


## SPREADSHEET GUIDE - PART THREE

### Overview of Spreadsheet Functions and Re-cap of Tutorials

This section can be read by all new users of the Notebook spreadsheet who have some previous experience of spreadsheets as a substitute for the tutorial guide. It is designed to give you a quick grounding in the way the Notebook spreadsheet operates and to ensure that you understand the philosophy behind the use of the various sections of the program. It is not intended to cover all the features of the program but you should be able to obtain pointers to where you will find more detailed information.

We must ask you to be patient during the explanation of what may be obvious points. Although much of the Notebook spreadsheet will be familiar, and will even use the same command names as other programs, you will find some features that go far beyond the abilities of any other sheet. It is well worth persevering to be sure that you appreciate all of the possibilities.

#### The Notebook spreadsheet's Dynamic Data Entry and Error Checking features

The Notebook spreadsheet has a unique system of dynamic prompting and error checking that provides you with full details of every possible command you can enter at any stage. Commands are input as one-letter mnemonics but if space permits, a full explanation of all the permissible entries is shown on the prompt line as you type. More extensive help can be obtained by pressing the  key.

At the same time as you are entering the data the Notebook spreadsheet evaluates the results of the commands, as far as they have progressed, as you type. Any mistakes that you make will be immediately pointed out to you.

If cell data that has been referred to by an expression is missing from the sheet, the calculation is performed assuming a value of zero, but you will see a row of question marks appear in the display to show where there is some data missing

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- Alternatively, if you want more control of the number and types of cells created then you can define all these things individually. Before you can enter any data into the spreadsheet you have to first define the depth and width of the sheet. The size of the sheet is set by using the Insert command to add the required numbers of Columns and Lines. The display width of each column is also set at this stage, although it can be changed again at any time.

You are also asked to specify a default display format for each column that you enter. This will only affect how the data you enter is displayed, the values used in calculations will always be the values you actually entered. Individual cells can be assigned their own formats regardless of the column defaults.

Each cell is only one character high but the columns can be any width between 1 and 67 characters. The New Width command can be used to change this at any time. The boundaries are shown on the screen by an upright line of vertical bar characters i.e. |. It would not be sensible to make a cell wider than 67 characters because this is the maximum width of the entry line.

As well as the number and size of lines and columns you are also prompted to specify WHERE you want these inserted. The defined sheet always has a rectangular shape. The line and column labels will be adjusted to reflect the new layout and so will any cell formulae that refer to specified co-ordinates.

Lines and columns can be removed from the sheet by the use of the Zap command. If you use this, the size of the defined sheet will actually reduce. Line and column labels and cell formulae will again adjust to the new layout. Data that is erased in this way is not recoverable. An alternative approach is to use the Blank command which removes the contents of a cell but leaves the cell position itself in a defined state. Again the data is lost.



You are not allowed to Zap cell co-ordinates or blocks that would create a 'hole' in the sheet, nor can you remove data in cells that are used by formulae in another cell. However, you are allowed to use Blank in any of these situations and in the case of the deleted data you will see some question marks to remind you that some data is expected.

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The continual recalculation feature can be switched off if desired, and indeed this may be advisable if you are entering any long and time consuming loops in the formula.

In normal circumstances both the prompts and the constant calculation are useful safeguards against error; there can be no ambiguity over exactly where a mistake has occurred.

See the section More Details on Error Messages if you are still unsure what has gone wrong.

At all times the  key will take you back to the previous step in the entry process. Mistakes are thus easily corrected. Pressing  will take you back to the primary command options available.

The only exception to the above situation is when you are using the EDIT option to make changes to cell data or a formula that already exists. In this case no prompting or error checking is performed until there is a recalculation. It is often safer and easier to simply re-enter new data into the cell.

#### The spreadsheet and its uses

The Notebook spreadsheet is designed to use the available memory space of your Notebook to the full. The size of the sheet can be anything up to a maximum of 52 columns, labelled A-Z then a-z, and 255 rows, and no matter what size you define it no memory is used until you start to enter data.


However, the number of cells that can contain data is limited by the amount of free memory in your Notebook. The amount of data you can enter is difficult to predict accurately because it depends on how complex the expressions you enter into each cell are. You can keep track of the remaining memory which is shown by the figure towards the top right of the screen. Although the Notebook spreadsheet will not allow any of your work to be lost, it is as well to plan in advance whether a large project will fit in one sheet or have to be split into two.


When you first start you have two options for setting up a worksheet:

- By using the Make sheet command you can instantly set up a blank sheet in which the choice of columns, columns sizes, cell formats, etc. are made for you. This is great if you just want to quickly try out some numbers and see what happens.

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#### Moving around

You can use cursor keys to move around the sheet you have defined. As an alternative use the L,R,U,D keys for left right etc. or the diamond shaped key cluster  + W,A,D,Z.

The current cursor location is the cell drawn in inverse text. To enter any data to the current cell you must use the dot command  to go into Entry mode. This will enter data using the default column format. If you want to use the default text or numeric format start data entry using " or ( respectively.

Any data, text or numeric, that will be used by the program in its calculations or other manipulations must, by necessity, be less than 127 characters long, but unless you are loading in a file created from another source the actual limitation will be the width of the entry line on your screen (67 characters). Note that the data is not restricted by the apparent size of the cell on the screen, which can be shortened down to only one character wide. The Notebook spreadsheet will display as much of the information held in that cell as is possible given the limitation of the display and of the display format. The true value of the data is used in all calculations regardless of the way it looks in the display.

As an exception to the above display rules, text can be entered in Heading format which means it will all always be visible. If necessary it will spread over several cells to act as comments on the data that is being displayed.

Instead of entering data directly, special built in functions CRD and SET can be used to create and fill cells on the basis of a calculation or formula. This is a useful feature that can be used to produce tables automatically. An example of table filling is given in one of the tutorials.

The third way of creating and filling cells is by use of the COPY function for copying a specified portion of the sheet into a new location. If you choose this option you will be prompted to decide whether or not you want the formulae held in the Cells that have been moved to be changed to reflect their new position.

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## Types of entry

Cell entries fall into two broad format categories, text and numeric. Each of these can have several sub-categories of display which can be freely interchanged. Text and numeric classifications cannot be interchanged since the data can only belong to one or the other. Text data can, of course, freely contain numbers and formulae, for example as an explanatory comment for the accompanying data. Even so, it is impossible to change the data to a numeric format or calculate with it.

If a numeric format is chosen each cell can be assigned a numerical constant as an entry, for example 3, 9000, 7.88401, or it can be given a formula value which calculates the number that should be displayed on the basis of the contents of the other cells in the sheet or of a calculation of constants.

The maximum number of decimal places you may use is 38. That is, the maximum number you can use in the spreadsheet is  $1 \times 10^{38}$  and the smallest number is  $1 \times 10^{-38}$ . 15 significant figures is the most that can be entered and displayed but internal calculations are done to 16 or 17 significant figures.

As well as entering numbers in normal format, you can use scientific notation for entering particularly big or small numbers. For example, rather than entering 12,345,000,000 you could be enter it as 1.2345E+10 or 0.12345E+11. Similarly, 0.0000000765 could be entered as 0.765E-7 (or 7.65E-8 or 76.5E-9 or 0.0765E-6 etc.). You must type the E in upper case for this to work.

You can use a special format to ensure that numbers are always displayed in an exponential format if you wish. Even in a General format cell, if it holds a large number and its width is reduced the display may be changed to exponential format so that the number can still be displayed.

Numeric cells can hold either constant numeric values or they may hold an expression. Simple examples of valid formulae would be

**3+B1, 10\*(343-A11), B23-C12/D13**

Unless you tell it to do otherwise, by switching off the automatic calculation feature, the Notebook spreadsheet will attempt to calculate the result of the formula that you type in as it is entered so that by the time you finish typing, the correct result, given the

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## Circular References

It is usually important to avoid circular references such as setting cell B1 equal to 2\*A1 and setting A1 to 3\*B1 for example, a situation that is not resolvable unless both cells take a value of zero.

Some circular references are logically correct and in certain special circumstances it is possible and indeed very useful to be able to enter a circular reference of some kind for the iterative solving of simultaneous equations. An example of a circular reference might be to set cell A1 equal to 0.5 then set B1 to COSR(A1) followed by setting A1 to B1. Then continually press I to force a recalculation until the values settle down to a nearly constant value. You will have solved the mathematically very difficult equation:  $x = \cos(x)$  (in radians).

A full list of built in functions available is given later in the Expression Entry section of the Complete command summary. The expressions and formulae you build up using these functions are the processing heart of the Notebook spreadsheet. It is these that make it such a useful tool. They can handle simple mathematics up to the most complex financial or scientific calculations.

## More on formats

Each piece of data entered onto a worksheet will have an associated format that determines how it is displayed on the screen.

There are about a dozen built in formats that can be used, some relating to text and some relating to numerical data. It is possible to switch formats as long as the data within a given cell can conform to the new type. For example you can switch a number between Integer format, which only displays the whole number part of a value, to a Financial format, which displays data correct to two decimal places.

Data can be assigned to an incorrectly formatted cell if it has been loaded in from an existing file onto an existing sheet or by using the edit option. However, any attempt at performing a calculation on the data will throw up the error.

As is the case when changing the display width of a cell, changing a format will change the way that information is displayed on

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current status of the sheet, will already be shown in the appropriate cell. Blank values in cells referred to in a formula will be taken as zero.

Formulae can also include within them complex functions, either built into the program already or those that are defined by you. Examples would include:

**B1+SUM(A10..A20)**

Which means add the contents of B1 to the sum of all the non-blank cells in the range A10 to A20.



**SIN(30)-COS(A23)**

Work out the sine of 30 degrees and subtract from it the cosine of whatever value is held in A23.

In these examples SIN, COS and SUM are all built in functions that can be used freely in your calculations. Any cell that is referred to in a formula, such as A23 in the example immediately above, can itself contain a value that is dependent on the solution of a formula entry.

# and ! commands are two useful commands that come into use when entering data. If # is typed after a cell co-ordinate when entering an expression then the reference is replaced by the actual value that is held in the cell at that time. If the value that is held in the cell is later changed it does not affect the expression that has been entered.

The ! command is similar, but it causes the entire expression up to the point where it is typed to be replaced by its current calculated value.

It is possible to switch between the normal spreadsheet display of numbers and text and a display of formulae that go to make up these numbers by use of the  - eXchange command. The  key can be used to temporarily see more lines of the sheet. When the X command is used it is often necessary to widen the display of columns using the NW command.

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screen but will not alter in any way the actual value of the information itself. For example if you have entered the value 2.5345 into cell A1 which is displayed in integer format (the value 3 is actually seen) and you put the expression 2\*A1 in cell B2 which is also in integer format, which displays the value 5, this would appear to give the result that  $3 * 2 = 5$ . A true integer calculation can be forced by using expression such as INT() in the calculation formula.

Certain of the Notebook spreadsheet's built in functions and expressions work on a specified range or column of the data. For example, to AVERAGE some of the data you would specify the range thus:

**AVERAGE (B1..B10)**

Which means find the average of all non-blank entries between B1 and B10.

Any blank cells that fall within this range are ignored in the above calculation. This saves you from having to create unnecessarily complicated expressions in order to encompass all of the data required. You can also leave a range of cells blank and only fill in the data when the other formulae have been entered.

Careful use of the Format option can help to produce some quite sophisticated displays and printouts. Text can be left or right justified in its Cell. There is also a format choice of Carriage Return that can be assigned to individual Cells or ranges. This is a special format that is only used to control printout in such a way that address labels can be produced.

## The COPY command

One of the most important commands available is Copy. Its use extends far beyond that of simply copying data from one part of the sheet to another, it is designed to allow any information to be written from any input device to any part of the sheet, or from any part of the sheet to any output device, or between any two parts of the sheet. It therefore takes the place of both a save and load command and of the printing command. As well as saving, loading or printing entire files it is also possible to perform operations on defined blocks or ranges of the data. 'Blocks' as small as one Cell can be copied to a file in memory or the printer. Once the option

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has been selected you will be prompted through all of the available choices.

When copying within the sheet you cannot copy beyond the current sheet boundaries. Any data at the destination will be overwritten unless another part of the sheet refers to it. The copied data takes its own format details with it.

## SAVING and LOADING

Unlike other spreadsheet programs which have separate Save and Load commands, the Notebook spreadsheet achieves all these functions with the ubiquitous Copy command. Saving is achieved by specifying "File" as the destination of the copy. Loading is achieved by specifying "File" as the source of the copy.

When you save data to a file you can specify up to an 8 character name. This is then followed by a full stop and either MEM, TXT, DAT or DIF. This "extension" determines the format of data written to the file. If you don't give an extension, .MEM is added automatically.

The different file formats are explained in the tutorial and within the command reference section.

If you use the Quit option to leave the Notebook spreadsheet without having previously saved your work then the spreadsheet automatically makes a copy of the sheet called RESTART.MEM. This file should be renamed or resaved as soon as possible so that it is not accidentally overwritten. When you next start the spreadsheet, you can use the Restart command to quickly reload this file and continue where you left off.

## Printing

Once again, the Copy command is used to achieve a task that may be done by a separate command in other spreadsheet programs. Worksheets, or a portion of them, can be printed by using the Copy to Printer command sequence. Sheets are printed as they appear in the display but without dividers or system messages.

Mail labels are a special print option but to use them to their full advantage will involve inclusion of special columns containing Carriage Return default formats. An example of this is included in the tutorial.

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## Database functions

The worksheet can be searched to find a specific data entry, either text or numeric. The search will operate on the true data value or expression that has been entered in the cell NOT the displayed data. The command used for this is the Get command.

Lines of data can be sorted into order, i.e. physically re-arranged in the sheet such that the information in the specified column ascends or descends. The Sort command is used to do this.

It is best to sort either text or numeric data, unpredictable results occur if they are mixed. If the data is text then upper case letters are treated the same as lower case, numbers rank below letters and are treated in a textual way e.g. 7 ranks higher than 66.

## Advanced functions

### Conditionals, Loops and Macros

The Notebook spreadsheet includes some features that will be familiar to anyone who has had experience of high level computer languages such as BASIC.

The conditional command sequence IF (*logical test*) THEN (*expression 1*) ELSE (*expression 2*) can be used to build decision making into the sheet. If the *logical test* is passed as TRUE the part of the expression after the THEN is calculated. If the test is FALSE then the ELSE part is calculated.

An extension of the IF THEN sequence is the DO (*range of expressions*) WHILE (*logical test*) loop. The expressions in the cells listed following the DO is performed at least once, and then repeated over and over again whilst the logical test is passed as TRUE. As soon as the test becomes FALSE, or an error occurs, then the loop is stopped. The simplest form of logical test is to set up a counter that is increased or decreased with every DO expression, special functions INIT, INC and DEC help you to do this; when the counter reaches a specified value the loop will stop.

A Macro is a term given to a sequence of commands that you are able to access with just one command. The \* command is used to call a macro. They are most useful when you find that you are performing a certain sequence of commands over and over again.

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Looping Macros can be defined, i.e. ones which continue to repeat until the task is completed or an error occurs.

Note that a Macro is a loop of direct commands rather than of mathematical functions such as occurs with a DO WHILE loop. It can contain commands such as L for cursor left, or NF for new Format, commands that act directly on the sheet and can not be made part of an expression. The Macro commands act exactly as if you have typed them in at the keyboard.

## Table creating and reading

Certain functions, (SET, INIT, DEC, INC) exist that will let you set the value of data held in another cell. These can be incorporated into a DO WHILE loop in order to facilitate the automatic creation and filling of tables.

Other functions exist such as LOOKUP and INTERP which are designed to automate the process of consulting tables in order to extract data.

## Date and Time Functions.

The Notebook spreadsheet will let you input date and time functions into the sheet. The spreadsheet gets the correct date and time from the Notebook's own clock so you must ensure it is set correctly if you use these functions. It is possible to build these functions into formula expressions, logical tests, loops and macros such that the program will adjust its output dependent on time.

## Graphics options

A range of graph and chart designs can be created through the spreadsheet's Trace graph command. Special functions exist to signal to the spreadsheet which type of graph you want to display and to inform the program of which data ranges are to be plotted together with labels and axis scales etc.

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