.

6.2.4 COUNT <(list)>

Returns the number of boxes in the list that actually contain numbers. Any box in the list that contains a label is ignored. A box containing the actual number zero will be counted, since it has a content. This command avoids the tedium (and possible error) involved in obtaining the number of "active" boxes for use in a particular calculation.

6.2.5 AVERAGE <(list)>

Finds the average value of the numbers in the boxes listed. It is exactly equivalent to $\text{SUM} \langle (list) \rangle / \text{COUNT} \langle (list) \rangle$, hence empty boxes will not be included in the average. If a box contains a zero then it will be included in both SUM and COUNT, so that AVERAGE will still give the correct result. If a box is empty, it is not included in the number of values. The possibility of averaging over several lists is likely to be especially useful in statistical applications.

Example:

AVERAGE(A1:A10,B2:B20,D6:D12)

will find the average for the combined contents of the three ranges A1 to A10, B2 to B20 and D6 to D1.

6.2.6 LOOKUP <number, 1st.list, 2nd.list>

This is a common spreadsheet command. It looks through the first list until it finds the given number, then it looks at the corresponding box in the second list and returns the value it finds there. If the original number appears more than once in the first list, the first occurrence will be taken, but if the number is not found at all in the first list then an error is generated.

6.2.7 IF <condition, 1st.result, 2nd.result>

This command allows a form of branching, in which the contents to be allocated to a particular box depend upon a specified condition. If the condition is true, then the first result applies, otherwise the second result is obtained. Any of the usual combinations of symbols for "equals", "less than" and "greater than" may be used in the condition.

Example:

Suppose you are selling a commodity, and you wish to impose a surcharge on quantity purchases of less than 10. The unit price is in C6, the number ordered by the purchaser will be entered in C8, and the total charge is to appear in C10. The surcharge is fixed at two pounds. Place the cursor at C10 and type:

```
IF(C8>10,C6*C8,C6*C8+2)
```

When the number ordered is inserted in box C8, the appropriate price will appear in C10.

The normal logical operators AND, OR, EOR and NOT may also be used. When necessary IF commands may be nested just as in BASIC. Note that logical operators may not be applied to numbers, only to sub-conditions.

Examples:

IF(7 OR 8 > 6, C1, B2) will produce the error message Comparison expected, but:

IF(8>7 AND 9>8, C1, B2) will put the contents of C1 into the current box, since both the sub-comparisons are true.

A further use for the IF command is to trap possible mathematical errors. For example, consider a box G8 of which the contents could become zero in some circumstances. If the contents of this box are used as a divisor, the error Division by zero will occur. This can be tested by the formula:

```
IF(G8=0,D5,D5/G8)
```

inserted in D9 (say). If G8 is zero, the contents of D9 will be D5, but if G8 is not zero they will be D5/G8. Other mathematical errors can be trapped by equivalent means.

6.2.8 BOX <Box number>

This references the contents of the specified box, regardless of whether or not they have been altered by some intermediate command. For example, suppose box A10 contains the formula SUM(A1:A9), i.e. the sum of the boxes A1 to A9 inclusive is stored in A10. If a column is subsequently inserted at this position, the formula will be moved and adjusted accordingly to SUM(B1:B9). This command accesses A10, regardless of any such previous changes. Other changes which do not affect this command are deletion of rows or columns or replication.

6.2.9 IMP <ROM-LINK command string>

The argument specifies an item of data, held in another ROM-LINK package, which is needed for the current worksheet. The string contained in the argument is offered around any other ROM-LINK packages present in memory. If recognised, the required data item will be returned. Since more than one worksheet can be in memory at any one time, and each is a recognised ROM-LINK package, it is possible for the current worksheet to import values from another in memory. Thus, if you are working on INTER-SHEET 6, with the cursor at box D5, the instruction:

5+IMP(IS.4:GETBOX A1)

would get the value held in box A1 on INTER-SHEET 4, add 5 to it and put the result into box D5 on INTER-SHEET 6. This command returns a single value from another source. It is not used to exchange data in general, and the ways of doing this are considered in section 7.

6.2.10 TRUNC <(expr)>

This is similar to the INT function, except that it truncates numbers toward zero, whereas INT will truncate toward the smaller value always. Its effect on positive numbers is therefore the same, but on negative numbers, truncation occurs in the opposite direction, for instance:

INT(-3.5)

gives -4, whereas :

TRUNC(-3.5)

gives -3.

6.2.11 ROUND <(expr)>

This function will round the expression to the nearest integer. In the case of the expression evaluating to, e.g. 3.5, where 3 and 4 are equally near, it will return the value of the closest even integer.

7. ROM-LINK COMMANDS

7.1 General

Some form of command protocol is necessary in order to allow the various ROM-LINK packages to communicate with one another. Commands relevant to a particular package will be described in the appropriate user manual, and we consider here those applicable to INTER-SHEET. All commands of this kind are issued in menu mode, and must be preceded by a colon. Such a command is offered around other ROM-LINK packages present in the computer, and are answered if recognised, otherwise an error message results. The information is EXPORTED from the package in which it was generated, and IMPORTED by the package requiring it (that which issued the command). It can be seen that the term EXPORT as used below refers to the information that INTER-SHEET can offer, or export, to other packages, though they will actually be issued as IMPORT commands from the package requiring the data. If this seems a little confusing, remember that INTER-SHEET cannot forcibly export data to another package, since only one ROM-LINK package can be active at any one time. Instead, data from all packages is held in memory, and imported only by the current package as required.

Up to 16 ROM-LINK compatible information sets may be in memory at any one time, and any of these could have been generated by any package. It would be possible, for example, to have 16 different worksheets, or 4 worksheets, 3 sets of graphics data and 9 wordprocessor files, and so on, all in memory at once. One great advantage for INTER-SHEET itself is that one INTER-SHEET can request information from another (see section 6.2.9), as well as from any other ROM-LINK compatible package. This confers enormous flexibility.

These commands, listed below, will normally be directed at a particular ROM-LINK program in memory. For this purpose the command is simply preceded with the name and number of the ROM-LINK program being addressed. For example:

:IS.4:GETBOXES A1:D12

asks for the boxes in **INTER-SHEET 4**, covering the area **A1** (top left) to **D12** (bottom right)

7.2 IMPORT COMMANDS (issued by this and other packages)

7.2.1 :GETBOX (<box>)

Obtains the current value for the contents of the specified box. This may be a number or a label. The extent of the contents will be only that visible on the screen. If the box is empty, zero will be returned. If no box number is given, the box at the cursor will be used.

7.2.2 :GETBOXES <box 1> <box 2>

Obtains the contents of the set of boxes within the area defined by **Box 1** (top left) and **Box 2** (bottom right). If both boxes have the same number, this command becomes exactly equivalent to **:GETBOX**. The contents are exported in standard ASCII format, row by row from left to right, using **TAB** as a box separator and **RETURN** as a row separator. The command would be used to transfer areas from one worksheet to another. The area can equally well be all or part of a row or a column. Only the box contents as seen on screen are returned (including asterisks where numbers over-run their boxes).

7.2.3 :GETCONTENTS <box 1> <box 2>

Returns the contents of the specified area in a similar manner to **:GETBOXES**, but with the vital difference that this command returns the whole of the contents, including any parts of numbers or labels not visible on screen, and returns any formulae behind the appropriate boxes rather than the number shown in these boxes. This command would also be used to transfer data from one worksheet to another, but in full and including formulae, whereas **:GETBOXES** will transfer only current and visible box contents.

7.2.4 :GETSHEET <box 1> <box 2>

Obtains the complete sheet, or part of the sheet, as defined by the coordinates of the top left and bottom right boxes, in a similar manner to **:GETBOXES**, except that boxes in a row are not separated by the **TAB** character. This allows the worksheet to be exported to **INTER-WORD**, where it will appear exactly as it did in its original form. It can then be edited if necessary and printed on its own or, more probably, as part of another document.

7.2.5 :TYPE <expression>

The argument expected is a mathematical one, using the functions allowed in **INTER-SHEET** (section 6.). The expression will be evaluated, and the result returned to the ROM-LINK package that called for it. The main use for this function is to extend the use of the **INTER-SHEET** mathematics capabilities to other **INTER-ROM** packages. For example, you could type from **INTER-WORD** (in menu mode):

:TYPE PI*SIN(82)+LOG(23.5)/16

and the result (1.06972898) will be returned to **INTER-WORD** and inserted in the text.

7.3 IMMEDIATE COMMANDS

7.3.1 General

Whereas the ROM-LINK commands in section 7.2 are concerned with transferring information from one package to another, individual ROM-LINK packages can issue commands in menu mode, the result appearing immediately on the screen. These commands do not import or export information via memory. INTER-SHEET has two such commands, described below.

7.3.2 :CANCEL Completely removes the current ROM-LINK package from memory. It differs from ZAP (section 5.13) in that the latter clears the worksheet completely, but leaves the empty "frame" in memory ready for re-use if necessary. This carries a small, but significant memory overhead. :CANCEL, on the other hand, removes the current sheet totally, allowing more space to be recovered for other packages. It cannot be applied to any package other than the one you are using, and therefore must be used with great care. You will be asked for confirmation.

After issuing the command an asterisk will appear on the screen at the start of the line. This is to remind you that you are no longer in a ROM, and you should type in the name of the ROM you wish to enter next, for example INTER-SHEET 5 (IS.5), or BASIC, etc.

7.3.3 :PRINT <expression>

Evaluates the mathematical expression given as argument just as :TYPE does, but the result is displayed in immediate mode on the screen. It is a handy way of doing one-off "back-of-an-envelope" calculations without the risk involved in switching into BASIC, or the bother of finding a pocket calculator with the functions you need. The result appears on screen for your own use, but is not directly available to the worksheet.

8. ERROR MESSAGES

The system of prompts used by INTER-SHEET will reduce error messages to a minimum, since nearly all prompts carry out a validation check on the reply, ignoring incorrect keypresses. Inevitably some errors are not trappable, and these are listed below. Filing system errors are not included.

Accuracy lost

A trigonometric function was applied to a very large angle, and accuracy has probably been lost in the process.

Bad Box

The box specification is not recognised, for example A! has been typed instead of A1.

Bad Box range

The box range specified is outside the range expected. This error also occurs if an area, row or column is specified in the wrong box order, such as SUM(C5:C1).

Bad origin

An attempt has been made to import data which starts with an illegal box definition.

Bad Reference

An incorrect reference has been entered in response to a request for an area, row, column or box.

Box empty

A formatting operation (such as Justify) has been attempted on an empty box.

Box off sheet

One or more boxes of a sheet imported by Menu Option 4 or one of the commands in section 7.2 has fallen outside the current sheet limits.

Box too long

An imported box contains more than 80 characters. This error can occur if over-long data is read from a word-processor (a **TAB** separator may be missing), or if garbage is loaded from an incorrect file.

Can't insert

An attempt has been made to insert a row (or column) when the bottom row (or extreme right-hand column) is occupied.

Comparison expected

The IF function contains an illegal sub-comparison, such as **IF(6>5,.....)**

Division by zero

The denominator in a division is zero. Note that it may have reached this value as the result of previous calculations.

Exp. range

The EXP function has been applied to a power greater than 88.

Forward reference

Warns that a formula includes a box which will not be recalculated until after the current one (see section 6.1). Not necessarily an error, and the formula will be accepted.

Locked box

An attempt was made to change the contents of a locked box, or to delete an area containing it.

Log range

An attempt was made to find the logarithm of a negative number.

Missing (

An opening bracket has been omitted.

Missing)

A closing bracket has been omitted.

Missing :

A colon separator has been left out.

-ve root

An attempt has been made to find the square root of a negative number.

No room

All available memory has been filled. This error is most likely to occur during replication, when there is insufficient memory to cope with the duplicated material. The user must repeat the operation in a lower column mode, since it will only have been partially completed. The error may also occur if very large worksheets, or a sufficient number of smaller ones are attempted.

No such label

An entry has been made, which is not recognised as a valid expression, box, number, etc. but which is not the name of a label either.

Syntax error

An expression or argument has been given in a form not understood by the computer.

Too big

A number has been used which is outside the computer's range, e.g. 1E55.

9. APPENDIX

IMPORTING AND EXPORTING DATA BETWEEN INTER-SHEET AND WORD PROCESSORS

9.1 General

This Appendix gives more technical details concerning the operation of Menu Options 3 and 4, and shows how files can be created in a wordprocessor for importation into a worksheet. It is also possible to carry out direct transfers between ROM-LINK packages using "colon" commands from Menu Mode - these are listed in section 7.

9.2 Export file format and contents

When option 3 (section 4.3) is used to save a worksheet, an ASCII file is produced. The actual data to be saved is decided by the user, who specifies whether the file is to contain the worksheet **RESULTS**, or the **CONTENTS**. The results are simply the numbers and labels, exactly as displayed on the screen, and any formulae used in the sheet will not be saved. The contents, on the other hand, include all formulae, labels and numbers (not derived from formulae) in their entirety, regardless of length, up to the 80 characters permitted for any entry. The contents can be regarded as the whole dynamics of the sheet - after transference elsewhere the sheet is still a potential working entity. If put into another worksheet, the formulae will be automatically adjusted to the new environment, and calculations can start again. The results show the worksheet "frozen" in time, giving a set of static data.

In either case the ASCII file is made up as follows. First comes the character **@**, to mark the initial box number in the set, followed without a space by the box number itself. Next come

the contents (or results) of the first row, with a **TAB** character between each box. A **RETURN** is sent at the end of the row, followed by the next row, and so on. The extent of the saved area has been previously determined by the user, or by a default value (see sections 4.3 & 4.5). The complete named file is stored, normally on disc – a cassette file can be used, but the time taken would rule it out for most serious applications. This file can be loaded into other ROM-LINK products and word processors such as WORDWISE and VIEW.

9.3 Creating ROM-LINK files in word-processors

If you wish to generate a file in WORDWISE or VIEW (for example), it must be in the format described above. The first entry must be the @ character, followed by the co-ordinates of the box in the worksheet which you want to be at the top left-hand corner of the data you are assembling. This is followed by **RETURN**. Next comes the first row of data items, each separated by **TAB**, and with **RETURN** at the end of the row. The remaining rows follow, until all the data is in place.

The data can consist of numbers, labels or formulae, just as on the worksheet.

Example 1:

```
@B10 RETURN
1 TAB 2 TAB 3 TAB 4 RETURN
5 TAB 6 TAB CASH TAB C10 RETURN
```

Box B10 has been specified as the top left one, which therefore contains 1. Hence C10 is the box containing 2. Our box E11 contains C10, which is therefore 2.

If this example is saved from the wordprocessor, retaining the correct format, and then loaded into INTER-SHEET by means of Option 4, it will be loaded so that the box containing the sheet cursor will take the contents of our box B10. All references will be adjusted automatically, as usual, so that if the sheet cursor is at A1, our box reference C10 will be changed to B1.

Example 2:

```
@A1 RETURN
10 RETURN
20 RETURN
30 RETURN
40 RETURN
SUM(A1:A4) RETURN
```

In this case the four numbers will be imported as a column, starting at the cursor position. The fifth box will contain the sum of the other four boxes.

9.4 Importing ROM-LINK files

This is very simple, and is carried out automatically using the appropriate Menu Option 4 (section 4.4). In general it is better that the file should have been saved as Contents, rather than as Results. Any formulae in the saved area will then be automatically changed so that all box references remain correct relative to the area imported. Thus a reference made to the top left corner of the area originally saved will refer to the top left corner at which it is reloaded.

It is essential to note that importing into worksheets always starts from the cursor position, with rows running to the right and columns downward from that position. The imported area will overwrite anything already in the sheet, except where an imported box is empty. You should ensure that no vital information is overwritten in this way. A check should also be made that the imported area is not big enough to overrun either the bottom or right-hand edges of the sheet. If it does, the **Box off sheet** error message will appear. In the great majority of practical applications there is more than ample space available.

A ROM-LINK file may be imported into a word-processor through the normal **Load text to cursor** option (Option 4 in the WORDWISE Menu). The **TAB** settings can be preset as required, and the data can be edited in the ordinary way. The usual application would be to insert tables of data into other text.

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