3D-CALC

**THE 3-DIMENSIONAL SPREADSHEET
FOR ATARI ST AND TT COMPUTERS**

MANUAL

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CONTENTS

INTRODUCTION TO THE 3D-CALC SPREADSHEET

To run the 3D-Calc program, you need an Atari ST computer with a mouse, at least 1 Mb of internal memory and preferably a high resolution monochrome monitor. However, the program runs in other resolutions than the ST high resolution, except low resolution (320x200).

Start the 3D-Calc program by double clicking the 3D-CALC.PRG icon. Loading the program takes a few moments. If all goes well, the 3D-Calc desktop appears.

Since 3D-Calc uses a lot of memory, it is recommended to use the program with only few accessories loaded. It is recommended however to load and activate the FREERAM accessory which comes with the 3D-Calc package, in order to monitor the amount of memory available to the program since 3D-Calc can run into problems when the amount of free memory is less than 32 Kb.

3D-CALC MENU BAR

The menu bar at the top of the screen contains the following headings:

- Desk   The About 3D-Calc option and possible desk accessories. The About 3D-Calc form displays the version number and release date of your 3D-Calc copy;
- File   Disk input and output of spreadsheet data files;
- Window   Spreadsheet data handling and presentation;
- Blocks   Block operations;
- Stat   Statistical analysis of spreadsheet data;
- Graph   Graphical presentations of data;
- Text   An integrated text editor;
- Macros   Recording and play-back of the user's actions;
- Options   Current settings and options.
- ?   Help menu

Many of the 3D-Calc menu commands can also be selected by pressing combinations of keys on the keyboard. If for a particular menu command this facility is available then the corresponding keys are displayed at the right side in the menu. E.g. at the right of the menu command *Read file* you see **^**L. This means that you can also read a spreadsheet file by pressing simultaneously the Control and the L keys.

Refer to appendix A of the manual for a full list of keyboard commands.

ON LINE HELP

At the right of the menu bar, a question mark is displayed as a menu heading. This menu gives access to the 3D-Calc On line help facility. After selecting this menu option, a window is displayed with an alphabetical list of items. You can select an item by clicking on it with the mouse. A help text will be displayed in the window. To obtain information on another subject, select the Help menu command again.

THE SPREADSHEET WINDOW

After starting the program the 3D-Calc desktop appears.   At the left, 3 icons are displayed representing 3 spreadsheets. At the bottom of the screen the meaning of the function keys is displayed.

3D-Calc can keep up to 3 spreadsheets in memory. You can change from one spreadsheet to another by selecting the corresponding menu command or by pressing the Alternate key together with the 1, 2 or 3 key, or by clicking on one of the spreadsheet icons. A spreadsheet window can be opened by selecting *Open window* in the *Window* menu, or by pressing function key F1, or by double-clicking on a spreadsheet icon. Up to 3 windows can be open per spreadsheet.

One cell (rectangle) of the spreadsheet is black. This black rectangle is called the *cell pointer*. In the upper left corner of the window the position (or address) of the cell pointer is displayed: 0A0.

The first number is the page number (the first page is numbered 0), the letter A is the column number and the next number is the row number (row 0 is the first row number).

The page, column and row number of the cell pointer are also called the current page, column and row.

HOW TO MOVE THE CELL POINTER

Press the right arrow key. The cell pointer is moved to cell 0B0. Press the down arrow key. The cell pointer is moved to cell 0B1.

Click with the mouse on any other cell. The cell pointer jumps to this cell. Now move around in the spreadsheet by use of the sliders and arrows at the right and at the bottom of the window.

Press function key F10. The first number (the page number) of the cell address changes to 1; column and row numbers remain unchanged. Press function key F10 again. The page number changes to 2. Press function key F9. You have returned to page number 1.

Select *Goto cell* in the *Data* menu, (or press Control F7). In the dialog form which appears, enter number 0 for page number, for column enter the letter A and for row enter number 0. Select the OK button or press the Return key. This brings the cell pointer right back to its start position 0A0.

HOW TO ENTER DATA

Move the cell pointer to cell 0A2. We will note this cell address as A2 (the page number is omitted, indicating that this cell is on the current page).

Now type the number 25.6. The characters that you type are displayed in the top line (the edit line) of the window, at the right of the cell address. Press the down arrow key. In cell A2 the number 25.60 appears, and the cell pointer is moved to cell A3. The edit line is cleared since cell A3 contains no data.

Move the cell pointer to cell A10. For cell A10 enter: A2 and press an arrow key. Notice that cell A10 now displays the contents of cell A2. Move the cell pointer to cell A2 and clear the contents of this cell by pressing the ESC key. Enter the value 12 and move the cell pointer. Cell A2 now contains the value 12.00, and cell A10 displays 12.00. Move the cell pointer to cell A10. The edit line displays A2. This illustrates the difference between the literal contents of a cell, which in this case is the formula A2, and the displayed (calculated) contents, in this case the value 12.00.

Move the cell pointer to cell A3, enter the number 14.3 and then move the cell pointer to cell A10.

Clear cell A10 by pressing ESC; type SUM(A2:A9) and press the Enter key. SUM(A2:A9) means: take the sum of cell range A2 to A9. The edit line displays the SUM formula, cell A10 displays 26.30 in reverse (the cell pointer was not moved).

Column A of your spreadsheet now looks like this:

```
┌──────────────────────────────────────┐
│ X ░░░░░░░░ NONAME.3DD ░░░░░░░░░ X │
├──────────────────────────────────────┤
│ 0  A  10 : SUM(A2:A9)|            ⇧   │
├──────────────────────────────────────┤
│        │    A    │    B    │   C   │  │
│     0  │         │         │       │  │
│     1  │         │         │       │  │
│     2  │  12.00  │         │       │  │
│     3  │  14.30  │         │       │  │
│     4  │         │         │       │  │
│     5  │         │         │       │  │
│     6  │         │         │       │  │
│     7  │         │         │       │  │
│     8  │         │         │       │  │
│     9  │         │         │       │  │
│    10  │  26.30  │         │       │  │
│    11  │         │         │       ⇩  │
│ ◇ │░░░░░░░░░░░░░░░░░░░░░░░░│ ◇ │ ▰  │
└──────────────────────────────────────┘
```

Enter the value 9 in cell A4. The SUM in cell A10 is automatically adapted and now displays 35.30. Enter 2*3 in cell A5 and press Enter. Cell A5 displays 6.00 and cell A10 displays 41.30.

We will now copy the SUM formula in cell A10 to cell B10. In order to do so, move the cell pointer to cell A10 and press function key SHIFT F5. Now press the right arrow key to move the cell pointer to cell B10 and press function key F5. The following appears in the edit line: SUM(B2:B9). The means that the formula is adapted automatically so that the SUM formula refers to a range of cells in the same relative position to the formula, as the original formula in A10.

```
┌──────────────────────────────────────┐
│ X ░░░░░░░░ NONAME.3DD ░░░░░░░░░ X │
├──────────────────────────────────────┤
│ 0  C  15 : |                     ⇧   │
├──────────────────────────────────────┤
│        │    A    │    B    │   C   │  │
│     0  │         │         │       │  │
│     1  │         │         │       │  │
│     2  │  12.00  │         │       │  │
│     3  │  14.30  │         │       │  │
│     4  │         │         │       │  │
│     5  │         │         │       │  │
│     6  │         │         │       │  │
│     7  │         │         │       │  │
│     8  │         │         │       │  │
│     9  │         │         │       │  │
│    10  │SUM(A2:A9)│SUM(B2:B9)│     │  │
│    11  │         │         │       ⇩  │
│ ◇ │░░░░░░░░░░░░░░░░░░░░░░░░│ ◇ │ ▰  │
└──────────────────────────────────────┘
```

When you enter numbers in the cells B2 to B9, you will see that the SUM formula in cell B10 will automatically display the sum of the numbers that you enter.

HOW TO SAVE AND READ DATA

Select the *Save as* command in the *File* menu (or press Control X). Enter a filename in the file selector form, e.g. TEST.3DD, and press the Return key or select the OK button.

Next select the *Read file* command in the *File* menu (or press Control L). The file selector panel displays some example spreadsheet data files, including the TEST.3DD file you have just created.

Select the CAR.3DD file. After the program clears the contents of the spreadsheet, the CAR data are read into memory. If you have previously closed the spreadsheet window, press F1 to open it again. A simple spreadsheet model is displayed. The totals at the bottom and at the right of the window are calculated by means of the SUM(range) function.

```
┌─────────────────────────────────────────────────────────────┐
│ ⊠│     │              A:\DATA\CAR.3DD              │○K│ ⊠ │
├──┴─────┴──────────────────────────────────────────┴──┴───┤
│  0  G   2 : SUM(C2:E2)│                                  ⇧ │
│    │    A    │ B │   C   │   D   │   E   │ F │   G   │      │
│  0 │CAR DATA │   │Loan   │Fuel   │Other  │   │TOTAL  │      │
│  1 │         │   │       │       │       │   │       │      │
│  2 │JAN      │   │    85 │    60 │       │   │   145 │      │
│  3 │FEB      │   │    85 │    45 │       │   │   130 │      │
│  4 │MAR      │   │    85 │    45 │       │   │   130 │      │
│  5 │APR      │   │    85 │    45 │       │   │   130 │      │
│  6 │MAY      │   │    85 │    45 │       │   │   130 │      │
│  7 │JUN      │   │    85 │    45 │    80 │   │   210 │      │
│  8 │JUL      │   │    85 │   150 │       │   │   235 │      │
│  9 │AUG      │   │    85 │    45 │       │   │   130 │      │
│ 10 │SEP      │   │    85 │    45 │       │   │   130 │      │
│ 11 │OCT      │   │    85 │    45 │   210 │   │   340 │      │
│ 12 │NOV      │   │    85 │    45 │       │   │   130 │      │
│ 13 │DEC      │   │    85 │    45 │       │   │   130 │      │
│ 14 │         │   │       │       │       │   │       │      │
│ 15 │TOTAL    │   │  1020 │   660 │   290 │   │  1970 │ ⇩    │
│ ◇│ │                                             │◇│▐ │
└─────────────────────────────────────────────────────────────┘
```

The SUM formula was entered once in cell G2, and then it was copied to the other cells in column G.

HOW TO CREATE A GRAPH

After reading the CAR.3DD data file as described above, select *Bar graph* in the *Graph* menu. A dialog form is displayed at the center of the screen.

Every 3D-Calc dialog form contains the following 3 parts: at the top left there is a close button, at the top right there is an OK button, and in between you see the title bar.

When you select the close button with the mouse, the dialog form disappears and the corresponding operation is abandoned.

As for a regular window, the title bar is used to move the dialog form. After having completed the form you can select the OK button at the top right of the form, or press the Return or Enter key.

Complete the dialog form as follows:

```
┌───────────────────────────────────────────────┐
│ ⊠│        GRAPH               │○K│
├───┴─────────────────────────────────┴──┤
│                                          │
│ GRAPH TITLE : A0│_____    OPTIONS :      │
│                                          │
│ HORIZONTAL AXIS          3D-Graph   : YES NO │
│ LABELS range : C0_____  Grid       : YES NO │
│        to cell : E0_____  Auto Y-axis : YES NO │
│                                          │
│ VERTICAL AXIS            Number of lines : __ │
│ DATA range   : C15_____  Increment      : _____ │
│        to cell : E15_____  Lowest value   : _____ │
└───────────────────────────────────────────────┘
```

For all options the YES button is selected. Now click on the OK button or press Return: the bar graph is displayed in a separate window.

BAR GRAPH

CAR DATA

```
1100
1000
 900
 800
 700
 600
 500
 400
 300
 200
```

Loan   Fuel   Other
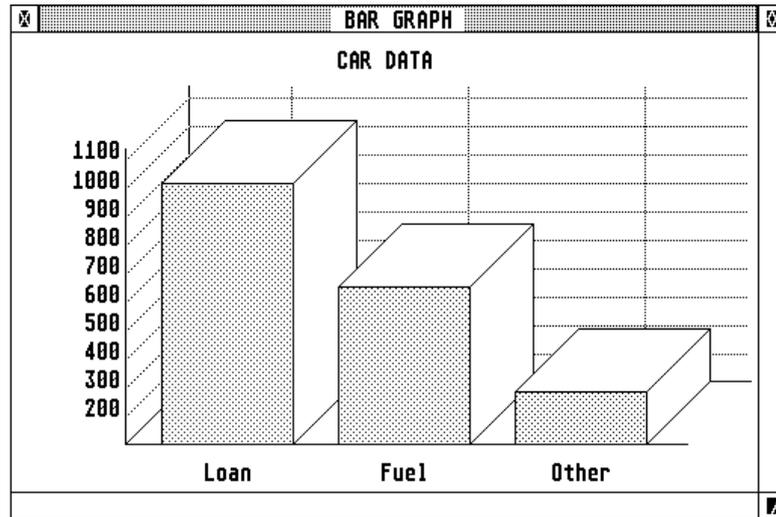
Close the Bar graph window by use of the mouse or, if this window is on top, by pressing SHIFT F1. Now select *Pie chart* in the graph menu. A dialog form is displayed similar to the Bar graph dialog form. Enter the same cell addresses and press Return or select the OK button to see the data represented in a pie chart.

PIE CHART

CAR DATA

```
51.8%  Loan
33.5%  Fuel
14.7%  Other
```
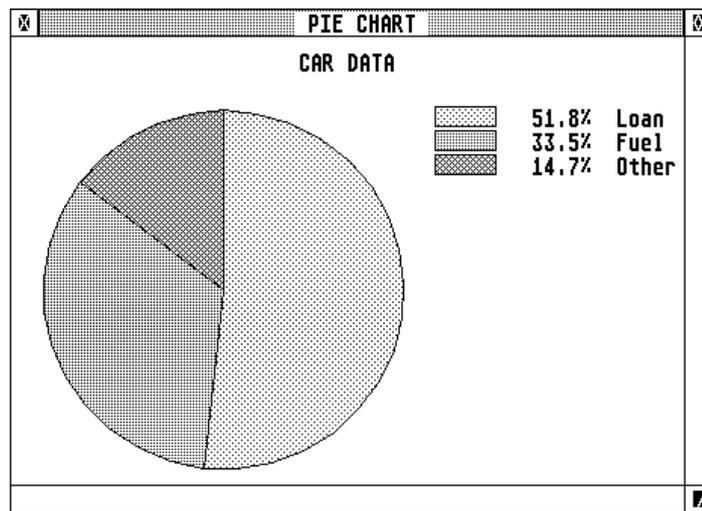
Next, select *Line graph* in the *Graph* menu, and enter the following cell addresses:

GRAPH   OK

GRAPH TITLE : A0_____   OPTIONS :

HORIZONTAL AXIS   3D-Graph   : YES NO
LABELS range : A2_____   Grid   : YES NO
        to cell : A13_____   Auto Y-axis : YES NO

VERTICAL AXIS   Number of lines : __
DATA range   : G2_____   Increment   : _____
        to cell : G13_____   Lowest value   : _____

Press the Return key to see the line graph.
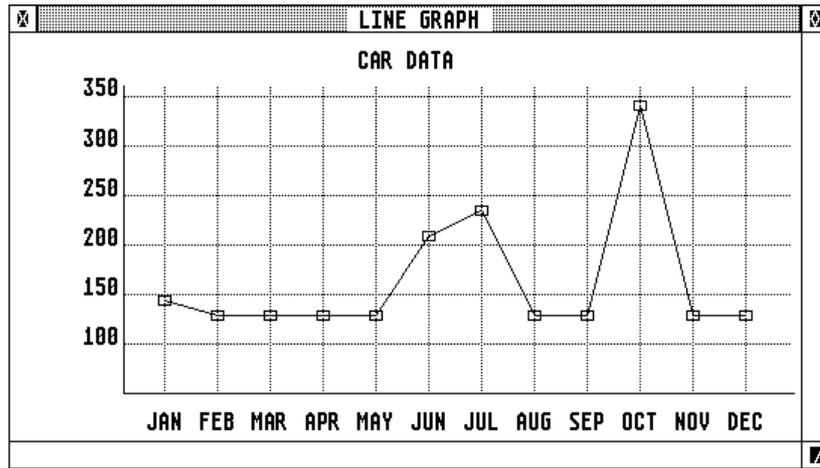
It is also possible to define a graph using the mouse. First drag the mouse over the cells A2 to A13. The define block dialog form appears. In this form, select the button *X-range* in the *Graph info* box, and select the *Set graph info* button. Next, close the dialog form by selecting the OK button at the top right of the form.

Now drag the mouse over the range G2 to G13. The define block dialog form appears. Select the button *Data range* in the *Graph info* box, and select the *Set graph info* button. Next, close the dialog form by selecting the OK button at the top right of the form.

When you select *Line graph* in the menu, you will see that the ranges you have indicated with the mouse, are already present in the dialog form. Select the OK button of this form to see the graph.

HOW TO CREATE A MULTIPLE RANGE GRAPH

Read the PRODUCT.3DD example file from the disk and open the spreadsheet window.

Select *Multiple range graph* in the *Graph* menu. In the form that appears in the center of the screen, enter the following cell addresses (remember that you can move the dialog form with the mouse in order to verify the cell addresses in the spreadsheet):

```
┌─────────────────────────────────────────────────────────────────────────┐
│▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨  MULTIPLE RANGE GRAPH  ▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨  OK │
├─────────────────────────────────────────────────────────────────────────┤
│                                                                           │
│   GRAPH        Graph title : A0|_____    OPTIONS :                       │
│   ▁▂▃█▁                                                                    │
│  ▀BAR GRAPH▀   X - AXIS                    3D-Graph   : │YES│ │NO│         │
│                Label range : A4_____                                     │
│   ▐█▐█▐█              to cell : A8_____   Grid       : │YES│ │NO│         │
│   STACKED                                                                 │
│                Y - AXIS                    Auto Y-axis : │YES│ │NO│        │
│                Label range : C2_____                                     │
│   ▐█▐█▐█              to cell : E2_____   Number of lines : __           │
│   STACKED %                                Increment        : _____       │
│                Data range : C4_____       Lowest value     : _____       │
│   ╱╲╱               to cell : E8_____                                    │
│   LINE GRAPH                                                              │
│                                                                           │
└─────────────────────────────────────────────────────────────────────────┘
```
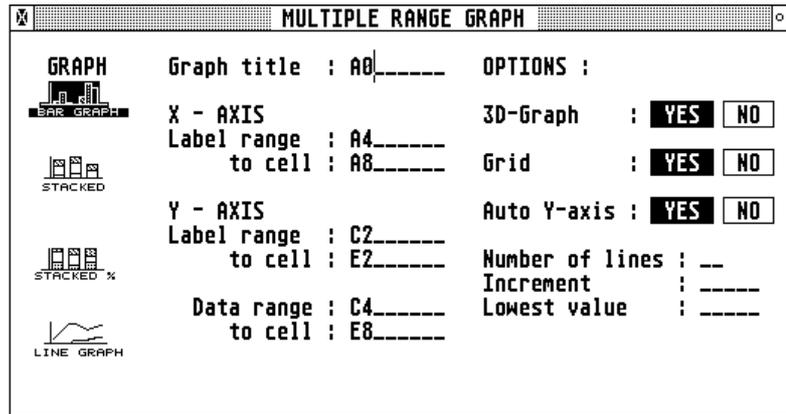
Select the multiple bar graph type by clicking on the corresponding icon and select the OK button. Now compare the graph which is displayed with the data in the spreadsheet window in relation with the cell addresses and ranges in the dialog form.
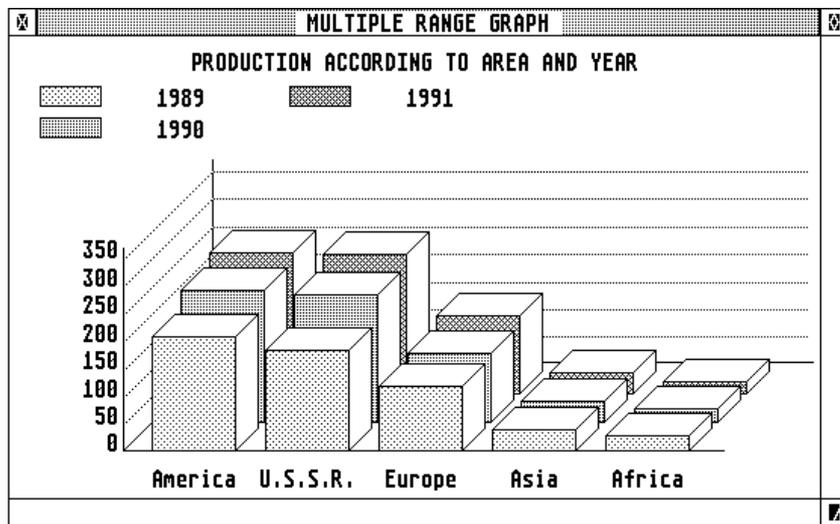
Close the multiple range graph window, and select this menu command again. In the dialog form, change the X-axis range and the Y-axis range as follows:

```
┌─────────────────────────────────────────────────────────────────────────┐
│▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨  MULTIPLE RANGE GRAPH  ▨▨▨▨▨▨▨▨▨▨▨▨▨▨▨  OK │
├─────────────────────────────────────────────────────────────────────────┤
│                                                                           │
│   GRAPH        Graph title : A0|_____    OPTIONS :                       │
│   ▁▂▃█▁                                                                    │
│   BAR GRAPH    X - AXIS                    3D-Graph   : │YES│ │NO│         │
│                Label range : C2_____                                     │
│   ▐█▐█▐█              to cell : E2_____   Grid       : │YES│ │NO│         │
│   STACKED                                                                 │
│                Y - AXIS                    Auto Y-axis : │YES│ │NO│        │
│                Label range : A4_____                                     │
│   ▐█▐█▐█              to cell : A8_____   Number of lines : __           │
│   STACKED %                                Increment        : _____       │
│                Data range : C4_____       Lowest value     : _____       │
│   ▀╱╲╱▀              to cell : E8_____                                   │
│  ▀LINE GRAPH▀                                                             │
│                                                                           │
└─────────────────────────────────────────────────────────────────────────┘
```
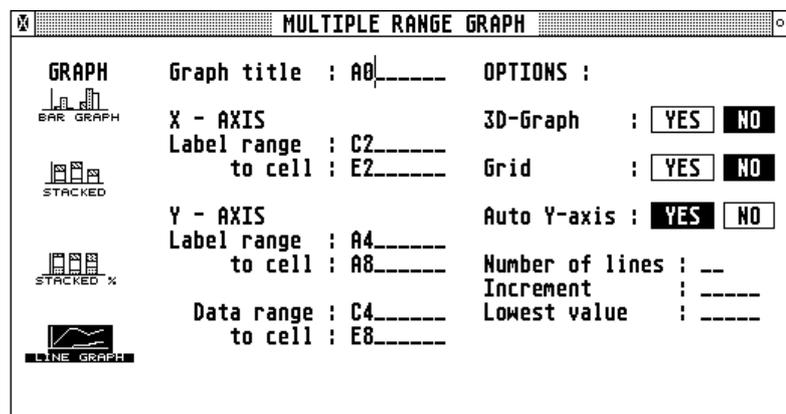
Click on the multiple line graph icon and select OK to view the new graph.

```
┌──────────────────────────────────────────────────────┐
│▓│░░░░░░░░░░░░░░░ MULTIPLE RANGE GRAPH ░░░░░░░░░░░░░░░│▓│
│                  PRODUCTION ACCORDING TO AREA AND YEAR              │
│  □──────□ America      +·····+ Europe      ◇─ ─ ◇ Africa          │
│  *─ ─ * U.S.S.R.      ×─·─·─× Asia                                │
│  350                                                              │
│  300                                                              │
│  250                                                              │
│  200                                                              │
│  150                                                              │
│  100                                                              │
│   50                                                              │
│    0                                                              │
│          1989            1990            1991                     │
└──────────────────────────────────────────────────────┘
```
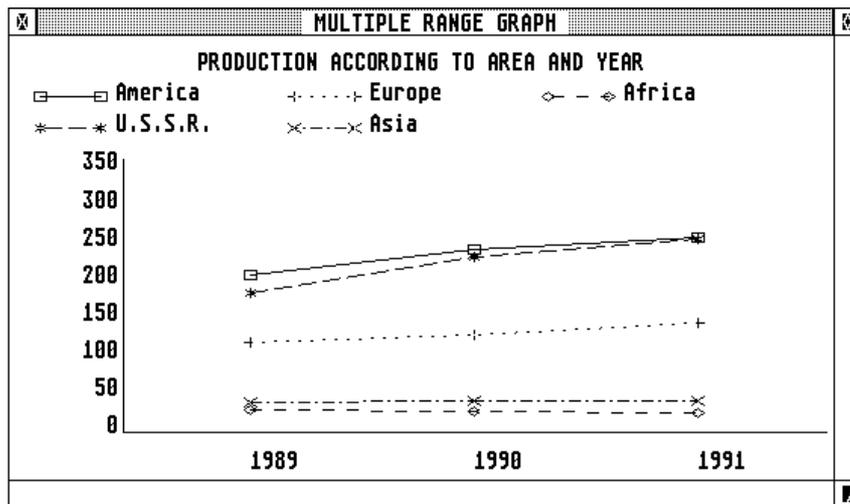
THE TEXT EDITOR

Open the text window by pressing Control T or by selecting the corresponding command in the Text menu. In this window you can edit a short text. Refer to the *Text* section of the reference manual for the use of special text editing keys.

A 3D-Calc text can import 3D-Calc spreadsheet data. As an example, read the ADDRESS.3DD spreadsheet file and open the spreadsheet window. The ADDRESS spreadsheet acts like a simple database. Page number 1 of the spreadsheet contains the actual addresses. Press function key F10 to see this page of the spreadsheet.

```
┌──────────────────────────────────────────────────────┐
│▓│░░░░░░░░░░░░░░░░ A:\DATA\ADDRESS.3DD ░░░░░░░░░░░░░░░│▓│
│ 1  A    0 : NAME│                                    │⇧│
│         │      A      │      B       │      C       │   │
│  0 │NAME          │ADDRESS       │CITY          │      │
│  1 │              │              │              │      │
│  2 │Hinting       │Kikkerstraat 52│9000 Gent    │      │
│  3 │Janssens      │Stationstraat 52│9000 Gent   │      │
│  4 │Pieters       │Dorpsplein 2  │3000 Leuven   │      │
│  5 │Desmet        │Ten velde 1   │2000 Antwerpen│      │
│  6 │Schoenmaker   │Tichelrei 23  │1000 Brussel  │      │
│  7 │              │              │              │    │⇩│
│◇│░░░░░░░░░░░░░░░░░░░░░░░░░░░░░░░░░░░░░░░░░░░░│◇│▓│
└──────────────────────────────────────────────────────┘
```

Press function key F9 to return to the first page (page number 0). Enter the following lines in the text window:

```
┌─────────────────────────────────────────────────────┐
│ ⊠         NOTE.3DT                                ⊠  │
│ [---^----1----^----2----^----3----^----4----^----5----^----] ⇧ │
│ ¹│To Mr. @UPPER(K(A))                                 │
│  @K(B)                                                │
│  @K(C)                                                │
│                                                       │
│  Dear Mr. @K(A)+","                                   │
│                                                       │
│  Enclosed please find our most recent product catalog,│
│  If you need any more information, please call our product│
│  information line (078) 256 2347,                     │
│                                                       │
│  Yours sincerely,                                     │
│                                                       │
│                                                       │
│  William D, Reynolds                              ⇩  │
│  Sales manager                                       │
└─────────────────────────────────────────────────────┘
```
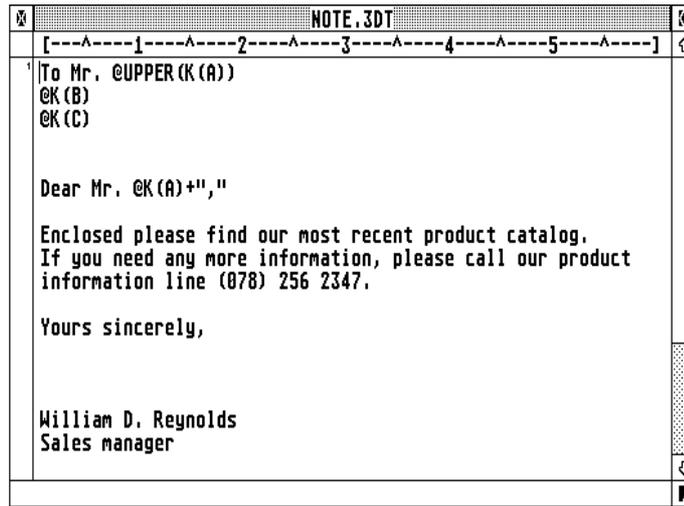
Select the *Format* option in the *Text* menu and enter the following margins in the dialog form:

```
┌──────────────────────────────────┐
│ ⊠        TEXT FORMAT         OK   │
│                                   │
│   Top margin        : 6_         │
│   Bottom margin     : 6_         │
│                                   │
│   Lines per page    : 66_        │
│                                   │
│   Left margin       : 10         │
│   Text width        : 60         │
└──────────────────────────────────┘
```
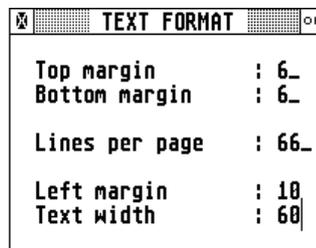
Now select the text *Print* menu command and enter:

```
┌──────────────────────────────────────────┐
│ ⊠              PRINT                OK    │
│                                          │
│  Initialization : _____        │
│                                          │
│  Pauze between pages :   │ NO │ │ YES │  │
│                                          │
│  TO :   │ PRINTER │ │ SCREEN │ │ DISK │  │
│                                          │
│  FROM                TO                  │
│  Page   : 1_         Page    : 1_        │
│  Column : A_         Column  : A_        │
│  Row    : 2___       Row     : 6___      │
│                                          │
│  Select : LEFT(K(C),4)="9000"_____       │
└──────────────────────────────────────────┘
```
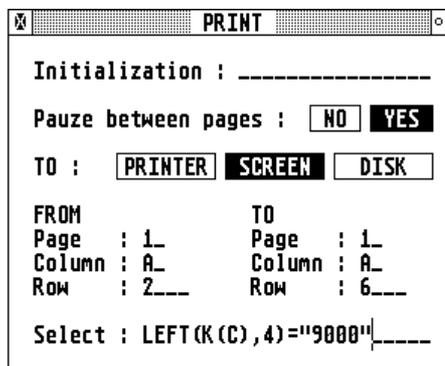
From page 1 to page 1 means that the text imports data from page number 1. The column numbers have no significance in this example. Rows 2 to 6 defines a data range, which would normally result in 5 copies being printed. However, in the SELECT field we have entered the formula LEFT(K(C),4)="9000". This expression will be evaluated before a copy of the text is printed. If the expression is FALSE, or 0, than this copy is not printed,

Select Print to SCREEN and press the Return key to view the text. This is the result:

```
To Mr. HINTING
Kikkerstraat 52
9000 Gent


Dear Mr. Hinting,

Enclosed please find our most recent product catalog.
If you need any more information, please call our product
information line (078) 256 2347.

Yours sincerely,



William D. Reynolds
Sales manager
```

You can now make some additions in the letter, add some addresses in the spreadsheet, adapt the entries in the print dialog form and repeat printing to the screen. If the result is not satisfactory (if some data imported from the spreadsheet are not printed), it may be necessary to include a space before and/or after the @ formula.

THE 3-DIMENSIONAL SPREADSHEET

3D-Calc is a 3-dimensional spreadsheet. This means that it does not only counts columns and rows, forming a 2-dimensional plane, but every spreadsheet consists of 13 such planes.

Obviously, the user does not have to make use of the rather complex possibilities offered by a 3-dimensional model. Indeed, he can limit himself to the top plane (page) of the spreadsheet.

The distribution disk contains some simple spreadsheet models illustrating the use of a 3-dimensional spreadsheet (BUDGET, ADDRESS).

To go from one page to another, the function keys F9 and F10 are used.

Ranges or blocks can also be 3-dimensional. Functions can address cells on other pages of the spreadsheet. E.g. when you enter the formula SUM(1B1:8B1) in cell 0B1 (this is cell B1 on page 0, or the first or top page of the spreadsheet), then this function will calculate the sum of all cells B1 on pages 1 to 8 of the spreadsheet.
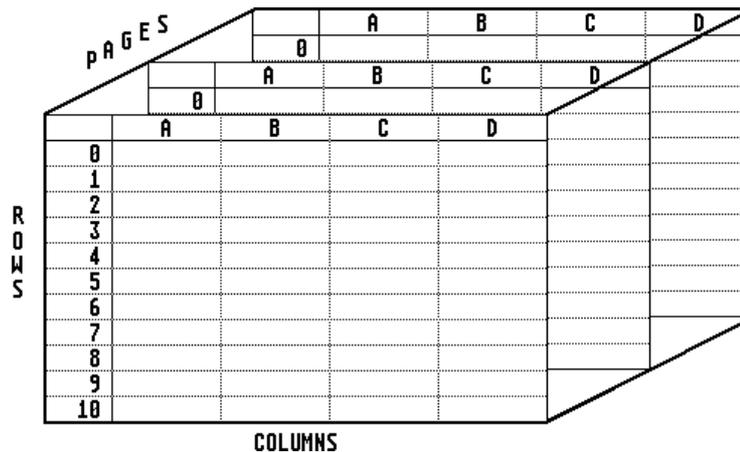
FILE MENU

SPREADSHEET 1, 2 AND 3

In 3D-Calc you may keep up to 3 spreadsheets in memory simultaneously. Select the appropriate option in the file menu, or click with the mouse on the corresponding spreadsheet icon to select one of the 3 spreadsheets.

Reading a data-file, block operations, graphs etc. all relate to the selected or active spreadsheet.

READ FILE (Control L)

In the standard file selector box you must enter the name of the file to be read into memory. Together with the spreadsheet data, the spreadsheet macros and options that are included in the data file, are read. After reading the file, the Alternate A macro is automatically executed. The Synchronize, Grid, Cell font and other options are set according to those contained in the 3D-Calc data file. Finally, the name of the file will appear under the selected spreadsheet icon.

3D-Calc files are always upward compatible. This means that version 2 of the program also reads the files created by version 1, and version 3 of the program also reads the files created by version 2 of the program, but not vice-versa.

When the program is started, it first reads the 3D-CALC.OPT options file. Next it searches for a data file named AUTO3D.3DD in the data directory. If such a file is found, it is automatically read into memory, and the macro Alternate A is executed, if such a macro is defined. If the AUTO3D.3DD file is not found, the program starts the desk macro Alternate F1, if this macro is defined.

If you want to read a data file without erasing existing data in memory, you can select the *Append* or *Merge* menu commands.

SAVE (Control S)

Select this menu command to save the spreadsheet on disk. A 3D-Calc data file also contains the current settings, including the spreadsheet window position and size, cell font, the spreadsheet macros and the entries in the different graph dialog forms.

SAVE AS (Control X)

Enter a new name for the spreadsheet data to be saved on disk in the standard file selector panel. You do not need to enter an extension because the program will automatically add the default extension 3DD. If you enter the name of an existing file, this file will be overwritten without further warning.

APPEND FILE

After you have selected the *Append* command, you must enter the name of the file to be placed on the open rows located under the rows already used in the spreadsheet. Use *Append* to concatenate address lists etc.

MERGE FILE

If you want to read a data file without first erasing the data in memory, you must use the *Merge file* command.

When you have a spreadsheet with data on page 0 and an empty page 1, and another spreadsheet with data on page 1 and an empty page 0, then you can use the menu command *Merge file* to read the data of one spreadsheet into the free page of the other spreadsheet.

If, on the other hand, you have 2 spreadsheets with data on the same page, then you can use function keys SHIFT F9 and SHIFT F10 to renumber the pages of one of the spreadsheets, and then merge the 2 spreadsheets to 1, with the data of the different spreadsheets on different pages of the new spreadsheet.

READ LOTUS123 FILE

The WKS format is used by the programs Lotus123 and Symphony on MS-DOS computers. Data and formulas from these files, WKS files used by Lotus123 version 1A as well as WK1 files used by release 2 can be imported in 3D-Calc.

The data are read starting on the current page of the current spreadsheet.

However, you should consider the following limitations when importing a WKS file:

- not all Lotus123 functions are implemented in 3D-Calc;
- 3D-Calc has only 2048 rows, where Lotus123 has 8182;
- Lotus123 cell attributes and formats are ignored.

IMPORT ASCII FILE

When you want to import data from other applications than Lotus123, you must use the delimited ASCII file format. In such files, the data are separated with commas, text is placed between single or double quotation marks, and every line ends with a carriage return (ASCII code 13). E.g.

```
"LENGTH","WEIGHT"
171,66
174,61.5
182,82
172,80
170,75
179,72.0
177,78.50
```

To read such a file select *Import ASCII file* in the menu and select the file in the file selector panel.

In order to transfer files in DBase3+ format to 3D-Calc, you must proceed as follows. In DBase3+ you must enter the command 'USE sourcefile', with *sourcefile* being the name of the file you want to transfer. Next enter the command 'COPY ALL TO targetfile DELIMITED', with *targetfile* being the name of a new file. Select the *Import ASCII file* command in the 3D-Calc *File* menu, and select the name of the new *targetfile* in the file selector form. The data will now be imported in the spreadsheet.

EXPORT ASCII FILE

Select *Export ASCII file* in order to write all data in the spreadsheet to a standard delimited ASCII file. Such ASCII file can easily be imported in other programs such as Lotus123, DBase, etc.

In order to import the ASCII file in Lotus123, use the Lotus123 command sequence /FIN (File Import Numbers), and select the ASCII file name.

To import the ASCII file in DBase, you must use the DBase command 'APPEND FROM sourcefile DELIMITED'.

When you want to import the ASCII file in Microsoft Excel for Windows, you must select the *Open* command in the Excel *File* menu. Select the *Text* button In the dialog form. A new dialog form appears. In this dialog form you must make the following selections: for *Column delimiter* select *Comma*, and for *File origin* select *DOS*. Click on the Ok button to close this dialog form. Change *.XL* in the file name box into *.* and you can now select the ASCII file that was created by 3D-Calc. The data will be imported in the Excel spreadsheet.

QUIT (Control Q)

Select this menu command to stop the program. Be sure to have saved all data, possibly also a text file, before selecting this menu command and returning to the desktop.

WINDOW MENU

OPEN WINDOW (F1)

Select this menu command or press function key F1 to open a spreadsheet window. You can also open a spreadsheet window by double-clicking on a spreadsheet icon.

The active or current cell is displayed in reverse, and its coordinates (page, column, row) and contents are shown in the top line of the window.

Refer to appendix A of the manual for an overview of control keys and special key functions.

By pressing the Esc key, you can clear the contents of the current cell, and by pressing the UNDO key, you can restore the original contents of the cell.

Although it is possible to move the cell pointer with the arrow keys, it is preferable to use the mouse to move the cell pointer over several cells, or to move the cell pointer directly to any cell by using the *Goto cell* command (Control F8).

By pressing the TAB key you move the pointer to the next cell.

Press the Return key to move the cell pointer to the cell in the first column of the next row.

By pressing the Enter key you can store the new or edited contents of a cell without moving the cell pointer.

To move the cursor within the cell contents, use the left and right cursor keys while depressing the Control key. Use the CLR HOME key to move the cursor to the beginning of the row.

The BACKSPACE key is used to delete the character at the left of the cursor, the DELETE key deletes the character at the right side. Press the INSERT key to toggle between Overwrite and Insert editing mode.

Function keys

The meaning of the function keys, as defined in the following table, is shown at the bottom of the screen.

Function key		Shift	Control
F1	Open window	Close window	Autocalc ON/OFF
F2	Insert page	Delete page	Clear page
F3	Insert row	Delete row	Clear row
F4	Insert column	Delete column	Clear column
F5	Paste cell	Load cell	
F6	Transform		
F7	Repeat find	Find string	Goto cell
F8	Calculate	Define column	
F9	Page down	Pull page down	
F10	Page up	Push page up	

In order to copy the contents of a cell to another cell, you must place the cell pointer on the first cell (the source cell), and press function key SHIFT F5. By doing so, the contents of this cell is copied into a buffer in memory. Now move the cell pointer to the second cell (the target cell) and press function key F5. The contents of the buffer is now copied into this cell.

By pressing function key F6 you can transform the formula of the cell into its calculated result. E.g. move the cell pointer to a blank -empty- cell. Enter the formula 6*3 and press function key F6. The formula 6*3 is replaced by its calculated result 18.00. Move the cell pointer or press Enter to store the result into the cell.

Use F9 and F10 to go to the different pages of the spreadsheet.

SHIFT F9 and SHIFT F10 do not, in fact, display another page, but rather renumber the pages (SHIFT F10: page 0 becomes page 1, page 1 becomes page 2, page 2 becomes page 3, etc. and page 12 becomes page 0).

Multiple windows and titles

In 3D-Calc, 3 spreadsheet windows can be open simultaneously for one spreadsheet. By careful positioning and overlapping the windows, it is possible to lock a title row or column. For example the next picture shows two overlapping windows. When data are entered in the lower window, and the cursor is moved down causing the window to scroll, then the contents of the top row of the spreadsheet will still be visible in the upper window. Refer also to the synchronization option in the options menu.

Since the position and size of the spreadsheet windows are also saved in the 3D-Calc data files, the windows will automatically have the same position when the file was saved and is reloaded in memory.

SORT

Select the *Sort* command when you want to sort a range of rows of the spreadsheet according to the contents of a specific column on a specific page. If *Link Pages* is selected (see Options menu), all pages of the spreadsheet are sorted.

If Autocalc is ON then the spreadsheet is sorted according to the calculated values of the cells. If Autocalc is OFF, then the literal contents of the cell is used for sorting.

Sorting data in 3D-Calc can be time-consuming. To increase the program's performance to sort a list of data, it is recommended to turn both Autocalc and Link Pages OFF.

FIND (F7 and SHIFT F7)

Search for a specific string, starting from the current cell pointer position. If the string to search for (SHIFT F7) is specified already, F7 will perform a repeat search. First the current row is searched through, starting at the current cell pointer position, form left to right. If no match is found, search continues on the next row, and if still no match is found on the current page, search continues on the next pages.

The search specification can contain the ? and * wildcards. The ? wildcard indicates that the character on this position can be ignored and, * indicates that the rest of the cell can be ignored. For example: Jones matches Jon* and Jo?es.

If Autocalc is OFF (see Settings), the search string is compared with the literal or raw contents of the cell, otherwise it is compared with the cells' calculated values. E.g. if cell B10 contains SIN(90), resulting in 1.00, and the search string is 'SIN*', cell B10 will be ignored when Autocalc is ON.

FIND does not distinguish uppercase from lowercase characters.

GOTO CELL (Control F7)

Select this menu command (or press Control F7) and a dialog form displaying the current cell pointer coordinates (page, column and row) appears in the centre of the screen. Enter the coordinates of the cell to which you want to move the cell pointer to, and press Enter or select the OK button at the top right of the dialog form with the mouse.

DEFINE COLUMN (SHIFT F8)

Press function key SHIFT F8 to define the characteristics of a range of columns. You can define the column's width or precision or both, by selecting with the mouse one of, or both, the buttons at the left side of the form. Press Enter, or select OK to store the new column settings.

In the next example, column D will have a width of 16 characters, independent of the global column width as defined in the options menu.

```
┌─────────────────────────────┐
│ ⊠▒▒  DEFINE COLUMN  ▒▒│OK│    │
│                             │
│  From column   : D_         │
│  to column     : D_         │
│                             │
│ ■ Column width  : 16│        │
│                             │
│ □ Precision     : 2_        │
│                             │
└─────────────────────────────┘
```

After specifying a specific width or precision for a column, changing the global width or precision will have no effect on the cells of this column.

In order to reset the width and/or precision of a column to the global width/and or precision, you must blank the corresponding input fields by pressing the Esc key, and select one of, or both, the buttons at the left side of the form.

```
┌─────────────────────────────┐
│ ⊠▒▒  DEFINE COLUMN  ▒▒│OK│    │
│                             │
│  From column   : D_         │
│  to column     : D_         │
│                             │
│ ■ Column width  : └_        │
│                             │
│ □ Precision     : 2_        │
│                             │
└─────────────────────────────┘
```

CALCULATE WINDOW (F8)

When you have to enter a lot of data, it is more efficient to turn the automatic recalculation of the spreadsheet off, either using function key Control F1 or using the Calculations Options form in the options menu. When Autocalc is off, selecting menu command *Calculate* or pressing function key F8 will result in a forced recalculation of the spreadsheet.

PRINT DATA (Control O)

In the *Print* dialog form, you can enter the hexadecimal codes to initialize your printer. Enter page, column and/or row range for the spreadsheet data to be printed. The output can be directed to the screen (for preview), disk (for transferring data to another program, e.g. a word processor), or printer.

```
┌──────────────────────────────────────────┐
│ ▣ ░░░░░░░░░░░░ PRINT ░░░░░░░░░░░ ▣OK      │
│                                          │
│  Initialization : _____       │
│                                          │
│  Pauze between pages :  █NO█ │YES│        │
│                                          │
│  TO :  █PRINTER█ │SCREEN│  │DISK│         │
│                                          │
│  FROM              TO                     │
│  Page   : 0_       Page   : 0_            │
│  Column : A_       Column : E_            │
│  Row    : 0___     Row    : 10__          │
│                                          │
│                                          │
└──────────────────────────────────────────┘
```
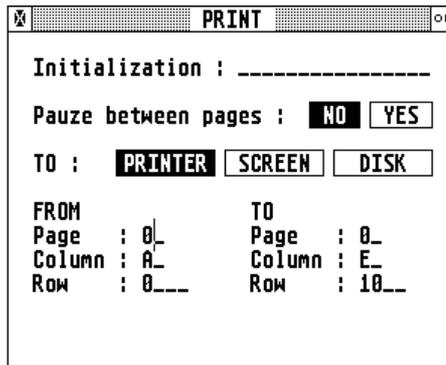
If Autocalc is OFF, the literal contents of the cells will be printed. If Autocalc is ON, the calculated results of the cells are printed.

In 3D-Calc, the print data procedure can also be used to export the spreadsheet data to other programs, using a formatted ASCII file file format.

CLEAR DATA (Control G)

With this menu command you clear the entire spreadsheet, including the spreadsheet macros, freeing up the memory for new data.

If you only want to delete the spreadsheet data, without losing the macros, you can use the Control F2 key in order to clear the different pages of the spreadsheet.

COMMAND LINE (Control F)

After selection of *Command line* the screen is cleared and the cursor waits at to top left corner of the screen. You are now in the command line mode. All commands as described in the chapter on the 3D-Calc Programming Language are available. Use the HALT command to return to the 3D-Calc desktop.

```
. clear
. print(a0)
. a0=5
. print(a0)
     5.00
. a1:=a0+2
. print(a1)
     7.00
. a0=8
. print(a1)
    10.00
. halt
```

In order to enter a number from 1 to 20 in cells A2 to A21, you can use the following commands:

```
. for row=2 to 21 do K(A)=row-1; next
. halt
```

OUTPUT WINDOW

Select Output window to print or to write the contents of the top window to the disk as a picture file. The output mode is specified under Options, Graph output format. Possible selections are: DEGAS, PCX, IMG (picture files) or PRINTER (hard-copy). If a disk file is selected, a file named GRAPHXX.??? will be created in the GRAPHS folder, where XX is a serial number and ??? is the extension according to the specified format.

After having saved a graph as a picture file, you can start your favourite drawing program to edit the graph by e.g. adding titles etc.

If you have selected PRINTER in the Graph output format dialog form, the program uses the computer's internal procedures for screen dump, or print-screen, to print the graph. Therefore, direct printing of a graph will only work if you have a printer connected to your computer that is able to print an adequate copy of the screen. In order to achieve this, it may be necessary to correctly set the printer in the ST's standard control panel to e.g. 960 pixels/line for a EPSON FX compatible printer.

```
┌─────────────────────────────────┐
│      INSTALL PRINTER            │
│ Printer Type: [ Dot ]  [ Daisy ]│
│        Color: [ B/W ]  [ Color ]│
│  Pixels/Line: [ 1280]  [ 960  ] │
│      Quality: [Draft]  [ Final ]│
│ Printer Port: [Printer] [Modem ]│
│   Paper Type: [ Feed ]  [Single]│
│       [ OK ]       [Cancel]     │
└─────────────────────────────────┘
```

If you are using a non-standard printer, you may need to load an additional printer driver before starting 3D-Calc.

BLOCK MENU

Dependent of the top window, the block menu commands and options refer to one of the three spreadsheets, or the text window.

Blocks are defined per spreadsheet, not per spreadsheet page. Most Block menu commands cannot be selected when all spreadsheet windows and the text window are closed.

The following block commands also apply to the text module: Set begin block, Set end block, Cut block, Paste block, Read block, Write block and Clear block.

In order to allow manipulation of large spreadsheet blocks, the program uses temporary files to store the information for CUT, COPY and MOVE block operations. These files are created in the folder specified in the PATHS form (see Options menu). If you do not dispose of a hard disk, and/or your ST is equipped with enough memory, it is recommended to install a RAM disk, and set the BLOCK path to this RAM disk in order to speed up block operations.

DEFINE BLOCK

When you select Define block, or drag the mouse over a range of cells, a dialog form is displayed which contains the following fields: the block's dimensions and the contents, precision and attributes of the cell in the top left side of the block.

In 3D-Calc, a cell can have one, or a combination of the following attributes:

Hide   The contents of the cell is not visible on the screen, and is not printed, but the formula
            is there and can be used by formula's in other cells;
Protect   The contents of the cell cannot be deleted or cleared;
Italic   The contents of the cell is displayed in *Italic* on the screen;

```
╔═══════════════════════════ DEFINE BLOCK ═══════════════════════════╗ OK
║                                                                     ║
║   ┌─── Block dimensions ───┐   ┌─ Attributes ─┐ ┌─ Graph info ─┐    ║
║   │ Page   : 0_    to : 0_ │   │              │ │              │    ║
║   │ Column : C_    to : E_ │   │    HIDE      │ │   X-range    │    ║
║   │ Row    : 2___  to : 48_│   │   PROTECT    │ │   Y-range    │    ║
║   │                        │   │   ITALIC     │ │  Data range  │    ║
║   └────────────────────────┘   └──────────────┘ └──────────────┘    ║
║                                                                     ║
║   Contents :   Precision : 2_                                       ║
║   ───────────────────────────────────────────────────────────      ║
║   ┌ Set attributes ┐┌ Set contents ┐┌ Set precision ┐┌ Set graph info ┐║
║   └────────────────┘└──────────────┘└───────────────┘└────────────────┘║
╚═════════════════════════════════════════════════════════════════════╝
```

Using the different options in this dialog panel, it is possible to set or change the contents, precision and/or attributes of a range of cells. Select the actions you want to perform: *Set precision* and/or *Set attributes* and/or *Set contents*. It is also possible to define *Graph info* ranges for the creation of graphs.

If you only want to define the dimensions of the block, select none of these actions. Press the Enter key, or select OK.

If you have selected one (or several) of the above actions, all cells in the specified block will get the same precision and/or attributes and/or contents.

In order to use blocks as an aid to define graphs, you can assign the block to an X-range, Y-range or Data-range. To do so, select the button *Set graph info* and one of the buttons *X-Range*, *Y-Range* or *Data range*. By doing so, the range of the block is copied to the dialog forms *Define variable*, *Define graph*, and *Define multiple range graph*, according to the following table:

X-range: Data for the statistics Averages and Percentiles, Histogram and Cumulative distribution.
            Data for the X-axis of the scatter diagram.
            Labels for the X-axis of the Bar, Line and
            Multiple range graphs.
            Labels that identify the segments of the Pie chart.

Y-range: Data for the Y-axis of the scatter diagram.
            Labels for the different elements of the Multiple range graph.

Data-range Data for the Bar and Line graph, Pie chart and Multiple range graph.

SET BEGIN BLOCK (Control B) - SET END BLOCK (Control E)

Select *Set begin block* to set the block's start point at the current cell pointer position.

Select *Set end block* to set the block's endpoint at the current cell pointer position.
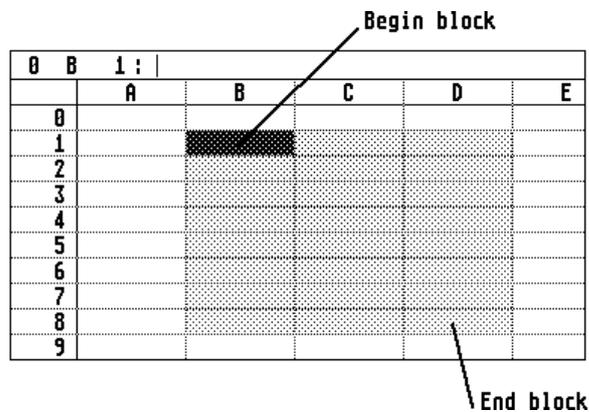
Block operations such as *Move block*, *Copy block*, *Cut block*, *Write block* can only be performed when the begin and end position of the block have been identified.

MOVE BLOCK (Control M)

Select this menu command if you want to move the block within the same spreadsheet. The defined block is the source area, and the cell pointer indicates the top left corner of the target area.

The cell pointer may be positioned in the source area so both areas overlap. When moving the block, the cells of the source area are copied to the target area and the source area is cleared.

The cell addresses used in the formulas in the block area that is being moved, will be adapted to fit the new location in the spreadsheet. In addition, the formulas in the entire spreadsheet that refer to cells in the block that is being moved, will also be adapted.
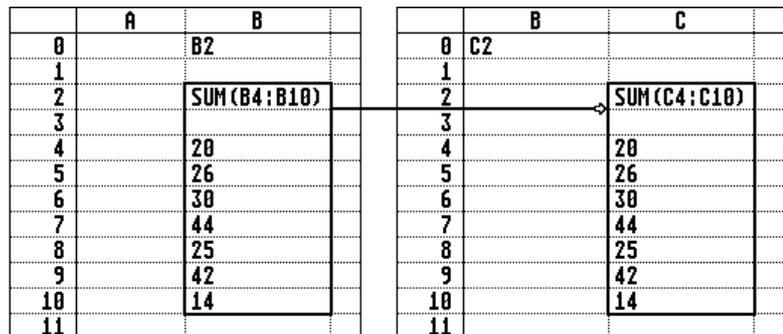
In the example above, the range B2:B10 is moved to C2:C10. The formula SUM(B4:B10), is adapted to the new position of the data. In addition, the cell reference B2 in cell B0 is also adapted to point to the new location of the SUM formula which was originally in cell B2, but is moved to cell C2.

COPY BLOCK (Control N)

Use the *Copy block* command in order to copy a block to another area in the same spreadsheet. As for moving blocks, the defined block is the source area, and the cell pointer indicates the top left corner of the target area. Both areas may overlap. When copying a block, the cells of the source area are copied to the target area, without clearing the source area.

The formulas in the block that is being copied will be adapted in order to fit the new location in the spreadsheet.

In the following example, the range B2:B10 is copied to D3:D11. The SUM formula, which is also copied, is adapted to point to the same range relative to the new position. The cell reference in cell B0 is not adapted.

	A	B	C	D	E
0		B2			
1					
2		SUM(B4:B10)			
3				SUM(D5:D11)	
4		20			
5		26		20	
6		30		26	
7		44		30	
8		25		44	
9		42		25	
10		14		42	
11				14	
12					

In 3D-Calc, there is an easy and quick method to copy a single cell. First put the cell pointer on the cell you want to copy, and press function key SHIFT-F5. The contents of the cell is now copied into an internal 3D-Calc buffer in memory. Next, move the cell pointer to the cell you want to copy to, and press function key F5. Cell addresses used in the cell that is being *pasted* will be adapted automatically. You can repeat pasting the internal buffer into several other cells, using function key F5.

COPY BLOCK TO TEXT

Select *Copy block to text* when you want to copy the block defined in the spreadsheet to the text window. This option is useful to copy an address into a letter, a table or a calculation into a text.

CUT AND PASTE BLOCK (Control C and Control P)

When you *Cut block* the defined block is cleared and the cells are saved in a buffer on disk. After selecting *Paste block*, the cells in the buffer are copied to a target area indicated by the cell pointer.

Cut block and *Paste block* may be used to transfer blocks between different spreadsheets in memory.

Similar as to Copy block, the formulas included in the cells that are being pasted, will be adapted to fit the block's new location.

WRITE BLOCK (Control W)

By selecting this menu command, you can store the defined block as a disk file. 3D-Calc block files have 3DB as an extension. If you want to transfer data between two spreadsheets with Write and Read block, you could speed up the read and write operations by using a RAM disk. To

change the default drive and path used by the program, select the Paths option in the Options menu, and enter the new block files' drive and folder.

READ BLOCK (Control R)

A block data file created using the *Write block* command can be inserted at the current cell pointer position by selecting the menu command *Read block*.

The formulas contained in the block that is read into the spreadsheet will be adapted automatically, in order to fit the new location in the spreadsheet, in a similar way as *Copy block*.

SET BLOCK VALUES (Control Y)

This function is used to transform the formula of a range of cells (=block) into their calculated results. After selection of this option all formulas in the block range will be destroyed and lost. This means that the cells do not longer contain the formula, but only contain the result of the formula.

Suppose cell D10 is located in the defined block, and it contains the formula A10+B10, and cells A10 and B10 contain the values 10 and 6 resp. Cell D10 will display 16. When the contents of either cell 10 or cell B10 is changed, cell D10 will be updated automatically. After selecting *Set values* in the block menu, cell D10 will not longer contain the formula A10+B10 but instead it contains the value 16. As a result, changing cell A10 or B10 does not longer affect cell D10.

HIDE BLOCK (Control H)

Normally, the defined block is displayed with a shaded background. If you want to remove this background, you must select the option Hide Block.

CLEAR BLOCK (Control K)

The *Clear block* command is used to clear all the cells in the defined block.

Note that in 3D-Calc, unlike in other spreadsheet programs, you do not need a special command to clear one single cell. If you only want to erase one cell, you can move the cell pointer to that cell and press the Esc key followed by the Enter key, or followed by moving the cell pointer.

STATISTICS MENU

AVERAGES AND PERCENTILES

After selection of *Averages and percentiles* the *Define variable* dialog form appears on the screen. Enter the following data:

Name   the address of a cell containing a name or description of the variable;

Data   the location of the data in the spreadsheet, i.e. the first and last cell addresses.

Possible cell address formats are e.g.: B1 (= current page, column B, row 1) or 1BA12 (= page 1, column BA, row 12).

Note that changes in the spreadsheet will not automatically cause a recalculation of the displayed statistics or reshaping of the graph screens.

In the *Averages and percentiles* window, the following statistics are calculated and displayed:

Number of cases: the number of cases N is the number of cells in the specified *Data* range with a numeric contents.

Range: the lowest and highest value of all observations.

Arithmetic mean: the arithmetic mean is the sum of all observations divided by the number of observations.

$$\overline{X} = \frac{\sum X}{N}$$

Geometric mean: the geometric mean is the *N*-th root of the product of *N* observations

$$G = \sqrt[N]{X_1\ X_2\ X_3 \dots X_N}$$

Harmonic mean: the harmonic mean is the reciprocal value of the arithmetic mean of the reciprocal values of all observations, and is calculated using the formula:

$$H = \frac{N}{\sum \frac{1}{X}}$$

Median: when you have 100 observations, and these are sorted from smaller to larger, than the median is equal to the middle value. If the distribution of the data is normal, than the median is equal to the arithmetic mean.

Mode: the mode of a number of observations is the observation with the highest frequency. In 3D-Calc the mode is calculated on the basis of grouped data. If the distribution of the data is normal, than the mode is equal to the arithmetic mean.

Mean absolute deviation: this is the arithmetic mean of the absolute value of the difference of the observations with the arithmetic mean.

Variance: the variance is the mean of the square of the differences of all values with the arithmetic mean. The variance is calculated using the formula:

$$s^2 = \frac{\sum (X - \overline{X})^2}{N - 1}$$

Standard deviation: the standard deviation is the square root of the variance:

$$s = \sqrt{\frac{\sum (X - \overline{X})^2}{N-1}}$$

When the distribution of the observations is normal, then 68% and 95% of all observations are located in the intervals $\overline{X} \pm 1s$ and $\overline{X} \pm 2s$ respectively. In the next figure the distribution curve is displayed of a number of observations with normal distribution and arithmetic mean equal to 0 and standard deviation equal to 1.
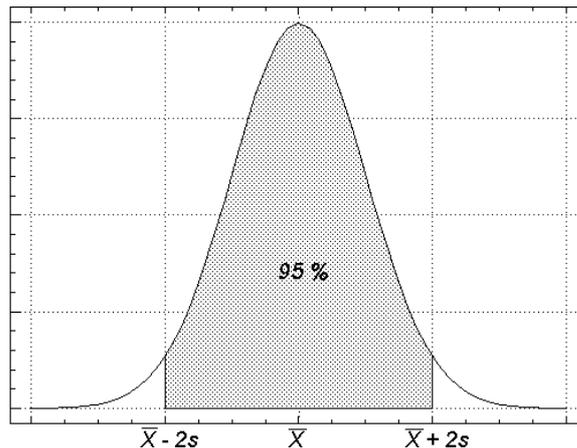
Standard error of the mean:

$$S.E.M. = \frac{s}{\sqrt{N}}$$

Coefficient of Kurtosis: the coefficient of Kurtosis is a measure for the peakedness of a distribution. For a normal distribution this coefficient is equal to 0. When the coefficient of Kurtosis is smaller than 0, then the histogram is platycurvic (flat-topped), and when the coefficient is larger than 0, the histogram is leptocurvic (high peak).

Skewness coefficient: the Skewness coefficient is a measure of the degree of asymmetry of a distribution. For a normal symmetrical distribution the Skewness coefficient is equal to 0. When the coefficient is less than 0, then the distribution is skewed to the left. If the Skewness coefficient is larger than 0, then the distribution is skewed to the right.

Percentiles: when you have 100 observations, and these are sorted from smaller to larger, then in principle, the 5th percentile is equal to the 5th observation, the 10th percentile is equal to the 10th observation etc.

HISTOGRAM
CUMULATIVE DISTRIBUTION

After selecting *Histogram* or *Cumulative distribution*, the same dialog form is displayed as for *Averages and percentiles*. Similarly, you must enter an address of a cell that contains a name for the variable, and the range of the cells containing the data, i.e. the first and last cell address.

In the histogram window, it can be evaluated visually whether the data are distributed symmetrical, normal or Gaussian or whether the distribution is asymmetrical or skewed.

When the distribution is not normal, it can not be accurately described by mean and standard deviation, but instead the median, mode, quartiles and percentiles should be used. The latter statistics are also reported in the *Averages and percentiles* window.
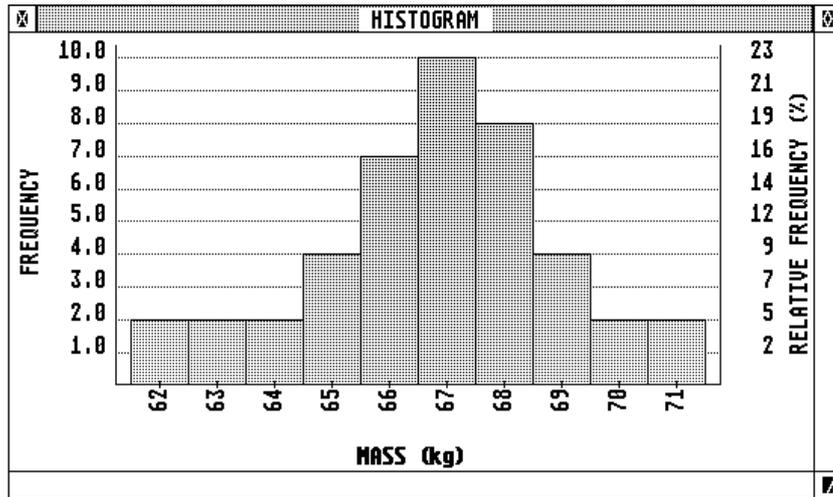
Select the option *Window grid* in the options menu in order to remove the horizontal grid lines in the histogram and cumulative distribution window, and by clicking with the mouse in these windows, you can change the fill pattern used in the diagrams.

REGRESSION AND CORRELATION

For *Regression and correlation*, cell addresses for names and data ranges for two variables must be entered in the *Define variables* form.

The *Regression and correlation* window displays the name, arithmetic mean and variance of the two variables, and the following statistics:

Number of cases: the number of data pairs

Coefficient of determination: this is the square of the correlation coefficient

Correlation coefficient with t-value and Degrees of Freedom. The correlation coefficient is calculated as follows:

$$r = \pm \sqrt{\frac{\sum (Y_{est} - \overline{Y})^2}{\sum (Y - \overline{Y})^2}}$$

The equation of the regression line: $Y = a + b X$

Standard error of estimate: this standard error can be used to construct lines on distances $s_{Y.X}$ and $2 s_{Y.X}$ from the regression line. In this interval 68% and 95% resp. of the data is located

$$s_{Y.X} = \sqrt{\frac{\sum (Y - Y_{est})^2}{N}}$$

25

Total variation: this is the sum of the squares of the difference between the Y values and their arithmetic mean

$$\sum (Y - \overline{Y})^2$$

Unexplained variation: this is the sum of the squares of the differences between the actual Y values and the estimated or predicted Y values (calculated using the equation of the regression line)

$$\sum (Y - Y_{est})^2$$

Explained variation:

$$\sum (Y_{est} - \overline{Y})^2$$

Correlation Coefficient

The correlation coefficient is a number between -1 and 1. In general, the correlation expresses the degree that, on an average, two variables change correspondingly.

If one variable, called the dependent variable, increases when the second one, the independent variable, increases, there is a positive correlation. In this case the correlation coefficient will be closer to 1. For instance the height and age of children is positively correlated.

If the dependent variable decreases when the independent variable increases, or vice versa, than there is a negative correlation and the correlation coefficient will be closer to -1. For instance, there is a negative correlation between age and hair growth of men.

It is important not to confuse correlation with causation. When two variables are correlated, there may or may not be a causative connection, and this connection may moreover be indirect.

The t-value which is also displayed in the window, is used to test the probability that the correlation coefficient is, in fact, zero. If this probability is lower than e.g. 5% or 10% the correlation coefficient is called statistical significant.

If for instance the window displays a correlation coefficient of 0.56, a t-value of 2.421, and degrees of freedom (DF) equal to 20, you must enter table 1 of appendix D in this manual, at the row corresponding with 20 DF. The t-value is situated between the value 2.086 and 2.845 corresponding with a probability of 5% and 1% respectively. Therefore the probability that the correlation coefficient might be 0, is between 5% and 1%. This is usually noted as $P<0.05$. Therefore, in this case, the conclusion would be that there indeed is a statistical significant positive correlation.

SCATTER DIAGRAM
DRAW CURVE

In the dialog form for the scatter diagram, the same cell addresses and ranges are entered as for regression and correlation.

In a scatter diagram, the correlation between two variables is represented graphically. With the option *Draw curve*, the straight line that fits best the plotted points can be drawn in the diagram. The equation of this line is displayed in the *Regression and correlation* window.

In order to remove the grid in the scatter diagram window, select *Window grid* in the options menu. Click with the mouse in the window if you want to change the point marker used in the XY diagram.

SCATTER DIAGRAM
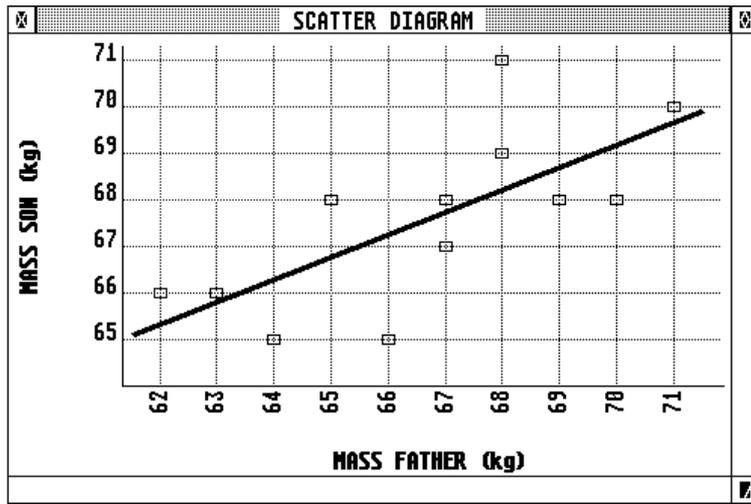
GRAPH MENU

BAR GRAPH
LINE GRAPH
PIE CHART

When you have selected one of these graphs in the menu, the following dialog form is displayed on the screen.

```
┌──────────────────────── GRAPH ────────────────────OK┐
│                                                      │
│  GRAPH TITLE  : |_____   OPTIONS :                │
│                                                      │
│  HORIZONTAL AXIS           3D-Graph  : │YES│NO│      │
│  LABELS range : _____   Grid      : │YES│NO│      │
│        to cell : _____   Auto Y-axis : │YES│NO│   │
│                                                      │
│  VERTICAL AXIS             Number of lines : __      │
│  DATA range   : _____   Increment      : _____    │
│        to cell : _____   Lowest value   : _____   │
│                                                      │
└──────────────────────────────────────────────────────┘
```

In this dialog form you must enter the following cell addresses:

Graph title   the address of a cell containing a title for the graph;

Label range   first and last cell address of a range of cells containing labels for the horizontal axis of the graph, or cells the identify the different segments of the pie chart;

Data range   first and last cell address of the numeric data to be represented in the graph on the vertical Y-axis, or in the Pie chart.

In the options panel you can select a graph with or without a grid, or you can define the scale of the Y-axis. Optionally, you may also select a three-dimensional representation of the graph (except for the pie chart).
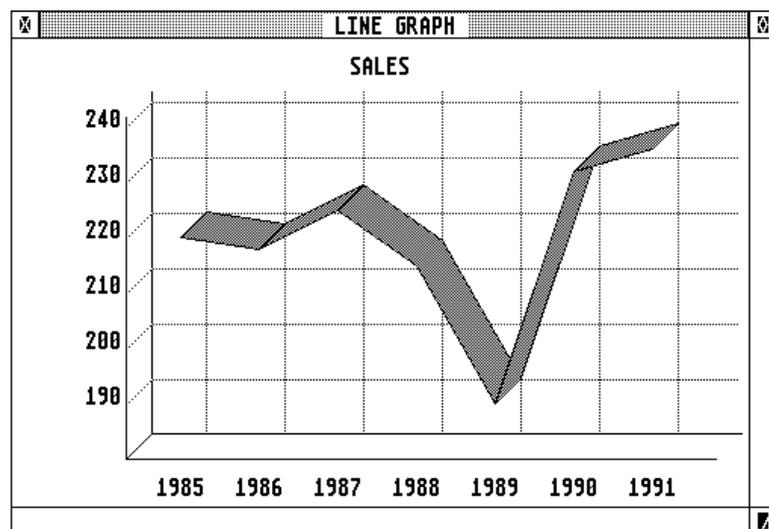
By clicking with the mouse in the bar graph window, you can change the fill pattern used in this diagram. By clicking with the mouse in the line graph window, you can change the marker used in this window.

Use the *Output window* menu command to print the graph or to output the graph as a file for input in a drawing program.

MULTIPLE RANGE GRAPH

In the Multiple range graph dialog form enter the address of a cell that contains an appropriate title for the graph. Enter the X and Y label range and the Data range. The Y label range contains a description of the different elements of the graph, e.g. the different lines in a multiple line graph. These elements will be identified at the top of the graph.

```
┌─────────────────────────────────────────────────────────────┐
│▓▓     MULTIPLE RANGE GRAPH                             OK│
├─────────────────────────────────────────────────────────────┤
│                                                             │
│  GRAPH      Graph title  : A0|_____    OPTIONS :           │
│  ▁▆▁▆                                                       │
│  BAR GRAPH  X - AXIS                     3D-Graph   : │YES│ ▉NO▉│
│             Label range  : A3_____                        │
│                   to cell : A9_____    Grid       : │YES│ ▉NO▉│
│  ▆▆▆                                                       │
│  STACKED    Y - AXIS                     Auto Y-axis : ▉YES▉ │NO││
│             Label range  : C2_____                        │
│                   to cell : D2_____    Number of lines : __│
│  ▉▉▉                                    Increment        : _____│
│  STACKED %                               Lowest value     : _____│
│                          Data range : C3_____             │
│  ╱╲                            to cell : D9_____          │
│  LINE GRAPH                                                 │
│                                                             │
└─────────────────────────────────────────────────────────────┘
```
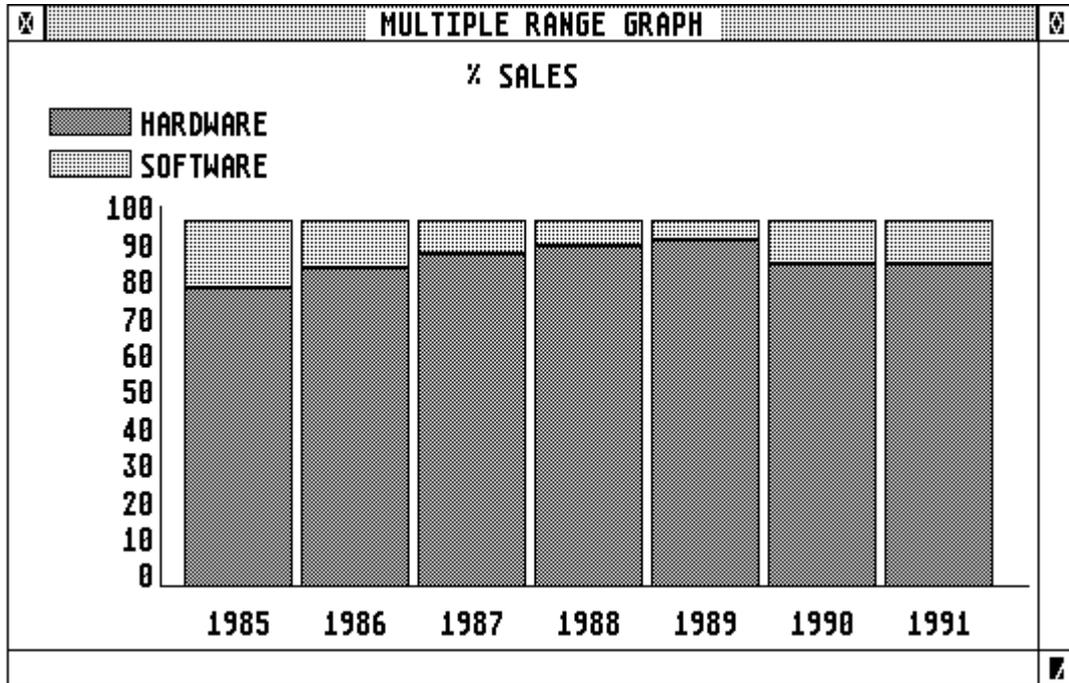
The graph type is selected by clicking with the mouse on the appropriate graph icon.

In the options panel you can select to display a grid in the graph and/or define the scale of the Y-axis. Also, you may select a three-dimensional representation of the graph.

```
┌─────────────────────────────────────────────────────────────┐
│▓▓           MULTIPLE RANGE GRAPH                          ▓│
├─────────────────────────────────────────────────────────────┤
│                        % SALES                              │
│   ▓▓▓▓ HARDWARE                                             │
│   ░░░░ SOFTWARE                                             │
│ 100┌─┬───┬───┬───┬───┬───┬───┬───┐                          │
│  90│ │   │   │   │   │   │   │   │                          │
│  80│ │   │   │   │   │   │   │   │                          │
│  70│ │   │   │   │   │   │   │   │                          │
│  60│ │   │   │   │   │   │   │   │                          │
│  50│ │   │   │   │   │   │   │   │                          │
│  40│ │   │   │   │   │   │   │   │                          │
│  30│ │   │   │   │   │   │   │   │                          │
│  20│ │   │   │   │   │   │   │   │                          │
│  10│ │   │   │   │   │   │   │   │                          │
│   0└─┴───┴───┴───┴───┴───┴───┴───┘                          │
│    1985 1986 1987 1988 1989 1990 1991                       │
└─────────────────────────────────────────────────────────────┘
```

FUNCTION GRAPH

The function command in the Graph menu permits to obtain the graph of a function defined in the spreadsheet. This means that you can vary the contents of a particular cell (the X-cell) and plot the contents of another cell (the Y-cell) in function of the variation in the X-cell.
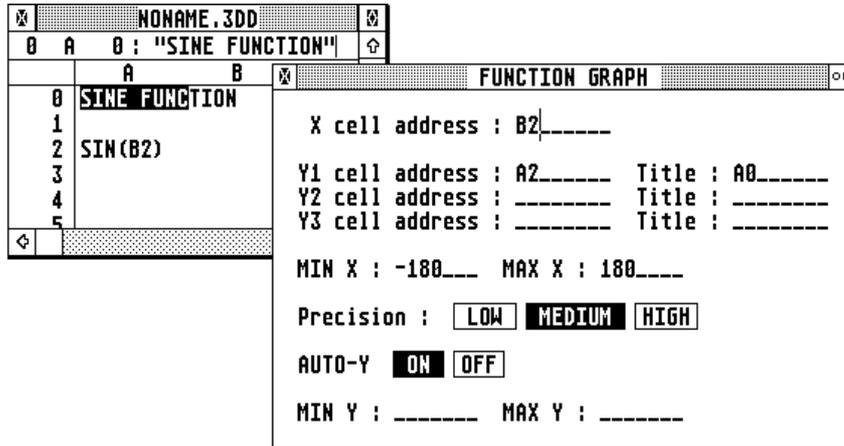
As an example, enter the following on page 0 of the spreadsheet:

cell A0 : "SINE FUNCTION"

cell A2 : SIN(B2)

Select *Function graph* in the graph menu.

For X cell address enter B2 and for Y1 cell address A2. For title enter A0; for MIN X enter -180 and for MAX X enter 180. Since Automatic Y is ON (default), you don't need to specify the graph's Y-axis range. If Auto Y if OFF, you must specify the Y range.

```
┌─┬─────────────────────────┬─┐
│Ⓧ│▒▒▒▒▒NONAME.3DD▒▒▒▒▒│Ⓧ│
│0  A    0: "SINE FUNCTION"│⇧│
├──┬────────┬──────┬─────────────────────────────────────────┐
│  │   A    │   B  │Ⓧ▒▒▒▒▒▒▒  FUNCTION GRAPH  ▒▒▒▒▒▒▒│OK│
│ 0│SINE FUNCTION  │                                         │
│ 1│        │      │    X cell address : B2|_____           │
│ 2│SIN(B2) │      │                                         │
│ 3│        │      │    Y1 cell address : A2_____   Title : A0_____ │
│ 4│        │      │    Y2 cell address : _____   Title : _____ │
│ 5│        │      │    Y3 cell address : _____   Title : _____ │
│◇ │▒▒▒▒▒▒▒▒▒│      │                                         │
└──┴────────┴──────┤    MIN X : -180___   MAX X : 180____     │
                   │                                         │
                   │    Precision :  [LOW] █MEDIUM█ [HIGH]    │
                   │                                         │
                   │    AUTO-Y  █ON█ [OFF]                    │
                   │                                         │
                   │    MIN Y : _____   MAX Y : _____     │
                   └─────────────────────────────────────────┘
```

Now press Return or select the OK button at the top right of the dialog form to see the graph.
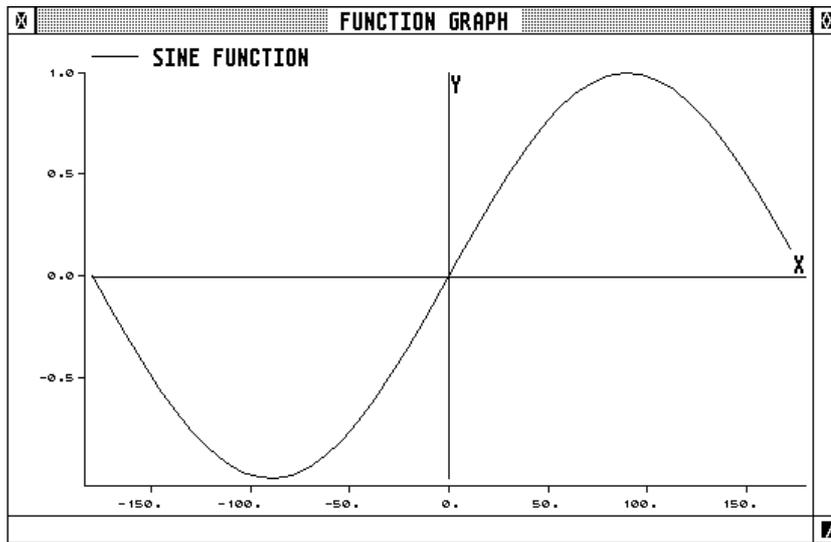
TEXT MENU

3D-Calc offers the facility to edit a short text. Some Block menu commands are also active for the text window: Set begin block, Set end block, Cut and Paste block, Read and Write block and Clear block.

The 3D-Calc text module can be used for creation of serial letters or labels with data-input from the spreadsheet (mail-merge); note-block during spreadsheet or graphs design; development and editing of 3D-Calc programs.

OPEN WINDOW (Control T)

Select this menu command, or press Control T to open the text window. Use the arrow keys to move the cursor, or position the cursor by clicking the left button of the mouse. Press the Insert key to toggle between Overwrite and Insert mode.

Use the Backspace key to delete the character left of the cursor and the Delete key to delete the character at the right side of the cursor. Pressing Control Delete deletes the word at the right of the text cursor. Press SHIFT F3 to delete an entire text line.

The text can reference data in the spreadsheet by means of the following functions: @C(), @K(), @R(), @P() and variables ROW, PAGE, COLUMN (see Print Text).

READ TEXT (Control I)

After selection of *Read text*, the standard file selector form appears. Select the text file to be read into memory. If the text is an ASCII file, such as e.g. the DESKTOP.INF or the ASSIGN.SYS file, this will be indicated by a check mark next to the corresponding menu option ASCII.

SAVE TEXT

This menu command is used to save the text with its previous filename. If the menu option ASCII is selected (checked), then the text file will be a true ASCII file. If the ASCII option is not selected, then the file will contain a small file header describing top margin, bottom margin, page width etc.

SAVE AS

Select Save as if you want to save a new text file, or to save an existing text file with a new name. 3D-Calc text files have 3DT as an extension.

ASCII

If the ASCII menu options is selected (checked), then the text files will contain no header describing the text format. In this way you obtain a true ASCII file such as e.g. the GDOS ASSIGN.SYS file.

FORMAT

Select Format to define the left, top and bottom margin, page length and text width. After pressing Return or Enter, or after selecting the OK button with the mouse, the text will be reformatted.

PRINT TEXT (Control U)

In the Print dialog form you can enter:

- the (hexadecimal) codes to initialize your printer;
- page, column and/or row range for the spreadsheet references in your text;

- and in the SELECT field you can enter a criterion used for mail-merge applications.

```
┌─────────────────────────────────────────┐
│▒▒▒▒▒▒▒▒▒▒▒▒▒ PRINT ▒▒▒▒▒▒▒▒▒▒▒▒▒│OK│
│                                         │
│ Initialization : _____       │
│                                         │
│ Pauze between pages :  │ NO │ YES        │
│                                         │
│ TO :  PRINTER │ SCREEN │ │ DISK │        │
│                                         │
│ FROM              TO                     │
│ Page   : 0_       Page   : 0_            │
│ Column : A_       Column : A_            │
│ Row    : 0___     Row    : 0___          │
│                                         │
│ Select : _____       │
└─────────────────────────────────────────┘
```

E.g.: if your text contains the formula @K(C) and you specify the range as:

Page	1	TO	1
Row	2	TO	10
Column	0	TO	0

then the program will output 9 copies of the text, with the formula @K(C) replaced with the contents of page 1, column C and row ranging from 2 to 10.

All other spreadsheet functions, indicated in the text by the @-sign, may also be used, and will be calculated during printing.

If your text contains the formula @6*2 then this formula will be replaced by the value 12. If the text contains the formula @UPPER(C2) then in the printed copy this formula will be replaced by the contents of cell C2 in uppercase.

When you are using the program for mail-merge, you can use the SELECT input field to define a selection criterion. If e.g. a spreadsheet file contains a list of members of a club, and in column E the membership fee for the current year is entered, you can write a letter to all members of the club who did pay their membership fee for the current year by entering the formula K(E)>0 in the SELECT field.

You can output the text to the screen (for preview), disk (for e.g. editing with a word processor) or printer (mail merge, labels, forms).

REFORMAT

When this menu options is selected (checked) then the text will be reformatted after replacing the spreadsheet formulas with their results. If you want to avoid this effect, you should cancel this option (no check mark).

PROGRAM (Control Z)

After selection of this menu command the text in memory will be interpreted as a 3D-Calc program. For a full description of the 3D-Calc programming language, refer to the corresponding chapter in this manual.

CLEAR (Control V)

After saving the text on disk, you can select this menu command to erase the text in memory.

MACRO MENU

3D-CALC MACROS

A sequence of the user's actions: pressing a key, clicking the mouse, opening a window, creating a graph, can be recorded and this sequence can be assigned to a particular key on the keyboard.

After pressing this *hot key*, simultaneously with the Alternate key, the sequence of actions is repeated. Such a macro is an ideal solution for automating repetitive tasks.

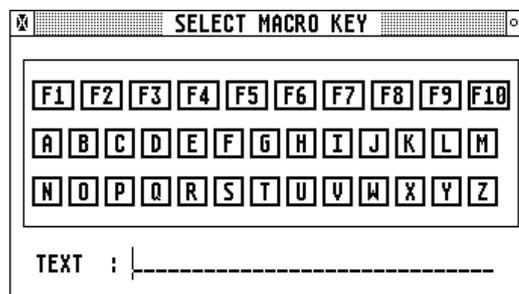In 3D-Calc you have 2 types of macros: Desk macros and Spreadsheet macros.

DESK macros can always be activated, and are independent of the active spreadsheet. Desk macros are always assigned to a function key. These 10 macros are saved as a separate disk file. The macro file 3D-CALC.MAC in the DATA directory is automatically read when starting the program. However, you can create several desk macro files, and load one when required. Saving a desk macro file is done by selecting the *Save macros* option in the *Macro* menu.

SPREADSHEET macros are macros that belong to a particular spreadsheet, so each spreadsheet possesses its own set of macros. The active spreadsheet macros are the macros belonging to the active spreadsheet. Spreadsheet macros are always assigned to a character key, and are stored in the spreadsheet data file.

After selecting the *List macros* command in the *Macro* menu, a window is opened that displays all active macros.

RECORDING OF A MACRO

Select the *Start recording* command in the Macro menu. From this moment on, all your actions are recorded, until you select the *End recording* menu command. A dialog form appears.

```
┌──────────────────────────────────────┐
│▨░░░░░░░░░ SELECT MACRO KEY ░░░░░░░░│OK│
├──────────────────────────────────────┤
│                                      │
│ [F1][F2][F3][F4][F5][F6][F7][F8][F9][F10]│
│                                      │
│ [A][B][C][D][E][F][G][H][I][J][K][L][M]│
│                                      │
│ [N][O][P][Q][R][S][T][U][V][W][X][Y][Z]│
│                                      │
│ TEXT : |_____ │
│                                      │
└──────────────────────────────────────┘
```

Select the key that you will use to replay the recording, or to activate the macro. Remember that, if you want the macro to be active at any moment, you have to select a function key to create a desk macro. If the recorded macro is specific for the active spreadsheet, select a character key to create a spreadsheet macro.

The 3D-Calc macro manager was not designed to record extensive actions such as e.g. the input of an entire text.

AUTOMATING 3D-CALC

DESK macros

If you want certain actions to be performed automatically when starting the program, such as loading a spreadsheet or opening a window, then you can record these actions and assign the macro to the function key F1. Select the Macro menu command *Save macros* and save the desk macros in a macro file named 3D-CALC.MAC in the data directory (as set with the Paths option in

the Options menu). This file is automatically read when the program is started, and the macro F1 is automatically executed.

SPREADSHEET macros

After reading a spreadsheet file the macro Alternate A, if defined, is automatically executed.

OPTIONS MENU

SETTINGS

The *Settings* dialog form looks like this:

```
┌─────────────────────────────────────────────────────┐
│ ⊠  ░░░░░░░░░░░░░░ SETTINGS ░░░░░░░░░░░░░░         │OK│
│                                                       │
│   Autocalc    │OFF│ ▐ON▌    Global column width : 9_  │
│                                                       │
│   Alert Error ▐OFF▌ │ON│    Global precision    : 0_  │
│                                                       │
│   Angle unit  │ RADIANS │ ▐ DEGREES ▌ │ GRADES │     │
│                                                       │
│   Date        ▐ DD/MM/YY ▌ │ MM/DD/YY │ │ YY/MM/DD │ │
│                                                       │
│   Time        │ HH:MM:SS AM/PM │  │ HH:MM AM/PM │     │
│               ▐ HH:MM:SS 24hrs ▌  │ HH:MM 24hrs │     │
│                                                       │
└─────────────────────────────────────────────────────┘
```

If *Autocalc* is ON, changing the contents of a cell will automatically cause the spreadsheet to be recalculated. If you have to enter a lot of data, it is more convenient to turn Autocalc OFF. The Control F1 key can be used to toggle between Autocalc ON and OFF. When Autocalc is OFF, you can force a recalculation by pressing function key F8.

If *Alert error* is ON, a message will appear when an error occurs in calculating a cell:

OM*   due to a too complex calculation (perhaps recursion).

ALTR*   when the Alternate and Control keys have been depressed simultaneously in order to interrupt the calculation of a cell. Pressing these keys while calculating a cell always makes the result unreliable, even though the alert might not appear.

ERR*   an error occurred (e.g. division by zero, arithmetic overflow etc.

Select the angle unit (radians, degrees or grades) to be used in the program. (Note that all examples in the manual assume the unit to be degrees). The relation between the 3 units is as follows:

$$2 \times Pi \text{ radians} = 360 \text{ degrees} = 400 \text{ grades}.$$

Select the date and time formats. The possible date formats are: DD/MM/YY, MM/DD/YY or YY/MM/DD; the possible time formats are: HH:MM:SS (AM/PM), HH:MM (AM/PM), HH:MM:SS (24 hr's) or HH:MM (24 hr's).

The global column width and global column precision affect those columns for which width and precision has not been specified by means of the *Define Column* option in the *Window* menu.

LINK PAGES

If *Link pages* is selected (as indicated with a check mark in the menu) then, when deleting or inserting a row, or sorting, all pages of the spreadsheet will be changed. If *Link pages* is not selected, these operations will only affect the active spreadsheet page.

Inserting or deleting a column in the spreadsheet, by pressing function keys F4 and SHIFT F4, always affects all pages of the spreadsheet.

COLUMN, ROW AND PAGE SYNCHRONIZATION

When one of these menu options is selected, then the different windows of the spreadsheet will always display the same column, resp. row or page.
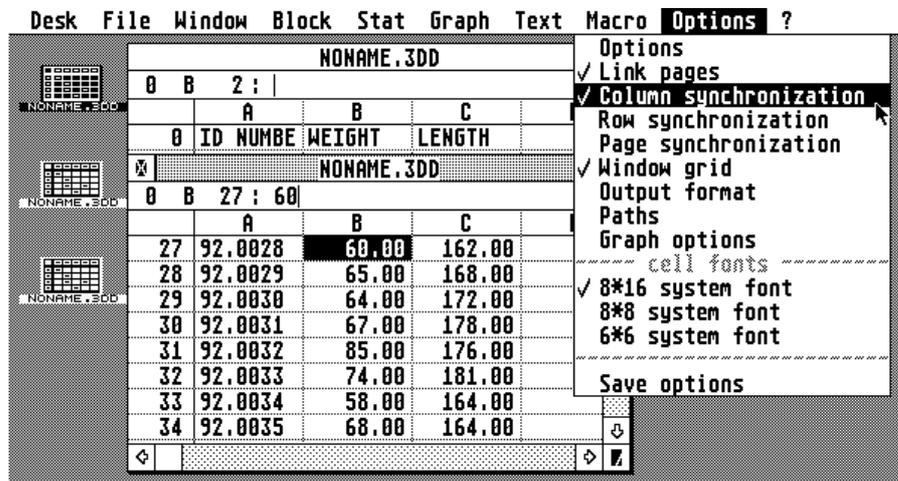
In the example, two windows are positioned in such a way that the upper window always displays the top row of the spreadsheet. However, when the cell pointer in the lower window is moved to the right, this window will scroll one column to the right. But when the option *Column synchronization* is selected then the top window will scroll to the right as well. The result is that the correct title will always be displayed in the upper window, corresponding with the columns and cell pointer in the lower window.

WINDOW GRID

If the option *Window grid* is selected (indicated by a check mark), then vertical and horizontal lines separate the cells in the active spreadsheet window. The contents of the cells is truncated to fit the column's width.

If the option *Window grid* is not selected, the horizontal and vertical lines are erased, and the cells are not truncated at the column's width when displayed in the spreadsheet window, or when printed, or when copied to the text window.

The option *Window grid* can also be used to remove or add a grid in the statistical *Histogram*, *Cumulative distribution* and *Scatter diagram* windows.

OUTPUT FORMAT

The graph or window output format can be selected in the *Output format* dialog panel. When you select *Output window* in the window menu, the contents of the top window is printed or written as a picture file on disk according to the specified format.
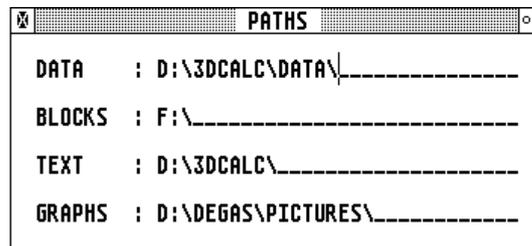
NAME	DEVICE	EXTENSION	FILE SIZE
DEGAS	Disk	PI?	32034
IMG	Disk	IMG	Compressed
PCX	Disk	PCX	Compressed
PRINTER	Printer	-	-

PCX picture files are particularly useful to transfer pictures to a MS-DOS computer system, since these files are compatible with Microsoft's Paintbrush.

PATHS

In the *Paths* dialog form you can enter the default path or folder (directory) names for the data, blocks, graph and text files. When your computer has enough memory, and you are using a lot of
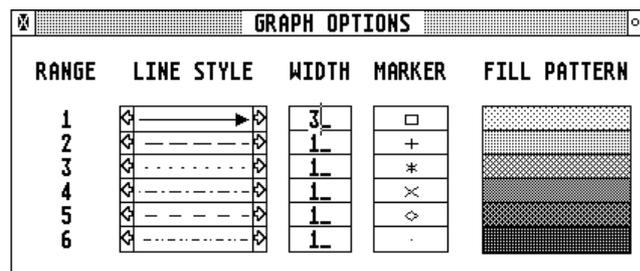
spreadsheet block Move, Copy, Read, Write, Cut and Paste operations, it might be useful to set the block's path to a RAM disk. However, if you do so, remember that the files saved in a RAM disk are forever lost when you turn the computer power off, or when you need to reboot the computer.

```
┌──┬──────────────────PATHS──────────────────┬──┐
│▓▓│                                          │OK│
├──┴──────────────────────────────────────────┴──┤
│                                                 │
│  DATA    : D:\3DCALC\DATA_____        │
│                                                 │
│  BLOCKS  : F:_____        │
│                                                 │
│  TEXT    : D:\3DCALC_____        │
│                                                 │
│  GRAPHS  : D:\DEGAS\PICTURES_____        │
│                                                 │
└─────────────────────────────────────────────────┘
```

GRAPH OPTIONS

Before a graphical window is opened, such as for a bar and line graph, histogram or scatter diagram, or multiple range graph, some graphical attributes can be set in the *Graph options* form.

For graphs displaying one or more lines, such as line graph, multiple line graph, scatter diagram, you can select line styles and optionally select an arrow at the begin and/or end of the line. Also, you can enter the line width. For the scatter diagram and line graphs you can also select the symbol or marker to identify different points in the graph.

```
┌──┬──────────────GRAPH OPTIONS──────────────┬──┐
│▓▓│                                          │OK│
├──┴──────────────────────────────────────────┴──┤
│  RANGE   LINE STYLE   WIDTH  MARKER  FILL PATTERN│
│                                                 │
│    1     ◁━━━━━━━▶▷    3_      □                  │
│    2     ◁ ─ ─ ─ ─▷    1_      +                  │
│    3     ◁ · · · · ·▷   1_      ✳                  │
│    4     ◁ ─·─·─·─▷    1_      ✕                  │
│    5     ◁ ─ ─ ─ ─▷    1_      ◇                  │
│    6     ◁ ─··─··─▷    1_      ·                  │
│                                                 │
└─────────────────────────────────────────────────┘
```

Finally, you can select different fill patterns for bar graph, histogram, multiple bar charts etc. For simple graphs such as bar graph, function graph, histogram, only the options in the top line (range 1) are used. The other graphical selections are used in the multiple range graphs.

Make sure to select the required graphical attributes before you create the graph.

CELL FONT

The *Cell font* options are used to select the current cell font (character size) to be used in the top spreadsheet window. When the global column size equals 8 and you are using a high resolution monochrome ATARI monitor, then when selecting system font 8*16, 144 (8 x 18) cells are visible, with font 8*8, 208 (8 x 26) cells are visible and with font 6*6 a total of 310 (10 x 31) cells are visible. The character size can be selected for every spreadsheet window separately.

SAVE OPTIONS

Use this command in order to save the default settings in a file named 3D-CALC.OPT. The spreadsheets' windows position and size etc. are also saved in this option file.
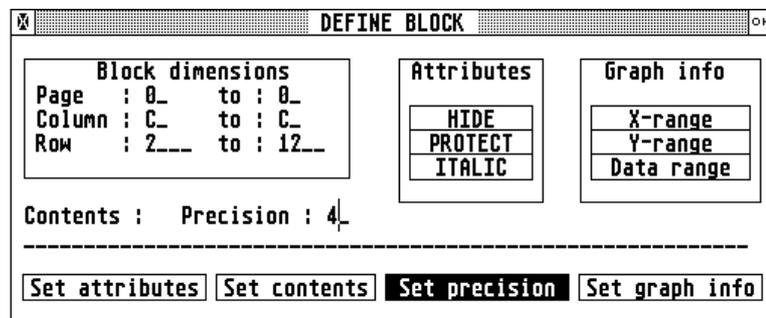
EXPRESSIONS AND CELL ADDRESSING

INTRODUCTION

In 3D-Calc, as in other spreadsheets, a cell can contain a text or string entry, or it can contain a number or a formula.

An example or a string entry is a name such as e.g. "Howard", Usually, string entries are placed between quotation marks.

A cell can also contain a number, negative or positive, and with or without a decimal fraction. E.g. 5, -23.5, 0.03. The number of decimals that 3D-Calc displays after the decimal point is called the precision. The precision used globally in the spreadsheet is selected in the options panel which can be found in the options menu. However, a different precision may be selected for one cell, or for a range of cells. This is achieved by means of the Set precision option in the Define block panel of the Block menu.

```
┌──────────────────────────────────────────────────────────┐
│ⓧ░░░░░░░░░░░░░░░░░░ DEFINE BLOCK ░░░░░░░░░░░░░░░░░░░░░░│OK│
│                                                          │
│  ┌─────────────────────┐ ┌──────────┐ ┌──────────────┐  │
│  │   Block dimensions  │ │Attributes│ │  Graph info  │  │
│  │ Page   : 0_    to : 0_ │ │          │ │              │  │
│  │ Column : C_    to : C_ │ │  ┌──HIDE──┐ │ │ ┌──X-range──┐ │  │
│  │ Row    : 2___  to : 12__│ │  │PROTECT │ │ │ │ Y-range   │ │  │
│  └─────────────────────┘ │  │ ITALIC │ │ │ │Data range │ │  │
│                          └──────────┘ └──────────────┘  │
│  Contents :   Precision : 4|                             │
│  ──────────────────────────────────────────────────────  │
│  ┌─────────────┐┌─────────────┐┌─────────────┐┌─────────────┐│
│  │Set attributes││Set contents ││Set precision││Set graph info││
│  └─────────────┘└─────────────┘└─────────────┘└─────────────┘│
└──────────────────────────────────────────────────────────┘
```

A formula may a simple mathematical formula, such as e.g. SQR(36). This formula will return the value 6, which is the square root of the number 36. Alternatively, the number 36 may be entered in a different cell of the spreadsheet, and the SQR function can take the address of this cell as an argument.

```
┌─────────────────────────┐
│ 0   B   1 : SQR(B5)|    │
├──────┬─────────┬─────────┤
│      │    A    │    B    │
├──────┼─────────┼─────────┤
│  0   │         │         │
│  1   │         │  6.00   │
│  2   │         │         │
│  3   │         │         │
│  4   │         │         │
│  5   │         │  36.00  │
│  6   │         │         │
└──────┴─────────┴─────────┘
```

In 3D-Calc more than 100 formulas are available. Most of these formulas work similar to their equivalents in other spreadsheet programs. However, in the 3D-Calc spreadsheet these formulas are not preceded by the @ character. And when a formula begins with a cell address, this must not be preceded by a + sign.

When a formula in a cell uses the contents of another cell, either relative or absolute cell addresses may be used to refer to this cell. In the next example, a formula with a combination of relative and absolute cell addresses is entered in cell c6.

```
      │    A     │    B     │    C
 0 │ PRICELIST│          │
 1 │          │          │
 2 │          │ VAT:     │ 16
 3 │          │          │
 4 │ AMOUNT   │ PRICES   │
 5 │          │ EXCL. VAT│ VAT
 6 │ 10       │ 200      │ B6*$C$2/100
 7 │ 20       │ 380      │
 8 │ 50       │ 900      │
 9 │ 100      │ 1700     │
10 │ 500      │ 8000     │
11 │          │          │
```

Next, the mouse is dragged over the cells C6 to C10. The define block dialog panel appears and the option *Set contents* is selected in order to fill all cells in the block with the same formula.

```
╔══════════════════════ DEFINE BLOCK ══════════════════════ OK
║
║   ┌───── Block dimensions ─────┐  ┌─ Attributes ─┐  ┌─ Graph info ─┐
║   │ Page   : 1_    to : 1_     │  │    HIDE      │  │   X-range    │
║   │ Column : C_    to : C_     │  │   PROTECT    │  │   Y-range    │
║   │ Row    : 6___  to : 10__   │  │   ITALIC     │  │  Data range  │
║   └────────────────────────────┘  └──────────────┘  └──────────────┘
║
║    Contents :   Precision : 2_
║    B6*$C$2/100|_____
║
║   ┌ Set attributes ┐ ┌ Set contents ┐ ┌ Set precision ┐ ┌ Set graph info ┐
╚═══════════════════════════════════════════════════════════════════
```

The result is shown below. The cell addresses in the formulas in the different cells were adapted to fit their new location. In all formulas the reference to cell C2 remains unchanged because the address is entered as $C$2, which indicates absolute addressing mode.

```
      │    A     │    B     │    C
 0 │ PRICELIST│          │
 1 │          │          │
 2 │          │ VAT:     │ 16
 3 │          │          │
 4 │ AMOUNT   │ PRICES   │
 5 │          │ EXCL. VAT│ VAT
 6 │ 10       │ 200      │ B6*$C$2/100
 7 │ 20       │ 380      │ B7*$C$2/100
 8 │ 50       │ 900      │ B8*$C$2/100
 9 │ 100      │ 1700     │ B9*$C$2/100
10 │ 500      │ 8000     │ B10*$C$2/100
11 │          │          │
```

OPERATORS

The arithmetic operators, in order of precedence, are :

^	Exponentiation
-	Negation
* /	Multiplication, division
+ -	Addition, subtraction

Relational operators compare two numbers or two strings. The result is a logical value expressed as a number, either 1 (=TRUE), or 0 (=FALSE). The relational operators, in order of precedence, are:

=	Equality
<>	Inequality
<	Less than

>	Greater than
<=	Less than or equal to
>=	Greater than or equal to

In 3D-Calc you also dispose off the logical operators AND and OR. These operators perform tests on 2 relations:

AND	Logical AND
OR	Logical OR

When arithmetic and relational operators are combined in one expression, the arithmetic are performed first. You have to use parentheses when you want to change the order in which the operations are performed. Operations within parentheses are performed first.

B6<5+3	Returns 1 if the contents of B6 is less than 8, otherwise this expression returns 0.
5+3*(A1>3)	Returns 8 if cell A1 contains a value greater than 3 (since A1>3 = TRUE = 1). If A1 contains 3 or a number less than 3, this expression returns 5 (A1>3 = FALSE = 0).

VARIABLES AND CONSTANTS

The logical constants TRUE and FALSE correspond to the numeric values 1 and 0.

The variables COLUMN (or COL), ROW and PAGE refer to the current column, row and page respectively.

The variables KHigh, RHigh and PHigh contain the highest column, row and page number used by the program. These variables are particularly useful to optimize range specifications. E.g. in cell B2 you want to know the sum of all cells in column B starting from row 10. You might enter the formula SUM(R(10):R(2047)) using 2047 to make sure that all rows are taken into account. Although the result will be the same it will be less time consuming to evaluate the formula SUM(R(10):R(RHIGH)).

The constant PI = 3.14159265.

A combination of letters with a number (e.g. BG256) is considered to be a cell reference, but letters only are interpreted as a number (e.g. A=0, BC=28).

String values are denoted by quotation marks. E.g.: "NAME", "Jones", 'Year'.

RELATIVE AND ABSOLUTE CELL ADDRESSES

If you want to use the value of a cell in a formula in another cell of the spreadsheet, than you must refer to this cell by means of its cell address, consisting of a column indicator and a row number. E.g. cell D14 is the cell in column D, row 14. In 3D-Calc, this cell address can optionally be preceded by a page number. E.g. cell 1D14 is cell D14 on page 1, cell 4E26 is cell E26 on page 4.

When a cell address includes a $ character before the page, column or row number, the address is considered as an absolute address. When cell C10 contains for instance the formula $B$5+$B$6, the actual addresses of these two cells are stored in memory. When the formula is copied or moved to cell C11, e.g. by inserting a row at row 9 by pressing function key F3, the formula will still be $B$5+$B$6.

When a cell address does not include any $ characters, the address is considered to be a relative address, which means that the program does not store the actual address self, but instead the program stores the number of columns and rows calculated relative to the cell containing the formula. When cell B5 contains the cell address B4, then the program does not store the address itself but stores how to get from cell B5 to cell B4, in this case one row up. When the formula 2*B4 is copied from cell B5 to cell D10, the formula will be changed to 2*D9.

When cell B1 contains the formula SUM(B2:B10), and this formula is copied to cell C1, the formula will be converted to SUM(C2:C10). When it is copied to cell D51, the formula will be converted to SUM(D52:D60).

A cell address or formula may contain a combination of absolute and relative cell addressing, e.g.: A$2, $B10, $1C5, SUM(B3:B20)*$A$1.

Indirect cell addressing is possible with the functions: C(p,x,y) Cell-function, K(x) Column-function, R(y) Row-function and P(p) Page-function (see further).

Ranges of cells are identified by two cell addresses separated by a colon. These cell addresses may also include relative and absolute cell addresses, e.g. B2:E8, $A$10:$A$25, K(A):K(D), 0D10:12D10, etc.

When designing a spreadsheet, attention should be paid to when to use relative and when to use absolute cell addressing.

INDIRECT CELL ADDRESSING FUNCTIONS

CELL FUNCTION C([p,],c,l)

Syntax: C([pagenumber,] columnnumber, rownumber)

Explanation: this function returns the contents of the cell whose address is passed as three parameters to the function. The first parameter, which may be omitted, is the page number, the second parameter is the column number and the third parameter is the row number of the cell.

C(3, D, 12)	returns the contents of cell 3D12. If you are working on page 3, then the page number may be omitted, and the formula may be written as C(D, 12).
C(0,2,10)	Returns the contents of the cell on page 0, column C and row 10.
C(A,-2)	Returns the contents of the cell on the current page, in column A, 2 rows higher than the current row.
C(N,B4)	Returns the contents of the cell on the current page, in column N and on the row which is specified in cell B4.

Relative addressing

Syntax: C([+ p,] + x, + y)

Explanation: when the page number, the column number and/or the row number are preceded by a + or - sign, then these parameters are calculated relative to the cell containing the formula.

A positive sign gives:	p pages next
	x columns left
	y rows up
A negative sign gives:	p pages previous
	x columns right
	y rows down

Example: C(D,-1) returns the contents of the cell, on the same page, in column D, in the previous row. If this formula is entered in cell E8, it refers to cell D7 (column D, row 8-1=7). When the formula is copied to cell E9, it refers to cell D8 (column D, row 9-1=8).

Note:

C(page,x,y)	= C(x,y)
C(x,row)	= K(x)
C(col,x)	= R(x)
C(x,col,row)	= P(x)

COLUMN FUNCTION K([p,]c)

Syntax: K([pagenumber,] columnnumber).

Explanation: this function returns the contents of a cell located on the specified page and column, but on the same row as the cell the formula is entered in. The first parameter, the page number, may be omitted when the function refers to a cell on the same page.

Example: When you enter the formula K(B) in cell D12, the formula returns the contents of cell B12, on the same page. When you copy the formula to cell D13, it returns the contents of cell B13, etc.

The formula K(B) + K(C) returns the sum of column B and column C. When the formula is entered in cell E2, it will return the sum of cells B2 and C2. When the formula is copied to cell E3, it returns the sum of cells B3 and C3. You can copy the formula to all other rows in column E, and the result will always be the sum of the corresponding cells in column B and C.

Relative addressing

Syntax: K([+ p,] + x)

Explanation: when the page number, and/or the column number are preceded by a + or - sign, then these parameters are calculated relative to the cell containing the formula.

A positive sign gives: p pages next
                          x columns left

A negative sign gives: p pages previous
                          x columns right

Example: K(-1) returns the contents of the cell, on the same page, on the same row, in the previous column. If this formula is entered in cell C8, it refers to cell B8 (row 8, column C-1). When the formula is copied to cell D8, it refers to cell C8 (row 8, column D-1).

Note:

K(2)	= C(2,row)
K(-2)	= K(col-2)
K(+2)	= K(col+2)

ROW FUNCTION R([p,]c)

Syntax: R([pagenumber,] rownumber).

Explanation: this function returns the contents of a cell located on the specified page and row, but in the same column as the cell the formula is entered in. The first parameter, the page number, may be omitted when the function refers to a cell on the same page.

Example: When you enter the formula R(2) in cell B6, the formula returns the contents of cell B2, on the same page. When you copy the formula to cell C6, it returns the contents of cell C2, in cell D8 it returns the contents of cell D2, etc.

The formula R(2) + R(3) returns the sum of row 2 and row 3. When the formula is entered in cell D8, it will return the sum of cells D2 and D3. When the formula is copied to cell E8, it returns the sum of cells E2 and E3. You can copy the formula to all other columns, and the result will always be the sum of the corresponding cells in rows 2 and 3.

Relative addressing

Syntax: R([+ p,] + y)

Explanation: when the page number, and/or the row number are preceded by a + or - sign, then these parameters are calculated relative to the cell containing the formula.

A positive sign gives: p pages next
                          y rows up

A negative sign gives: p pages previous
                          y rows down

Example: R(-2) returns the contents of the cell, on the same page, in the same column, 2 rows up. If this formula is entered in cell C8, it refers to cell C6 (column C, row 8-2=6). When the formula is copied to cell C16, it refers to cell C14 (column C, row 16-2=14).

Note:

R(25)	= C(col,25)
R(-4)	= R(row-4)

PAGE FUNCTION P(p)

Syntax: P(pagenumber)

Explanation: this function takes only 1 parameter. When you use the function in a cell, the formula returns the contents of the cell at the same location on the specified page of the spreadsheet.

Example: when you enter the formula P(3) in cell 0A4, the function returns the contents of cell 3A4.

Relative addressing

Syntax: P(+ p)

Explanation: when the page number is preceded by a + or - sign, the page is calculated relative to the cell the formula is used in.

A positive sign gives: p pages next

A negative sign gives: p pages previous

Example: in cell 0D5, the formula P(+2) returns the cell 2D5. In cell 1D5, the formula P(+2) returns the cell 3D5.

Note:

    P(5)   = C(5,col,row)
    P(-1)   = P(page-1)

INDIRECT ADDRESSING

In any of the formulas on the previous pages, C([p,] x, y), K([p,] x), R([p,] y) or P(p), one or more of the parameters may be a cell address itself! In this way, it may de decided in any other cell of the spreadsheet which cell, column, row or page to use in the formula.

	A	B	C
0	ROW NUMBER :	10,00	
1			
2		Phil	◇ R(B0)
3			
4		Kathy	
5		Ben	
6		Ann	
7		Lisa	
8		Susan	
9		Frank	
10		Phil	
11		Laura	
12		Murier	
13			

HOW A CELL KNOWS ITS OWN LOCATION

How can a cell know where it is located in the spreadsheet? For this purpose, 3D-Calc has introduced the variables PAGE, COLUMN and ROW.

At any time, these 3 variables return the coordinates of the cell that is being processed. When you enter COLUMN, or in short COL, in any cell of the spreadsheet, the column number of that cell will be displayed. Similarly, the variables PAGE and ROW return the page and row number.

If you enter the formula C(page,col,row) in a cell, this will cause an error, because the cell references itself (circular reference).

MATHEMATICAL FUNCTIONS

ABS Absolute value

The function ABS(x) returns the absolute value of the expression x.

     ABS(-6.3)   = 6.3
     ABS(A1)   = 6.3 if A1 contains -6.3 or 6.3

ACOS Arc cosine function

ACOS(x) returns the arc cosine of x. The arc cosine function is the inverse function of the cosine function and calculates the angle for a given cosine. X must be in the [-1..1] range. The result is a number in the range [0..180] (degrees).

ASIN Arc sine function

ASIN(x) returns the arc sine of x. The arc sine function is the inverse function of the sine function and calculates the angle for a given sine. X must be in the range [-1..1]. The result is a number in the range [-90..90] (degrees).

	A	B	C	D	E
0		-1.00	0.00	1.00	
1					
2	ACOS	180.00	90.00	0.00	◇ ACOS(D0)
3	ASIN	-90.00	0.00	90.00	◇ ASIN(D0)
4	ATAN	-45.00	0.00	45.00	◇ ATAN(D0)
5					

ATAN Arc tangent function

ATAN(x) returns the arc tangent of x. The arc tangent function is the inverse function of the tangent function and calculates the angle for a given tangent. The result is a number in the range [-90..90] (degrees).

COS Cosine function

COS(x) returns the cosine of an angle x. The result range is [-1..1].

     COS(30)   returns 0.87

EXP Natural exponential function

The function EXP(x) returns the natural exponential of x: 2.71828^x.

     EXP(0)   = 1
     EXP(1)   = 2.71828

EXP and LN are inverse functions:

     EXP(LN(x))   = x
     LN(EXP(x))   = x

FACT Factorial function

FACT(x) returns the factorial of x, i.e. 1*2*3*...*X. If the function results in an arithmetic overflow (when x is more than 34), the result is an error message.

        FACT(5)   = 120

INT Integer value

This function returns the integer portion of a number.

        INT(34.23)   = 34
        INT(6.4)   = 6
        INT(-6.4)   = -6

LN Natural logarithm function

LN(x) returns the natural logarithm of the positive number x to the base e (e = 2.71828). The argument x must be greater than 0.

        LN(2.71828)   = 1
        LN(1.25)   = 0.22

LN and EXP are inverse functions:

        EXP(LN(x))   = x
        LN(EXP(x))   = x

LOG Logarithm function

LOG(x) returns the logarithm of the positive number x in the base 10. The argument x must be greater than 0.

        LOG(1.5)   = 0.18

Note:

        LOG(10^x)   = x
        LOG(10*x)   = 1 + LOG(x)

MOD Modulo function

The MOD function takes one or two arguments. In case of one argument, the function MOD(x) returns the decimal fraction of the number x. In case of two arguments, the function MOD(x,a) returns the remainder of the division of x by a.

        MOD(25.36)   = 0.36
        MOD(15,4)   = 3

Note:

        MOD(x,1)   = MOD(x)
        MOD(x,y)   = y*MOD(x/y)

RND Random number function

This function generates a pseudo-random number between 1 and its argument. This random number is not drawn from a genuine random number table but is computer generated. The function will return a different value every time the spreadsheet is recalculated. If you want to fix the random number, refer to 'Set values' in the block menu.

        RND(10)   returns a pseudo-random number between 1 and 10.
        RND(0)   = 0

ROUND Round function

Round(x [,n]) returns the rounded value of x to n decimals. If the number of decimals is not specified, the number is rounded to a whole number.

      ROUND(5.26,1)   = 5.3
      ROUND(5.26)   = 5

SGN Sign value

SGN(x) returns a number that indicates the sign x: -1 if x is negative; 0 if x equals 0; or 1 if x is positive.

      SGN(0)   = 0
      SGN(B12)   = -1 if cell B12 contains a value < 0

Note:

      SGN(x)*ABS(x)   = x

SIN Sine function

This function returns the sine of an angle. The result range is [-1..1].

      SIN(x)^2+COS(x)^2   returns 1.00

SQR Square root function

This function returns the square root of a positive number. If the argument of the function is negative, the function returns an error.

      SQR(16)   = 4
      SQR(-2)   returns an error

TAN Tangent function

This function returns the tangent of an angle.

      TAN(0)   = 0
      TAN(87)   = 19.08

FINANCIAL FUNCTIONS

CTERM Compounding periods

CTERM(*int*,*fval*,*pval*) computes the number of periods for an investment with present value *pval* to grow to a future value *fval*, when earning a fixed interest rate *int*.

CTERM(1%,10,5) returns 69.66. This means it will take about 70 months to double 5$, with a monthly interest rate of 1%.

DDB Double-declining depreciation

DDB(*cost*,*salv*,*life*,*period*) computes the double-declining depreciation allowance of an asset for a specific *period*, given the original *cost*, predicted salvage value *salv* and the *life* of the asset. The program continuously adjusts the result to ensure that the total depreciation taken over the life over the asset equals the asset's cost minus its salvage value.

FV Future value

FV(*pmt*,*int*,*term*) computes the future value of a series of payments *pmt* over a period of time *term* and earning interest rate *int*.

FV(1000,10%,5) returns 6105.10. This is the value of your account after 5 years, with an annual investment of 1000 and interest rate of 10%.

NPV Present value of future cash flows

NPV(int,range) returns the present value of a series of future cash flows in *range*, discounted at periodic interest rate *int*. This function is useful to evaluate various investment possibilities.

0 B 4 : NPV(B3,B1:D1)			
	A	**B**	**C**	**D**
0	YEAR	1990.	1991.	1992.
1	INCOME	100.	120.	150.
2				
3	Discount Rate	0.10	◇ 10%	
4	Net Present Value	303.	◇ NPV(B3,B1:D1)	
5				

PMT Periodic payment

PMT(*prin*,*int*,*term*) returns the amount of the periodic payment needed to pay of a loan amount *prin*, at periodic interest rate *int*, over the number of payment periods in *term*.

PMT(10000,8%,10) results in 1490.29. This is the periodic payment needed to pay of a loan of 10000 in ten years time, given a yearly interest rate of 8%.

PV Present value

PV(*prin*,*int*,*term*) returns the present value of a series of equal payments of amount *pmt*, discounted at periodic interest rate *int*, over the number of payment periods in *term*.

```
0  B    5 : PV(B1,B2,B3/12)|
           A              B        C         D
    0
    1  PAYMENT        100.00
    2  INTEREST         0.08    ◇ 8.0%
    3  TERMS (months)  36.00
    4
    5  PRESENT VALUE  257.71    ◇ PV(B1,B2,B3/12)
    6
```

RATE Periodic interest rate

RATE(*fval*,*pval*,*term*) computes the periodic interest rate necessary for the present value *pval*, to grow to the future value *fval*, over the number of compounding periods in *term*.

RATE (10000,7000,5) results in 0.074 (=7.4%). This is the periodic (e.g. yearly) interest rate for an investment of 5000 growing to 10000 in 5 periods (years).

SLN Straight-line depreciation

SLN(*cost*,*salv*,*life*) returns the straight-line depreciation allowance of an asset for one period, given the *cost*, the predicted salvage value *salv*, and *life* of the asset.

SYD Sum-of-the-year's digits depreciation

SYD(*cost*,*salv*,*life*,*period*) returns the sum-of-the-year's digits depreciation allowance of an asset for a specific *period*, given the *cost*, the predicted salvage value *salv* and the *life* of the asset.

The three different depreciation functions are compared in the following figure:

```
        A            B      C              D
 0
 1  COST        :  10000
 2  SALVAGE VALUE :  1000
 3  LIFE        :      5
 4
 5  DEPRECIATION
 6  PERIOD      :      1      2
 7
 8  DDB           3690   2329   ◇ DDB($B$1,$B$2,$B$3,C6)
 9  SYD           3000   2400   ◇ SYD($B$1,$B$2,$B$3,C6)
10  SLN           1800   1800   ◇ SLN($B$1,$B$2,$B$3)
11
```

In this example, a combination of absolute and relative cell addressing was used in order to be able to enter the formula once for period one, for every function, and next copy it to the cell corresponding with period 2. Note that the SLN function is independent of the depreciation period.

TERM Payment periods

TERM(*pmt*,*int*,*fval*) returns the number of payment periods of an investment in which equal payment of amount *pmt* are made, the periodic interest rate is *int*, and the future value of the investment equals *fval*.

TERM(200,7%/12,5000) results in 23.40. This means that you need 23.40 monthly payments of amount 200, before you reach the amount of 5000, given a yearly interest rate of 7%.

STATISTICAL FUNCTIONS

Statistical functions perform a calculation on one or two ranges of cells containing numeric values.

For all statistical functions, exept for the test functions WPTEST, WUTEST, TTEST, TPTEST and COR, but including the function COUNTS (see database functions), a list of ranges is accepted as an argument.

E.g. SUM(A1:A3,A10,B5:B6) will calculate the sum of cells A1, A2, A3, A10, B5 and B6.

For an extension of the statistical functions refer to the Database statistical functions. In the latter functions, a criterion can be defined for the cells in the data range.

AVG Average

This function computes the arithmetic mean of the contents of the cells in the specified range. If one of the cells in the function's range does not have a numeric value, but is empty or has a string value, this cell will not be taken into account for calculating the average, or any of the other statistical funtions.

AVG(A0:A3)	returns the mean of the contents of cells A0,A1,A2 and A3.
AVG(P(1):P(5))	returns the mean of the contents of the cells on page 1 to 5 in the current column, on the current row.

COR Correlation

COR(range1,range2) calculates the correlation coefficient between the data in range1 and range2. The result is a number in the range [-1..1]. If the result if closer to 1, there is a positive relationship between the data in range 1 and range 2. If the result is closer to -1, there is a negative relationship between the data in range 1 and range 2. A more elaborate correlation analysis can be performed by means of the *Regression and correlation* option in the statistics menu.

COUNT Count

COUNT(range) counts the number of cells in the specified range that have a numerical contents. See also the database COUNTS(range) function. The latter function counts the number of non-empty cells.

COUNT(A0:A4)	Returns 4 if the contents of cells A0,A1,A2 and A4 is a number, and A3 is blank or contains non-numeric data.

De COUNT function has 3 variants:

COUNTNEG(range)	counts the number of negative values in range (< 0);
COUNTPOS(range)	counts the number of positive numbers in range (> 0);
COUNTPOS0(range)	counts the number of positive values + values equal to 0 in range (>= 0).

MAX Maximum

This function returns the maximum value of the contents of the cells in the specified range.

MAX(A0:A3)	returns the maximum value of the contents of cells A0,A1,A2 and A3.
MAX(A0,C10)	returns the maximum value of cells A0 and C10.

MIN Minimum

This function returns the minimum value of the contents of the cells in the specified range.

MIN(A0:A3)   returns the minimum value of the contents of cells A0,A1,A2 and A3.

MIN(C5,B2:B10) returns the minimum value of the contents of cell C5 and the cells in the range B2 to B10.

STD Standard deviation

This function computes the 'population' standard deviation (divisor n) of the contents of the cells in the specified range.

STD(A0:A3)   returns the standard deviation of the contents of cells A0,A1,A2 and A3.

STDS Standard deviation - sample

STDS(range) calculates the 'sample' standard deviation (divisor n-1) of the data in range.

SUM Sum

This function computes the sum of the contents of the cells in the specified range. The SUM function is probably the most frequently used function in any spreadsheet model.

SUM(A0:A3)   returns the sum of the contents of cells A0,A1,A2 and A3.

SUM(P(1):P(5)) returns the sum of the contents of the cells on page 1 to 5 in the current column, on the current row.

The SUM function has 2 variants: SUMNEG(range) and SUMPOS(range) calculating the sum of resp. the negative and positive values in range.

VAR Variance

VAR(range) computes the 'population' variance (divisor n) of the contents of the cells in the specified range.

VAR(A0:A3)   returns the variance of the contents of cells A0,A1,A2 and A3.

VARS Variance - sample

VARS(range) computes the 'sample' variance (divisor n-1) of the data in the specified range.

TTEST T-test

The TTEST(range1,range2) function is used to test the hypothesis that the difference between the means of two samples is equal to 0 (the hypothesis is therefore called the null hypothesis). The function takes two arguments, which are the ranges containing the data of the two samples. The result of the function is a string with the following form: t=1.611 DF=13. The user should enter the t-distribution table in appendix D (Table 1) at 13 DG (degrees of freedom). The t-value 1.611 is located between the values 0.694 and 1.771, corresponding with probabilities of 0.5 and 0.1. Since the probability is not less than the conventional 0.05, the null hypothesis can not be rejected and the conclusion is that the two means do not differ significantly.

```
 0    A     2 : TTEST(A4:A11,B4:B11)|
 _____|_____A_____|_____B_____|_____C_____
    0    |          16.43  | ◇ AVG(A4:A11)   |
    1    |          15.12  | ◇ AVG(B4:B11)   |
    2    | t= 1.611 DF=13  | ◇ TTEST(A4:A11,B4:B11)
    3    |                 |                 |
    4    |          20.00  |          23.00  |
    5    |          12.00  |          15.00  |
    6    |           8.00  |          20.00  |
    7    |          15.00  |           7.00  |
    8    |          41.00  |          32.00  |
    9    |          12.00  |          14.00  |
   10    |           7.00  |           2.00  |
   11    |                 |           8.00  |
   12    |                 |                 |
```

TPTEST Paired T-test

The TPTEST(range1,range2) function performs the t-test on paired samples. In this test, the null hypothesis is that the average of the differences between the paired observations in the two samples is zero. This function also takes two parameters which are the ranges that contain the data of the two samples. The TPTEST function returns a string interpreted similar as the resulting string of the TTEST function.

WPTEST - WUTEST Wilcoxon tests

When the distribution of a parameter is not Normal, this distribution can not be described accurately by the mean and standard deviation, and the t-tests should not be used. Two so-called non-parametrical tests were introduced by Wilcoxon in order to test the significance of the average difference between two samples. The first test on unpaired samples, or the two-sample test, is implemented here as the WUTEST function. The second test on paired samples, or the signed rank test, is implemented as the WPTEST function.

Both the WPTEST and WUTEST function take 2 parameters, being the ranges that contain the data of the two samples.

The WPTEST(range1,range2) function returns a string in the form r=xx n=yy. The first number is the lower sum of ranks and the second number is the number of data in the two ranges. These numbers are used to enter table 2 in appendix D. If the number xx is less than or equal to the number found in the table, the difference is significant at the corresponding level. If the result is e.g. r=9 n=12, then the table is entered at the row corresponding with number of pairs equal to 12. The value 9 is lower than the number 13 in the 5% column. Therefore, the probability that the medians in the 2 samples is equal can be estimated less than 5%.

The WUTEST(range1,range2) functions returns a string in the form r=xx n1=aa n2=bb. The first number is the lower sum of ranks and the second and third number are the number of data in the two ranges. These numbers are used to enter table 3 in appendix D. If the number xx is less than or equal to the number found at the intersection of the row corresponding with n1 and the column corresponding with n2, than the difference is significant at the corresponding P level.

If the result is e.g. r=20 n1=5 n2=8, we look in the top panel of table 3 of appendix D, and find the number 21 at the intersection of n1=5 and n2=5+3. The number returned by the WUTEST function was 20, and this is smaller than the number found in the table. Therefore, we conclude that the difference is significant at the 5% P level.

STRING FUNCTIONS

String functions are functions that have a non-numerical result. A string is a sequence of characters not interpreted as a number, e.g. Jones, "25".

CHR Character function

CHR(x) returns a string value of length 1 (if x>0). The ASCII code of this single character corresponds with x.

      CHR(65.0)   returns the string value A
      CHR(0)   returns an empty string: LEN(CHR(0)) = 0.

CODE Character to ASCII conversion

CODE(str) returns the ASCII number of the first character of the string 'str'. If the length of the string is 0, i.e. the string is empty, the function returns 0.

      CODE("Andy")   returns 65.00

EXACT String comparison

EXACT(str1,str2) returns 1 (= TRUE) if str1 and str2 are exactly alike, otherwise it returns 0 (=FALSE).

      EXACT("YES",a1)   returns 1 if cell A1 contains the string value "YES".

FIND Find position in string

FIND(str,string,start) returns the position of the first occurrence of str in string.

      FIND("git","digitizer",0)   returns 3.

LEFT Left portion of string

LEFT(str,n) returns the first n characters of str. If n equals 0, then the LEFT function returns an empty string. If n is equal to or more than the length of the string 'str', the function returns the complete string.

      LEFT("Position",3)   returns "Pos"

LEN Length of string

LEN(str) returns the length of the string str.

      LEN(C(1,2,10))   returns 5 if the cell on page 1, in the second column and on the 10th
                                    row contains the string value "start".

LOWER Lowercase conversion

LOWER(str) returns all letters of str in lowercase.

      LOWER('GAMES')   returns 'games'.

MID Mid portion of string

MID(str,start,n) returns n characters of str, beginning at the position given by the parameter start.

MID("computer",4,3)   returns "put"

PROPER Proper name function

PROPER(str) returns all words in str with the first letter of every word in uppercase and the rest in lowercase.

PROPER('joan smith')   returns 'Joan Smith'.

REPEAT Repeat string

REPEAT(str,n) returns str duplicated n times.

REPEAT("*",5)   returns the string value "*****"

REPLACE Replace part of string

REPLACE(Ostr,sn,n,Nstr) removes n characters from the original string Ostr beginning at start number sn, and then inserts the new string Nstr at the same place.

REPLACE("This is very nice",9,4,"not") returns "This is not nice"

RIGHT Right portion of a string

RIGHT(str,n) returns the last n characters of str. If n equals 0, then the RIGHT function returns an empty string. If n is equal to or more than the length of the string 'str', the function returns the complete string.

RIGHT("Keyboard",5) returns "board"

STR Number to string conversion

STR(x,n) returns the numeric value x as a string, with n decimal places.

STR(25.56,1)   returns the string value "25.6"

TRIM Delete spaces in string

TRIM(str) returns a string with no leading, trailing or consecutive spaces.

TRIM(" Arc sine ")   returns "Arc sine"

UPPER Uppercase conversion

UPPER(str) returns all characters in str in uppercase.

UPPER("Mean")   returns the string value "MEAN"
UPPER("Jones")   returns "JONES"

VAL String to number conversion

VAL(str) evaluates str as a number.

VAL("25.0")   returns 25.0
VAL("text")   returns an error

DATE AND TIME FUNCTIONS

Serial date numbers are integer numbers indicating the number of days since 01/01/1901. A serial time number is a fractional number corresponding with a certain moment during a day.

Serial date and time numbers can be added up. Date functions will only use the integer part of such a mixed number, time functions will only use the fractional part.

DATE Serial date number function

DATE(yy,mm,dd) returns the serial date number corresponding with the year yy, month mm and day dd.

DATE(89,1,25)   = 32167
DATE(1,1,1)   = 1

DATEVAL String to serial date number

The function DATEVAL(str) returns the serial date number for the date expressed in the string str. The format of the date string is set in the options menu.

DATEVAL("10/12/88")= 32121 if date format is DD/MM/YY.

DATE$ Serial date number to string

DATE$(dnr) returns the date corresponding with the serial date number dnr expressed as a string in the format specified in the options menu.

DATE$(32231.25)   = "30/03/89" (date format DD/MM/YY)

DAY Day function

DAY(dnr) returns the day of the month of serial date number dnr.

DAY(32012)   = 23 (date is 23/08/88)

DAY$ Day name

This function returns the name of the day corresponding with a serial date number.

DAY$(32012)   = "Monday"

The following picture illustrates different date functions:

	A	B	C
0	DATE OF BIRTH :	05/07/56	
1			
2	DATEVAL	20275	◇ DATEVAL(B0)
3	NOW	33523	◇ NOW()
4			
5	AGE (days)	13248	◇ B3-B2
6	AGE (years)	36	◇ INT(B5/365)
7			
8	DAY OF BIRTH	Thursday	◇ DAY$(B2)
9			

HOUR Hour function

HOUR(tnr) returns the hour of the serial time number tnr.

    HOUR(32068.05664) = 1

MINUTE Minute function

MINUTE(tnr) returns the minutes of the serial time number tnr.

    MINUTE(.05664)   = 21

MONTH Month function

MONTH(dnr) returns the month of the year of the serial date number dnr.

    MONTH(32012)   = 8

MONTH$ Month name

This function returns the name of the month corresponding with a serial date number.

    MONTH$(32012)   = "August"

NOW Present date and time serial number

This function takes no arguments and returns the serial date plus serial time number for today's date and present time.

    NOW()   = 32068.05664

SECOND Second function

SECOND(tnr) returns the seconds of serial time number tnr.

    SECOND(.05664)   = 33

TIME Serial time number function

TIME(hh,mm,ss) returns the serial time number corresponding with the hour hh, minutes mm and seconds ss.

    TIME(13,36,25)   = 0.56696

TIMEVAL String to serial time number

The function TIMEVAL(str) returns the serial time number for the time expressed in the string str. The format of the time string is set in the options menu.

    TIMEVAL("20:15:45")   = 0.84427 if time format is HH:MM:SS (24 hrs).

TIME$ Serial time number to string

TIME$(tnr) returns the time corresponding with serial time number tnr expressed in a string in the format specified in the options menu.

    TIME$(0.51234)   = "12:17:46" (time format is HH:MM:SS 24hrs)

YEAR Year function

YEAR(dnr) returns the year of the serial date number dnr.

    YEAR(32012)   = 88

LOGICAL, HEXADECIMAL, AND SPECIAL FUNCTIONS

IF If-then-else function

IF(condition,x,y) returns x if the condition is TRUE (=1), but returns y if the condition is FALSE (=0).

IF(C2<0,"NEG","POS") returns the string value "NEG" if the number in cell C2 is less than 0 (C2<0 = TRUE). If cell C2 contains a number equal to or more than 0, this function returns the string value "POS").

IF(A1>1,25,33) returns 25 if cell A1 contains a value greater than 1. IF A1 contains 1 or a value less than 1, this expression returns 33.

ISNUMBER Cell-is-number function

ISNUMBER(var) results in the logical value 1 (=TRUE) if the calculation of var results in a number.

ISNUMBER(25.6) returns 1
ISNUMBER(B2) returns 0 (=FALSE) if B2 contains e.g. the string value "SMITH"

ISSTRING Cell-is-string function

ISSTRING(var) results in the logical value 1 (=TRUE) if the calculation of var does not result in a numeric value.

ISSTRING(B2) returns 1 (=TRUE) if B2 contains the string value "SMITH"
ISSTRING(25.6) returns 0

HEXADECIMAL FUNCTIONS

The HEX$(val) function converts the decimal number val into its hexadecimal string representation. The HEX(str) function converts the string str, which must represent a hexademical number, into a decimal number.

HEX$(255) results in the string value FF
HEX("FF") results in the decimal number 255

CELL Formula function

CELL(adr) returns the formula in the cell 'adr'. E.g. if cell C5 contains the formula SQR(A5) then CELL(C5) returns the string value "SQR(A5)".

SYS System information function

The SYS function returns program and computer specific information.

SYS(1) 3D-Calc version number
SYS(2) 3D-Calc language
SYS(4) Number of columns
SYS(5) Number of rows
SYS(6) Number of pages
SYS(8) Cell's precision
SYS(9) Column width
SYS(10) Global column width
SYS(11) Global precision
SYS(16) Spreadsheet number (1, 2 or 3)
SYS(22) Draw grid status

SYS(23)	Set values status
SYS(24)	Alert Error status
SYS(25)	Link Pages status
SYS(28)	Horizontal synchronization status
SYS(29)	Vertical synchronization status
SYS(30)	Page synchronization status
SYS(32)	Window selection
SYS(33)	Font height
SYS(34)	Font width
SYS(38)	File name
SYS(48)	Block begin page
SYS(49)	Block begin column
SYS(50)	Block begin row
SYS(51)	Block end page
SYS(52)	Block end column
SYS(53)	Block end row
SYS(54)	Block status (TRUE if block is defined)
SYS(64)	Graph files path
SYS(65)	Data files path
SYS(66)	Text files path
SYS(67)	Block files path
SYS(100)	Printer status
SYS(101)	RS232 output status
SYS(102)	Console input status
SYS(103)	RS232 input status
SYS(108)	Input/output status
SYS(129)	Free memory
SYS(148)	GEMDOS version

When the SYS function's parameter is none the ones listed above, the function returns the value zero, or an undocumented value, e.g. SYS(256) will return the value 640 on some systems.

DATABASE FUNCTIONS

INTRODUCTION

3D-Calc can be used to set up a -small- database. To define a database in 3D-Calc you need not to use special commands. In principle, the rows of the spreadsheet are the records of the database, the columns define the fields in the records. Every column can contain the name of the field in one of the top rows of the spreadsheet. The row number is used as a pointer to the records.

The following is a simple example of a database (top rows left open for later use).

	A	B	C
7			
8	NAME	CITY	SALES
9			
10	Marlowe Philip	London	56000.
11	Jones Allan	Manchester	36000.
12	Robinson Bob	Glasgow	28500.
13	Wilson Pat	Sheffield	14000.
14			

If you know the row for a particular salesman -which you can find with one of the functions described later- and you store this number in cell A6, then C(A,A6) returns the salesman's name, C(B,A6) returns the city and C(C,A6) returns the sales number.

FROW Find row
FCOL Find column
FPAGE Find page

FROW(searchspec,range) searches for the first occurrence of searchspec in range and returns the row number of the cell found.

FCOL(searchspec,range) and FPAGE(searchspec,range) return the column and page number respectively.

E.g. Add the following formulas in the database described in the introduction:

	A	B	C
0			
1	ENTER NAME	robinson	◇ Your input
2	NAME	Robinson Bob	◇ C(A,A6)
3	CITY	Glasgow	◇ C(B,A6)
4	SALES	28500.00	◇ C(C,A6)
5			
6		12.00	◇FROW(B1+"*",R(10):R(RHIGH))
7			
8	NAME	CITY	SALES
9			
10	Marlowe Philip	London	56000.00
11	Jones Allan	Manchester	36000.00
12	Robinson Bob	Glasgow	28500.00
13	Wilson Pat	Sheffield	14000.00
14			

The key formula is the one in cell A6. If the user enters e.g. the name JONES in cell B1, the formula adds the wildcard * and compares the result (JONES*) to the cells in column A from row 8 to the highest row used in the spreadsheet (in this case 13). The result is 11. This number is used in cells B2 to B4 to display the full name, the city and the sales amount.

HLOOKUP Horizontal lookup function
VLOOKUP Vertical lookup function

HLOOKUP(searchspec,range,v) searches for the first occurrence of searchspec in range; it then adds v to the row number in which searchspec was found, and returns the contents of that cell.

VLOOKUP(searchspec,range,v) searches for the first occurrence of searchspec in range; it then adds v to the column number in which searchspec was found, and returns the contents of that cell.

If searchspec is a number, these functions search for a perfect match in range. If none is found, they return an error. If searchspec is a string value, this can contain the ? and * wildcards (as in the FIND command).

As an example, enter the following data in the spreadsheet window:

```
0  C   0:5|
       A       B       C           D       E       F
  0 NUMBER           ███████5,  ◊ User input
  1 NAME          Bogaert      ◊ VLOOKUP(C0,A6:A11,2)
  2
  3
  4 NUMBER        NAME
  5
  6       1,      Allan
  7       2,      Edwards
  8       5,      Bogaert
  9       6,      Smith
 10       4,      Newman
 11       3,      Hendrix
 12
```

VLOOKUP(C0,A6:A11,2) will search range A6 to A11 for the first occurrence of the numeric value that is entered in cell C0. This number -in this case 5- is found on row 8 in column A (=0). The value 2 is added to the column number, resulting in 2 (=C). The string value "Bogaert" is returned, being the contents of the cell C8.

DATABASE STATISTICAL FUNCTIONS

The following functions:
DAVG(range,criterion)
DCOUNT(range,criterion)
DCOUNTNEG(range,criterion)
DCOUNTPOS(range,criterion)
DCOUNTPOS0(range,criterion)
DCOUNTS(range,criterion)
DMAX(range,criterion)
DMIN(range,criterion)
DSTD(range,criterion)
DSTDS(range,criterion)
DSUM(range,criterion)
DSUMNEG(range,criterion)
DSUMPOS(range,criterion)
DVAR(range,criterion)
DVARS(range,criterion)

perform the same calculations as the corresponding statistical functions (AVG,COUNT,MAX,MIN etc.), but only those cells in range for which the criterion is TRUE are taken into account.

In the next example, the formula DAVG(B1:B6,K(A)="Ok") calculates the average of those cells in the range B1:B6 for which the corresponding cell in column A contains the string value "Ok". The result in this example is 6, this is the average of cells B1, B3 and B4.

```
0  B    8 : DAVG(B1:B6,K(A)="Ok")|
         A         B        C        D        E
  0 |
  1 | Ok        4.00
  2 | Bad       5.00
  3 | Ok        6.00
  4 | Ok        8.00
  5 | Bad       2.00
  6 | Bad       9.00
  7 |
  8 |           6.00     ◊ DAVG(B1:B6,K(A)="Ok")
  9 |
```

COUNTS Count non-empty cells

COUNTS(range) counts the number of cells in range that are non-empty, irrespective if the cell contains a formula or a numeric or text value. This distinguishes the COUNTS function from the statistical COUNT function that only counts cells containing a numeric value, or a formula resulting in a numeric value.

THE 3D-CALC PROGRAMMING LANGUAGE

INTRODUCTION

The 3D-Calc programming language enables consultation and updating of spreadsheet data in a non-graphical environment.

A 3D-Calc program has the following structure:

- the program text starts with the procedure declarations;
- execution of the program starts at the first line after the procedure declarations; if the program does not use procedures, then the program starts at the first text line;
- output to the screen is only possible after using the ClrScr command;
- commands are separated by the ';' character;
- the command 'END.' -including the full stop- indicates the end of the program.

At any time, the program can be interrupted by pressing the UNDO key.

Example:

```
Procedure MyName;      (* procedure declaration *)
  Print('Jones Allan');(* print text on screen  *)
  Print('-----------');
  PrintLn;           (* cursor to begin next line *)  Return;
(* end of procedure         *)

ClrScr;            (* clear screen, enable output *)
MyName;            (* call procedure MyName      *)
Pauze;             (* request to press a key     *)
End.               (* end of program            *)
```

VARIABLES AND FUNCTIONS

In the 3D-Calc programming language all variables are stored in cells of a spreadsheet. Also you may use and change the ROW, COLUMN and PAGE variables, and all the mathematical, financial, statistical and other functions described in the previous chapters in this manual.

Assignment of values to a cell

```
b10=5              b10 contains value 5
b10=5*6            b10 contains value 30
```

Assignment of formulas to a cell

```
b10:=5*6           b10 contains formula 5*6, resulting in 30
b10:=a5+a6         b10 contains formula a5+a6
```

PROCEDURES

A procedure declaration starts with the word PROCEDURE, followed by the procedure's name. The end of the procedure is indicated by the word RETURN. In the program text a procedure is called by its name.

Example:

```
PROCEDURE InitScreen;
     ClrScr;
     Print('-------------'); PrintLn;
     Print('My name      '); PrintLn;
     Print('-------------'); PrintLn;
RETURN
InitScreen;
```

```
Pauze;
END.
```

REMARKS

The 3D-Calc program text may contain remarks placed between the (* and *) symbols. E.g. (* this is a remark *)

CLEAR SCREEN, CLEAR LINE

The screen is erased with the ClrScr command. The part of the line at the right of the cursor is erased with the ClrEOL command. After ClrScr the cursor is positioned at the left top corner of the screen, this is position 0,0. The ClrEOL command does not influence the cursor position. Note that it is mandatary to initialize the screen with the ClrScr command before printing data on the screen.

REVERSE, TEXT COLOR

After the ReverseOn command the text on the monitor is displayed in reverse, the ReverseOff command stops this effect.

With the TextColor(var) and BackgroundColor(var) commands you can define the text and background color of the monitor. Note that the effect of ReverseOn/ReverseOff and the selected color codes depends on the terminal you are using.

DISPLAY TEXT AND DATA

Text and data can only be displayed on the screen after the ClrScr command has been used at least once. The text cursor is positioned with the GotoXY(x,y) command. The contents of a cell is displayed with the Print(cell) command. The PrintLn command moves the cursor to the beginning of the next line.

Data input is performed with the INPUT(var) command.

The Pauze command puts the message 'Strike any key to continue ...' on the screen and waits for the user to strike a key.

Example:

```
ClrScr;
GotoXY(5,1);
Print('Enter your name : ');
Input(A0);
PrintLn;
Pauze;
End.
```

PRINT TEXT AND DATA

Text or data are printed on the printer by using the LPrint(var) command. The LPrintLn command is used to place the print head at the first position of the next line.

The following example will print all records of the sample database in the previous chapter.

```
ClrScr;
Print('Is the printer ready ? '); PrintLn;
Pauze;
For row=10 To RHigh Do
    LPrint(K(a)) ; LPrintLn;
    LPrint(K(b)) ; LPrintLn;
    LPrint(K(c)) ; LPrintLn;
    LPrintLn;
Next;
```

```
        End.
```

SELECT SPREADSHEET, FILES

All three 3D-Calc spreadsheets are accessible in the 3D-Calc programming language. The active spreadsheet is selected by the command Select(nr). The data of the selected spreadsheet are cleared with the Clear command. A data file is read by using the Load(filename), and saved using the Save or Save(filename) command. The ChDir is used to change to another directory.

Example:

```
        Select(2);
        Clear;
        ChDir('B:\DATA');
        Load('ADDRESS.3DD');
        End.
```

OTHER FILE OPERATIONS

Five commands are available for reading and writing files other than 3D-Calc data files.

Openfile(filename)   opens a file on disk. If the file does not exists, a new one is created. Only one file can be open at the same time.
Closefile   closes the file.
Read(len,var)   reads 'len' number of characters into cell 'var'.
Write(len,var)   writes 'len' number of characters of cell 'var'.
SeekEOF   locates the filepointer to the end of the file.

The success of the different procedures can be evaluated with the SYS(108) function.

Example:

```
        ClrScr;
        Print('This program reads a'); PrintLn;
        Print('comma-delimited ASCII file.'); PrintLn;
        PrintLn;
        PrintLn;
        Print('Enter file name : '); Input(A0);
        PrintLn;
        PrintLn;
        Openfile(A0);
        IF SYS(108)="0"
        THEN Print("File not found.");
             PrintLn;
             Pauze;
             HALT
        ENDIF;
        Print('Processing : ');
        Clear;
        row=1; column=0;
        REPEAT
           Read(1,A0);
           A0="'"+CELL(A0);
           IF A0<>CHR(10)
           THEN IF (A0<>CHR(13))AND(A0<>",")
                THEN B0=CELL(B0)+A0;
                ELSE C(column,row)=B0;
                     B0="";
                     IF A0=CHR(13)
                     THEN column=0; row=row+1;
                     ELSE column=column+1;
                     ENDIF;
                     Print('.');
                ENDIF;
           ENDIF;
        UNTIL SYS(108)="0";
        A0=""; B0="";
        Closefile;
```

```
        PrintLn; PrintLn;
        Pauze;
        END.
```

INSERT, CLEAR AND DELETE PAGES, ROWS, COLUMNS

Clearing, inserting and deleting rows, columns and pages of the spreadsheet is possible by the following commands:

ClearPage(var);   ClearColumn(var);   Clearrow(var);
InsertPage(var);   InsertColumn(var);   InsertRow(var);
DeletePage(var);   DeleteColumn(var);   DeleteRow(var);

COMMAND OVERVIEW

(* remark *)	Remarks are placed between these symbols
BackGroundColor(var)	Select monitor background color
ChDir	Change drive/directory
Clear	Clear data in memory
ClearColumn(var)	Clear spreadsheet column
ClearPage(var)	Clear spreadsheet page
ClearRow(var)	Clear spreadsheet row
Closefile	Closes the external file
ClrScr	Clear screen
ClrEol	Clear to end-of-line
DeleteColumn(var)	Delete spreadsheet column
DeletePage(var)	Delete spreadsheet page
DeleteRow(var)	Delete spreadsheet row
End.	End of program
Exit	Exit Loop ... Endloop
GotoXY(x,y)	Place cursor at specified location on the screen
Halt	Interrupt the program, end the command mode
InsertColumn(var)	Insert spreadsheet column
InsertPage (var)	Insert spreadsheet page
InsertRow(var)	Insert spreadsheet row
Load(file)	Read spreadsheet datafile
LPrint(var)	Print a variable on the printer
LPrintLn	Move the printer head to the beginning of the next line
Openfile(filename)	Open an external file on disk for read/write
Pauze	Display the message 'Press any key to continue ...' and wait until a key is pressed
Print(var)	Print a variable on the screen
PrintLn	Move the cursor to the beginning of the next line on the screen
Procedure	Begin of a procedure declaration
Read(len,var)	Read 'len' number of characters into cell 'var'
Return	End of a procedure
ReverseOn	Switch to reverse display
ReverseOff	Switch back to normal display
Run(progfile)	Load and executes program progfile
Save	Save spreadsheet data
Save(file)	Save spreadsheet data with specified filename
SeekEOF	Locates the filepointer to the end of the external file
Select(var)	Select spreadsheet 1, 2 or 3
Set optie var	Select options
TextColor(var)	Selects textcolor
Write(len,var)	Write 'len' number of characters of cell 'var'

SETTINGS AND OPTIONS

The following commands are used to select the options as described in the chapter on the spreadsheet options.

Set Linkpages ON/OFF
Set AutoCalc ON/OFF
Set AlertError ON/OFF

Set Width var
Set Precision var
Set ColumnWidth var
Set ColumnPrecision var

Set Angle   Degrees / Radians / Grades
Set Date   DMY / MDY / YMD
Set Time   HMS24 / HMSAP / HM24 / HMAP

LOOP ENDLOOP

Loop ... Endloop;

The commands between Loop and EndLoop are executed repeatedly. The loop can only be interrupted by the EXIT command.

The next program continues to ask the user to press key X. If this key is pressed, the program is abandonned.

```
ClrScr;
Loop
    Print("Press key X to stop the program");
    PrintLn;
    Print("followed by RETURN"); PrintLn;
    Input(A0); PrintLn;
    If Upper(a0)="X" Then Exit EndIf;
End.
```

WHILE WEND

While condition Do ... Wend;

The command sequence between Do and Wend is executed as long as the condition is TRUE (=1). Since the condition is evaluated before execution of the command sequence it is possible that these commands are never executed.

The example program requests the user to input a number and if it is a positive number it displays the square root, otherwise the program ends.

```
Procedure AskNumber;
    Print('Enter a number  : '); Input(a3);
    PrintLn;
Return;
ClrScr;
AskNumber;
While A3>=0 Do
    Print('The square root is: '); Print(Sqr(A3));
    PrintLn;
    AskNumber;
Wend;
End.
```

REPEAT UNTIL

Repeat ... Until condition;

The command sequence between Repeat and Until are executed until the evaluation of condition is FALSE (=0). Since the condition is evaluated after execution of the command sequence, these commands are executed at least once.

The next example displays all cells in column A.

```
ClrScr;
row=0;
Repeat
    Print(K(row)); PrintLn;
    row=row+1;
Until row>RHigh;
Pauze;
End.
```

FOR NEXT

For var=startvalue To endvalue Do ... Next;

The control variable var is initiated with the value startvalue. After execution of the command sequence between Do and Next, the variable var is increased by 1. As long as var is not greater than the endvalue, the sequence is repeated.

The following example shows another method to display all cells in column A.

```
ClrScr;
For row=0 To RHigh Do
     Print(K(A)); PrintLn;
Next;
Pauze;
End.
```

IF ENDIF

If condition Then ... Else ... EndIf;

The command sequence following THEN is executed if the evaluation of the condition results in 1 (=TRUE), otherwise the (optional) command sequence following ELSE is executed.

```
ClrScr;
Input(A5);
PrintLn;
IF A5<0 Then Print('This number is negative');
Else If A5=0 Then Print('This number equals 0');
     Else Print('This number is positive');
     EndIf;
EndIf;
End.
```

RUN

RUN(progname) loads and starts the 3D-Calc program named progname. The program text in memory is cleared and replaced with the new program text which is then executed. If the program file is not present in the current folder or directory you must include its path or folder name.

```
ClrScr;
Loop
   Print('Your selection : '); Input(B5);
   IF B5=1 Then run('PROGS\PROGRAM1.3DT') EndIf;
   IF B5=2 Then run('PROGS\PROGRAM2.3DT') EndIf;
EndLoop;
End.
```

HALT

The Halt command is used to interrupt program execution before the actual end of the program text is reached.

```
Procedure DisplayTopSecretData;
    Print('1 + 1 = 2');
Return;
ClrScr;
Print('Enter your password : ');
Input(1A0);
IF 1A0<>'XYUI4P' Then Halt EndIf;
DisplayTopSecretData;
End.
```

END.

The END. command indicates the end of the program. All text following the END. command is ignored.

APPENDIX A. FUNCTION AND CONTROL KEYS

ALTERNATE + CONTROL Interrupts calculations
ALTERNATE + Function key Desk macro
ALTERNATE + Character key Spreadsheet macro

ALTERNATE 1   Select spreadsheet 1
ALTERNATE 2   Select spreadsheet 2
ALTERNATE 3   Select spreadsheet 3

TAB, RETURN, LEFT ARROW, RIGHT ARROW, UP ARROW and DOWN ARROW Store the new (or edited) contents of a cell, and move the cell pointer

ENTER   Store the new (or edited) contents of a cell, without moving the cell pointer.

CTRL LEFT   Move cell cursor to left
CTRL RIGHT   Move cell cursor to right
BACKSPACE   Delete character left of the cursor
DELETE   Delete character right of the cursor

ESC   Clear cell
UNDO   Restore cell contents
INSERT   Toggle Overwrite/Insert edit mode

CTRL Q   Exit the 3D-Calc program
CTRL O   Print spreadsheet data
CTRL L   Read spreadsheet data file
CTRL S   Save spreadsheet data file
CTRL X   Save spreadsheet data file with a new name
CTRL A   Load and execute other program
CTRL G   Clear spreadsheet

     F1   Open spreadsheet window
SHIFT F1   Close top window
CTRL F1   Toggle Autocalc ON/OFF

     F2   Insert page
     F3   Insert row
     F4   Insert column

SHIFT F2   Delete page
SHIFT F3   Delete row
SHIFT F4   Delete column

CTRL F2   Clear page
CTRL F3   Clear row
CTRL F4   Clear column

     F5   Paste cell, copy cell buffer to current cell
SHIFT F5   Load current cell in paste cell buffer

     F6   Replace formula with its calculated result

SHIFT F7   Specify and find string
     F7   Repeat find
CTRL F7   Goto cell

     F8   Calculate spreadsheet window
SHIFT F8   Define column width and precision

     F9   Page up (next page)
     F10 Page down (previous page)

SHIFT F9   Renumber pages (-)

SHIFT	F10	Renumber pages (+)
CTRL	D	Define block
CTRL	B	Set begin block
CTRL	E	Set end block
CTRL	M	Move block
CTRL	N	Copy block
CTRL	C	Cut block
CTRL	P	Paste block
CTRL	W	Write block
CTRL	R	Read block
CTRL	H	Hide block markers
CTRL	K	Clear block

TEXT WINDOW

CTRL	T	Open text window
SHIFT	F1	Close (top) window
CTRL	I	Read text file
CTRL	J	Write text file
CTRL	F	Format text
CTRL	U	Print text
CTRL	V	Clear text
CTRL	Z	Execute text as a 3D-Calc program
TAB		Move text cursor to the next tab position (insert spaces when in Insert mode)
LEFT ARROW		Move text cursor to previous character
RIGHT ARROW		Move text cursor to next character
UP ARROW		Move text cursor to previous line
DOWN ARROW		Move text cursor to next line
CTRL	LEFT	Move text cursor to previous word
CTRL	RIGHT	Move text cursor to next word
BACKSPACE		Delete character left of the text cursor
DELETE		Delete character right of the text cursor
CTRL	DELETE	Delete word
SHIFT	F3	Delete line
INSERT		Toggle between Overwrite and Insert edit mode

APPENDIX B. FUNCTIONS OVERVIEW

ARITHMETIC OPERATORS

^	Exponentiation
-	Negation
* /	Multiplication, division
+ -	Addition, subtraction

RELATIONAL OPERATORS

=	Equality
<>	Inequality
<	Less than
>	Greater than
<=	Less than or equal to
>=	Greater than or equal to

LOGICAL OPERATORS

AND	Logical AND
OR	Logical OR

CONSTANTS

TRUE	Equals 1
FALSE	Equals 0
PI	Equals 3.14159265

VARIABLES

COL (or COLUMN)	Current column
ROW	Current row
PAGE	Current page
KHigh	Highest column number used
RHigh	Highest row number used
PHigh	Highest page number used

CELL ADDRESSING

C(p,c,l)	Cell function
K(c)	Column function
R(l)	Row function
P(p)	Page function

MATHEMATICAL FUNCTIONS

ABS(x)	Absolute value of x
ACOS(x)	Arc cosine of x
ASIN(x)	Arc sine of x
ATAN(x)	Arc tangent of x
COS(x)	Cosine of x
EXP(x)	Natural exponential of x
FACT(x)	Factorial function (1*2*..*x)
INT(x)	Integer value of x
LN(x)	Natural logarithm of x
LOG(x)	Logarithm of x (base 10)
MOD(x[,d])	Modulo function
RND(x)	Returns random number less than x
ROUND(x[,n])	Round function
SGN(x)	Sign value
SIN(x)	Returns sine of x
SQR(x)	Returns square root of x

TAN(x)	Returns tangent of x

FINANCIAL FUNCTIONS

CTERM(int,fval,pval)	Compounding periods
DDB(cost,salv,life,period)	Double-declining depreciation
FV(pmt,int,term)	Future value
NPV(int,range)	Present value of future cash flows
PMT(prin,int,term)	Periodic payment
PV(prin,int,term)	Present value
RATE(fval,pval,term)	Periodic interest rate
SLN(cost,salv,life)	Straight-line depreciation
SYD(cost,salv,life,period)	Sum-of-the-year's digits depreciation
TERM(pmt,int,fval)	Payment periods

STATISTICAL FUNCTIONS

AVG(range)	Arithmetic mean of range
COR(range1,range2)	Correlation
COUNT(range)	Count cells containing numbers
COUNTNEG(range)	Counts number of negative values
COUNTPOS(range)	Counts number of positive numbers
COUNTPOS0(range)	Positive values + values equal to 0
MAX(range)	Returns highest value in range
MIN(range)	Returns the lowest value in range
STD(range)	'Population' standard deviation
STDS(range)	'Sample' standard deviation
SUM(range)	Computes the sum of data in range
SUMNEG(range)	Sum of negative values
SUMPOS(range)	Sum of positive values
TTEST(range1,range2)	T-test
TPTEST(range1,range2)	Paired t-test
VAR(range)	Computes the 'population' variance
VARS(range)	Computes the 'sample' variance
WPTEST(range1,range2)	Paired Wilcoxon test
WUTEST(range1,range2)	Wilcoxon test

STRING FUNCTIONS

CHR(x)	Returns character with ASCII code x
CODE(str)	Returns ASCII code of str
EXACT(str1,str2)	Compares str1 and str2
FIND(st1,st2,start)	Position of st1 in st2
LEFT(str,n)	Returns first n characters of str
LEN(str)	Returns length of string str
LOWER(str)	Lowercase conversion
MID(str,start,n)	Mid portion of string
PROPER(str)	Proper name function
REPEAT(str,n)	Repeat string str n times
REPLACE(Os,s,r,Ns)	Replace portion of string
RIGHT(str,n)	Returns last n characters of str
STR(x,n)	Number to string conversion
TRIM(str)	Delete spaces in string
UPPER(str)	Uppercase conversion
VAL(str)	String to number conversion

DATE AND TIME FUNCTIONS

DATE(yy,mm,dd)	Returns serial date number
DATEVAL(str)	String to serial date number
DATE$(dnr)	Serial date number to string
DAY(dnr)	Day function
DAY$(dnr)	Day name
HOUR(tnr)	Hour function

MINUTE(tnr)	Minute function
MONTH(dnr)	Month function
MONTH$(dnr)	Month name
NOW()	Present date and time serial number
SECOND(tnr)	Second function
TIME(hh,mm,ss)	Returns serial time number
TIMEVAL(str)	String to serial time number
TIME$(tnr)	Serial time number to string
YEAR(dnr)	Year function

LOGICAL, HEXADICIMAL AND SPECIAL FUNCTIONS

IF(condition,x,y)	If-then-else function
ISNUMBER(var)	Cell-is-number function
ISSTRING(var)	Cell-is-string function
HEX$(x)	Returns HEX representation of x
HEX(hx)	Converts string hx to decimal number
CELL(adr)	Returns formula of cell 'adr'
SYS(x)	System information function

DATABASE FUNCTIONS

COUNTS(range)	Non-empty cells in range
FROW(searchspec,range)	Returns row of searchspec in range
FCOL(searchspec,range)	Column of searchspec in range
FPAGE(searchspec,range)	Returns page of searchspec in range
HLOOKUP(searchspec,range,v)	Horizontal lookup function
VLOOKUP(searchspec,range,v)	Vertical lookup function

DATABASE STATISTICAL FUNCTIONS

DAVG(range,criterion)	Arithmetic mean of range
DCOUNT(range,crit)	Counts cells containing numbers
DCOUNTNEG(range,crit)	Number of negative values
DCOUNTPOS(range,crit)	Number of positive numbers
DCOUNTPOS0(range,crit)	Positive values or equal to 0
DCOUNTS(range,crit)	Counts non-empty cells
DMAX(range,criterion)	Returns highest value in range
DMIN(range,criterion)	Lowest value in range
DSTD(range,criterion)	'Population' standard deviation
DSTDS(range,criterion)	'Sample' standard deviation
DSUM(range,criterion)	Sum of data in range
DSUMNEG(range,crit)	Sum of negative values
DSUMPOS(range,crit)	Sum of positive values
DVAR(range,criterion)	'Population' variance
DVARS(range,criterion)	'Sample' variance

APPENDIX C. 3D-CALC DATA FILE DESCRIPTION

This appendix provides information about a file format that can easily be imported in 3D-CALC. This information should enable you to create 3D-Calc data files from within your own programs, or to write a program that converts any data file to a 3D-Calc file.

3D-Calc knows several types of data files. A normal full size data file as created by the 3D-Calc main program contains, in addition to the contents of the spreadsheet cells, information about options such as precision and column width, windows positions and sizes, spreadsheet macros etc. However, a file with cell information only is also accepted by the program.

If you want to create data files from within your own programs, you should adhere to the following format.

Table: Simplified 3D-Calc data file structure.

File Id	5912	INTEGER	= 3D-Calc file identification
Cells	page	INTEGER	= cell page number
	row	INTEGER	= cell row number
	column	INTEGER	= cell column number
	len	INTEGER	= length of cell string, including termination byte ASCII 0
	cell	String	= NUL terminated ASCII string
	prec	INTEGER	= cell precision or -1 for global precision
	attr	BYTE	= attributes, bit coded
			bit 0 : hidden
			bit 1 : protected
			bit 3 : italic
EOF	-1	INTEGER	= End of File Marker

3D-Calc distinguishes files by means of a 2 byte identification code in the beginning of the file. The first word (two bytes) of the file must be the data file's identification number 5912. After this number, the cell information follows: page, row and column number, followed by the length + 1 of the contents of the cell. The cell is written as an ASCII string and is terminated by the zero (CHR$(0)) termination character. Next follows the cell's precision. Use -1 if the cell has the global spreadsheet precision. The last byte is the cell's attribute byte. This byte is bit coded (see table). When all cells are written to disk (their order being of no importance), you must write the value -1 to indicate the end of the data file.

As an example we list a Gfa-Basic program that initializes a 3D-Calc data file, writes some formulas, requests the user to input some numbers which are written to the data file and finally closes the file. This program is also included on the program disk (GFA-3D.LST).

Gfa-Basic program to create a 3D-Calc data file.

```
'
id%=5912            ! 3D-Calc file identification number
eof%=-1             ! 3D-Calc End-Of-File marker
'
OPEN "o",#1,"TEST.3DD"        ! Create 3D-Calc file
PRINT #1,MKI$(id%);           ! Write id. number
'
writecell(0,0,0,"'SUM :")     ! page 0 row 0 column 0
writecell(0,0,1,"SUM(B3:B10)") ! page 0 row 0 column 1
'
FOR i%=3 TO 10
  PRINT "Enter number : ";
  INPUT a
  writecell(0,i%,1,STR$(a))
```

```
      NEXT i%
      '
      PRINT #1,MKI$(eof%);          ! Write End-Of-File marker
      CLOSE #1                      ! Close file
      '
      END                          ! Program end
      '
      PROCEDURE writecell(page%,row%,column%,cell$)
        PRINT #1,MKI$(page%);            ! page number
        PRINT #1,MKI$(row%);             ! row number
        PRINT #1,MKI$(column%);          ! column number
        PRINT #1,MKI$(LEN(cell$)+1);    ! cell length + 1
        PRINT #1,cell$;                  ! cell as ASCII
        PRINT #1,CHR$(0);           ! string termination byte
        PRINT #1,MKI$(-1);          ! -1 for global precision
        PRINT #1,CHR$(0);           ! no attributes
      RETURN
```

APPENDIX D. STATISTICAL TABLES

TABLE 1. Ditribution of t

DF	Probability			
	50%	10%	5%	1%
1	1.000	6.314	12.706	63.657
2	0.816	2.920	4.303	9.925
3	0.765	2.353	3.182	5.841
4	0.741	2.132	2.776	4.604
5	0.727	2.015	2.571	4.032
6	0.718	1.943	2.447	3.707
7	0.711	1.895	2.365	3.499
8	0.706	1.860	2.306	3.355
9	0.703	1.833	2.262	3.250
10	0.700	1.812	2.228	3.169
11	0.697	1.796	2.201	3.106
12	0.695	1.782	2.179	3.055
13	0.694	1.771	2.160	3.012
14	0.692	1.761	2.145	2.977
15	0.691	1.753	2.131	2.947
16	0.690	1.746	2.120	2.921
17	0.689	1.740	2.110	2.898
18	0.688	1.734	2.101	2.878
19	0.688	1.729	2.093	2.861
20	0.687	1.725	2.086	2.845
21	0.686	1.721	2.080	2.831
22	0.686	1.717	2.074	2.819
23	0.685	1.714	2.069	2.807
24	0.685	1.711	2.064	2.797
25	0.684	1.708	2.060	2.787
26	0.684	1.706	2.056	2.779
27	0.684	1.703	2.052	2.771
28	0.683	1.701	2.048	2.763
29	0.683	1.699	2.045	2.756
30	0.683	1.697	2.042	2.750
40	0.681	1.684	2.021	2.704

Table 2. Critical values for the Wilcoxon Signed Rank Test (paired samples)

Number of pairs	Probability 10%	5%	1%
7		3	2
8	5	3	0
9	8	5	1
10	10	8	3
11	13	10	5
12	17	13	7
13	21	17	9
14	25	21	12
15	30	25	15
16	35	29	19
17	41	34	23
18	47	40	27
19	53	46	32
20	60	52	37
21	67	58	42
22	75	66	48
23	83	73	54
24	91	81	61
25	100	89	68
26	110	98	76
27	120	107	84
28	130	117	92
29	141	127	100
30	152	137	109
31	163	148	118
32	175	159	128
33	188	171	138
34	201	183	149
35	214	195	160
36	228	208	171
37	242	222	183
38	256	235	195
39	271	250	208
40	287	264	221

Table 3. Critical values for the Wilcoxon Rank Sum Test (unpaired samples)

Critical values for 5% P level

N1	3	4	5	6	7	8	9	10	11	12	13	14
N2=N1	5	11	18	26	37	49	63	79	96	116	137	160
+1	6	12	19	28	39	51	66	82	100	120	141	165
+2	6	12	20	29	41	54	68	85	103	124	146	170
+3	7	13	21	31	43	56	71	88	107	128	150	174
+4	7	14	22	32	45	58	74	91	110	131	154	179
+5	8	15	24	34	46	61	77	94	114	135	159	184
+6	8	16	25	36	48	63	79	97	118	139	163	189
+7	9	17	26	37	50	65	82	101	121	143	168	194
+8	10	17	27	39	52	68	85	104	125	147	172	198
+9	10	18	29	41	54	70	88	107	128	151	176	203
+10	11	19	30	42	56	72	90	110	132	155	181	208
+11	11	20	31	44	58	75	93	113	135	159	185	213
+12	12	21	32	45	60	77	96	117	139	163	190	218
+13	12	22	33	47	62	80	99	120	143	167	194	222
+14	13	23	35	49	64	82	101	123	146	171	198	227

Critical values for 1% P level

N1	3	4	5	6	7	8	9	10	11	12	13	14
N2=N1	4	9	15	23	33	44	57	71	88	106	126	148
+1	5	10	16	24	34	46	59	74	91	109	130	152
+2	5	10	17	25	36	47	61	76	94	113	133	156
+3	5	11	18	27	37	49	63	79	97	116	137	160
+4	6	11	19	28	39	51	65	82	100	119	141	164
+5	6	12	19	29	40	53	68	84	102	123	144	168
+6	6	12	20	30	42	55	70	87	105	126	148	172
+7	6	13	21	31	43	57	72	89	108	129	152	176
+8	7	13	22	32	45	59	74	92	111	133	156	180
+9	7	14	23	34	46	61	77	95	114	136	159	185
+10	7	15	24	35	48	62	79	97	117	139	163	189
+11	8	15	25	36	49	64	81	100	120	143	167	193
+12	8	16	26	37	51	66	83	103	123	146	171	197
+13	8	16	26	38	52	68	86	105	126	150	175	201
+14	9	17	27	40	54	70	88	108	129	153	178	205

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