Minimum Squares Line

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I. About the Program

The program helps the ploting of points (x, y) and the drawing of the Least Squares Line and the corresponding confidence lines at 90% and 95% on millimeter paper (paper shown in Figure 1). **it really works not only with millimeters. If the scale ranges are inserted in inches the final results come in inches**

The following parameters must be entered for both the X axis (horizontal) and the Y axis (vertical) (Figure 3):

- Choose whether the scale is logarithmic or linear.
- The lower limit of the scale in the units measured in the experiment.
- The upper limit of the scale in the units measured in the experiment.
- The number of millimeters on the sheet between the lower and upper limits.

Figure 3 shows an example of the settings: X axis with a logarithmic scale, lower limit 0.1, upper limit 10 (2 decades), and 200 millimeters (100 mm per decade).

As the values (x, y) are entered (up to a maximum of 100 points), the program computes and displays the corresponding millimeter values for x and y in order to plot the points on the sheet (Figure 4).

If a scale is logarithmic, the values (x and/or y) used to compute the Least Squares line are the values in millimeters (only in this way does the line make sense, since exponential values are not suitable for computing a linear fit).

The resulting Least Squares line has the form $y = mx + b$, where m is the slope and b is the y-intercept. Three points of the line are computed in millimeters in order to draw it (Figure 5): two points at the extremes of the X scale and one point in the middle.

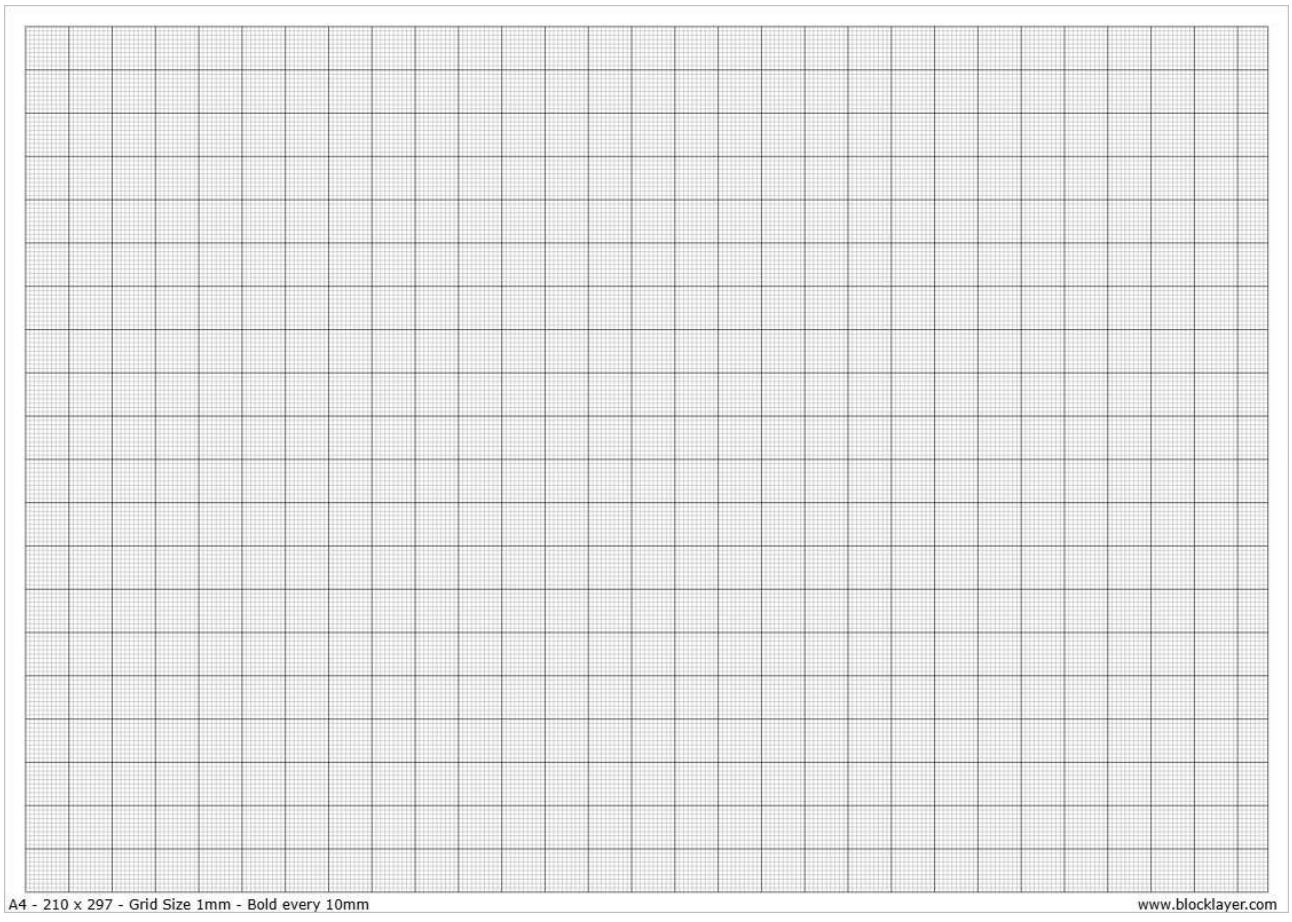

Figure 1

II. How to Run the Program

The program was written in BASIC and compiled with the Softek BASIC Compiler. The compiled version of the program is provided. The program was tested using the emulator "The Spectrum" from Retro Games. It works on all Sinclair platforms (ZX 48K, 128K, etc.) within "The Spectrum".

However, the Softek compiler does not work with the firmware that comes with "The Spectrum". The provided zip file must be extracted to the root directory of the USB pen drive used in "The Spectrum". It already contains the original ZX Spectrum firmware. After extracting the zip file, the original firmware of the ZX Spectrum is automatically used.

The firmware files are located in the directory */THESPECTRUM/roms*. The files in that directory must be renamed if you wish to revert to the original "The Spectrum" firmware after using the program.

You can confirm that "The Spectrum" is using the original ZX Spectrum firmware because, at startup, the Sinclair message appears instead of the Retro Games message.

The procedure is as follows:

- Decompress the zip file to the root directory of the USB pen drive.
- Select the media file *Line54000_WR.tap* in "The Spectrum".
- At the command line, type *CLEAR 53999:LOAD "" CODE:RANDOMIZE USR 54000* (Figure 2). The program will then start.

A WAV file is also provided for use with the original ZX Spectrum, although it has not been tested.

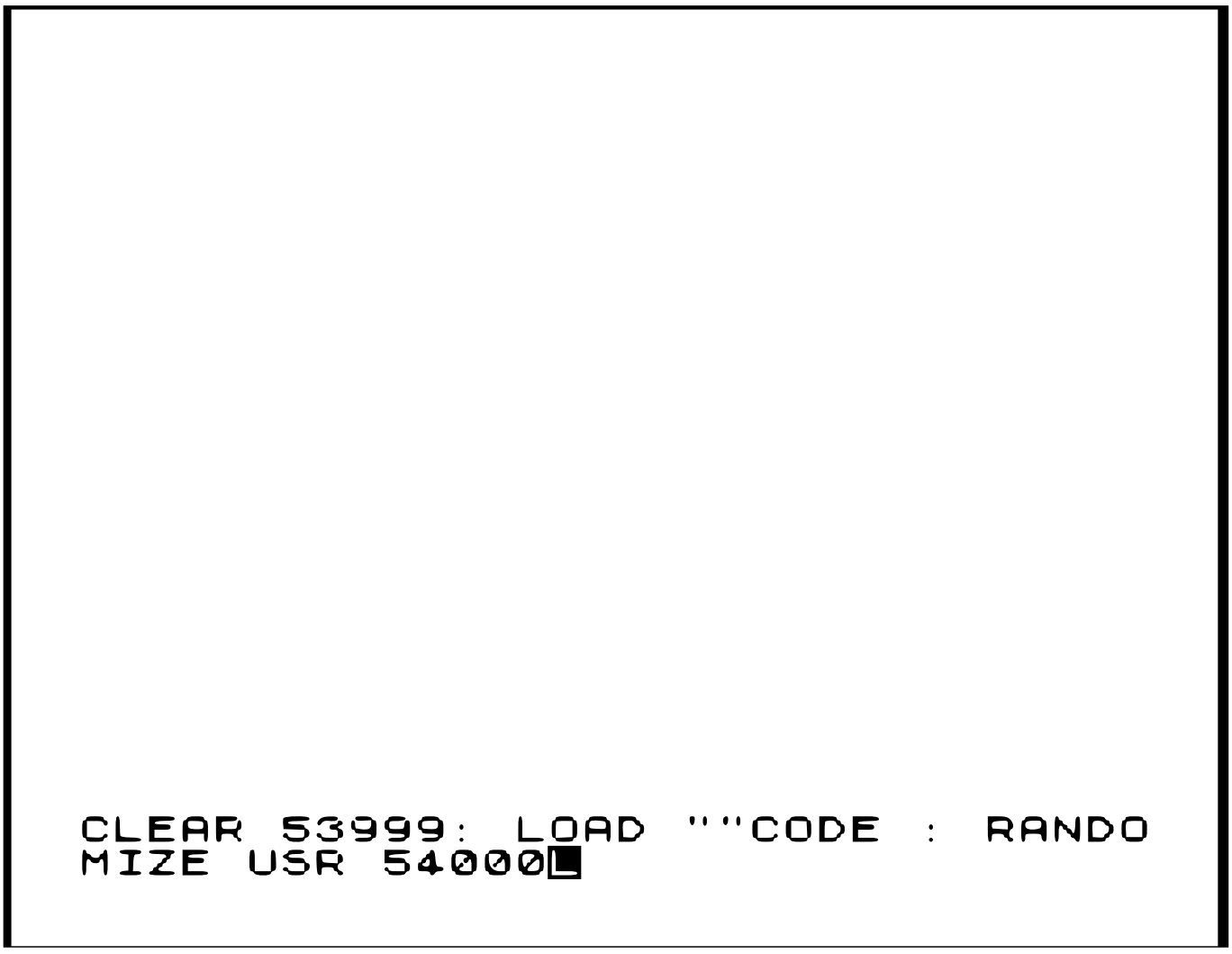

Figure 2

```
X scale
Logarithmic scale
Lower Value of scale   0.1
Higher Value of scale   10
Number of millimeters in the Sca
le    200
Y scale
Linear scale
Lower Value of scale   0
Higher Value of scale   200
Number of millimeters in the Sca
le    200


Press a key
```

Figure 3

```
Point 1
Value X   0.1    Millimeters   0
Value Y   0    Millimeters   0
C key to continue inputing, K ke
y to input again the last point
Point 2
Value X   10    Millimeters   200
Value Y   200    Millimeters   200
A key to computing the line, C k
ey to continue inputing, K key t
o input again the last point
```

Figure 4

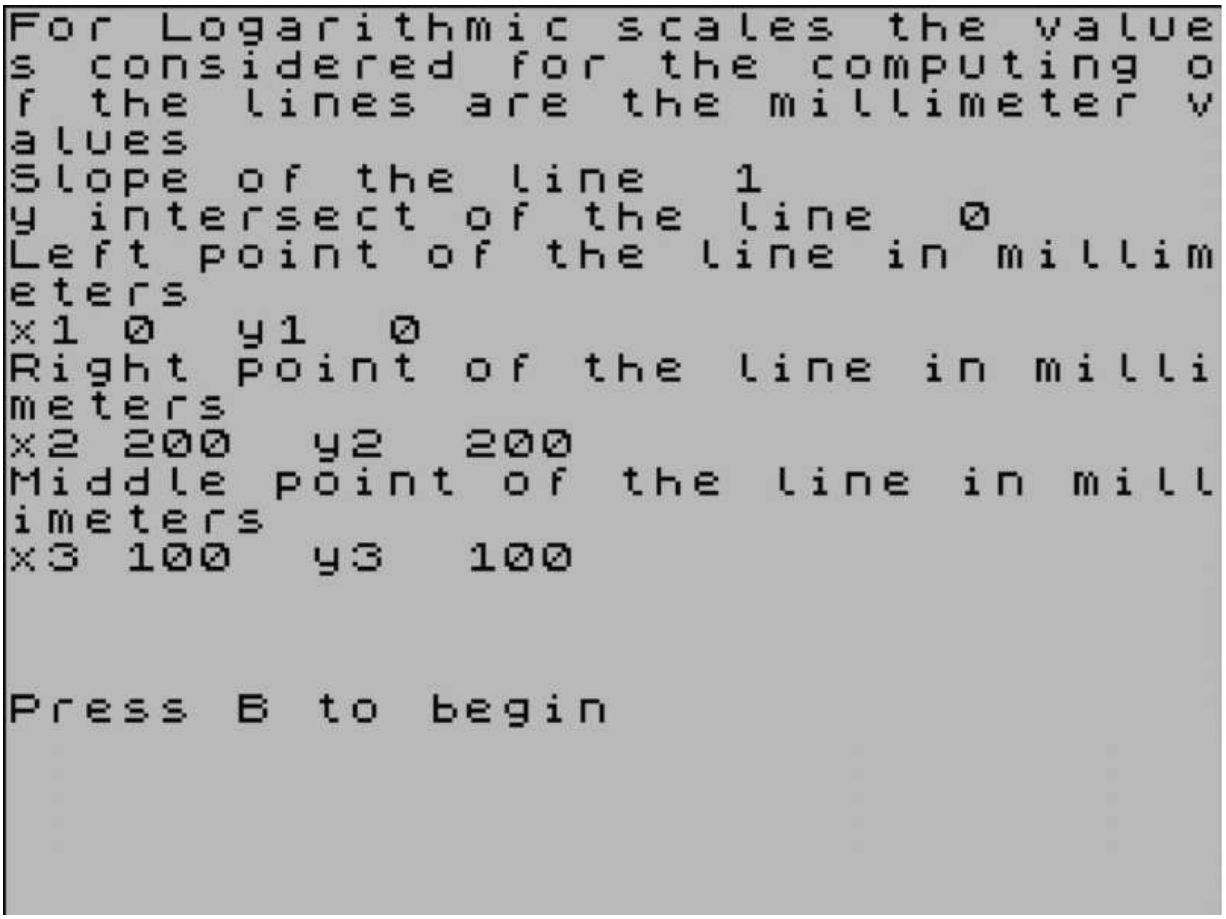
For Logarithmic scales the value
s considered for the computing o
f the lines are the millimeter v
alues
Slope of the line 1
y intersect of the line 0
Left point of the line in millim
eters
x1 0 y1 0
Right point of the line in milli
meters
x2 200 y2 200
Middle point of the line in mill
imeters
x3 100 y3 100
Press B to begin

Figure 5