



## TANGO schematic v1.5, pcb plus v2.2, in Windows 7

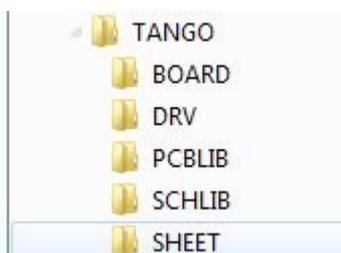
The tutorial is done for those nostalgic and enthusiast designers who want continue using this efficient CAD tool and to young people who want start designing electronic boards.

To use nowadays TANGO it is helpful to understand the [installation](#) initial procedure. There were used 6 floppy disks which provided some configuration options ensuring the same number of different configurations of the folders.

By the time, floppy disks came out of use but TANGO continued to work on new PC generations equipped with Windows operating systems, the folders being transferred by the help of CD, memory stick, etc.

If you have not, TANGO can be obtained on the [net](#) in one configuration or another.

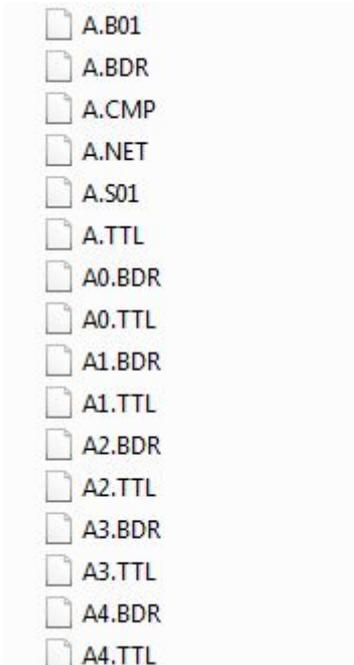
**Our tutorial is based on folders' configuration of TANGO, hypothetically installed using the original floppy disks, so that the user just pressed the Enter key.** In this way, the files belonging to the unused SCH and PCB folders are contained in the main TANGO folder. The minimal configuration of TANGO folders is:



- BOARD contains own user's previously made .PCB files.
- DRV contains drivers with .DRV extension. It's important to be contained VESA800.DRV, VESA1024.DRV and VESA1280.DRV files.
- PCBLIB contains both PCB system libraries and user's own previous libraries.
- SCHLIB contains both SCH system libraries and user's own previous libraries.
- SHEET contains own user's previously made .S01 files.

TANGO mainly contains system files:

- SCH.EXE, SCH.INI, SCH.KEY, SCH.MSG belonging to TANGO schematic along with border files:



- PCB.EXE, TANGOCRK.COM, PCB.INI, PCB.KEY, PCB.DFN, PCB.MSG belonging to TANGO pcb.
- TANGO.CF, PCBTRAN.EXE, ROUTE.EXE, ROUTE.MSG
- EGA.DRV, EPSFX120.DRV, GERBER.DRV

**To install TANGO you need to modify your TANGO folders' configuration and content so as to correspond to the above model.**

Of course, you will save your old TANGO configuration. Once TANGO is functional in the new configuration, any new folders and files may be added later.

When installing, it is preferred disc D to protect data in case of formatting disc C to a new Windows reinstallation.

Here are five TANGO installations examples on different PC models.

**Table**

<b>Model</b>	<b>PC</b>	<b>Operation system</b>	<b>Video card</b>	<b>Monitor</b>
1.	ACPIx64-based PC	Win 7 Pro 64 bit	AMD Radeon HD 7560D	LCD 1980x1080 16/9
2.	Laptop AMD Turion(tm)64X2 Mobile	Win XP Pro 32 bit	NVIDIA GeForce 8400M G	LCD 1280x800 16/10
3.	AMD Athlon(tm)XP	Win XP Pro 32 bit	NVIDIA RIVA TNT2 Model64	CRT 1024x768 4/3
4.	AMDSempron(tm) Processor 3000+	Win XP Pro 32 bit	NVIDIA GeForce Fx5200	LCD 1280x1024 5/4
5.	HP Pavilion 15-n001sq Notebook PC	Win 7 Home 64 bit	AMD Radeon HD 8670M 1GB	LCD 1366x768 16x9

## 1. Directly implementation on 32 bit machines

TANGO can be directly installed (without using other intermediate Windows applications) on 32 bit Windows XP, Vista and Windows 7 machines.

A big problem is the compatibility between TANGO's DOS VESA graphic drivers and computer's video (processor) card. In most cases the video cards are compatible with those old DOS standards. There are negative examples. So, the video **NVIDIA GeForce Fx5200** card does not support the application. A partial list of these compatibilities is in [this link](#).

Directly TANGO installation on 32 bit machines is useful only when the monitor ratio  $x/y = 4/3$ .

In the case of LCD monitors with the ratio  $x/y \neq 4/3$ , geometric distortions occur inevitably, the circle becomes oval, the square becomes rectangle. These distortions cannot be tolerated in TANGO and must be used the [indirectly DosBox implementation](#).

### Example 1.

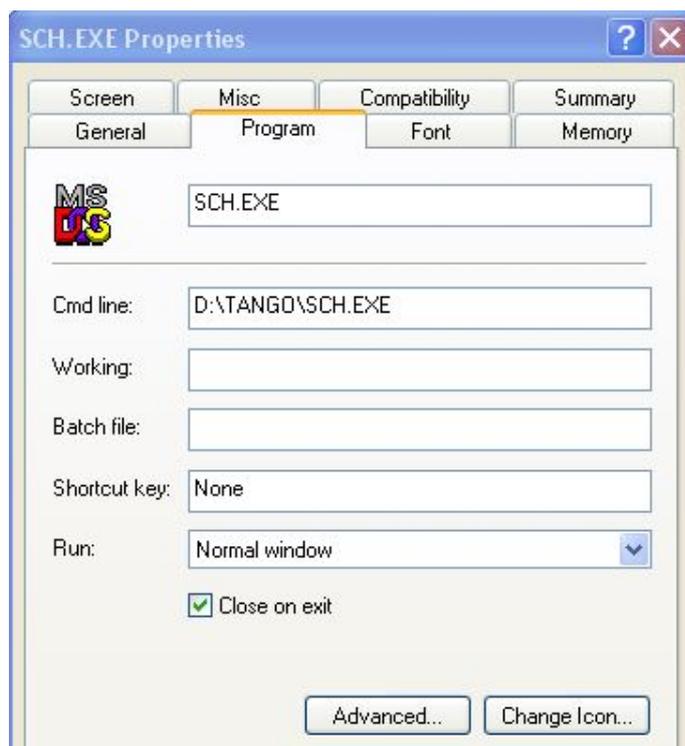
We use the model nr. 3 in the [table](#). We have a Window XP 32 bit and a CRT 4/3 monitor with 1024x768 pixels ratio.

#### 1.1. TANGO schematic installation

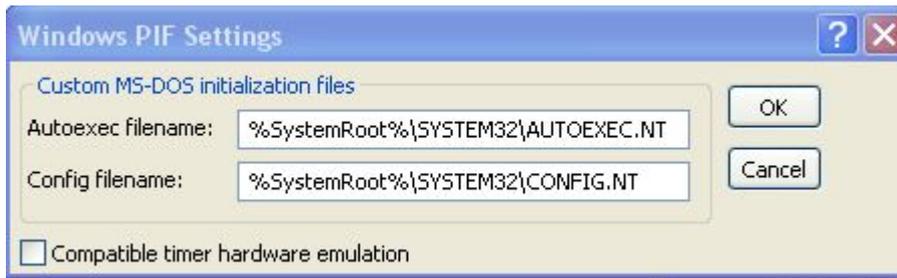
Open Windows Explorer. The executable and configuration files are located in TANGO.

Delete or move the SCH.INI file into a temporary folder (you'll delete it later because of its useless).

The SCH.EXE executable file is as follows:

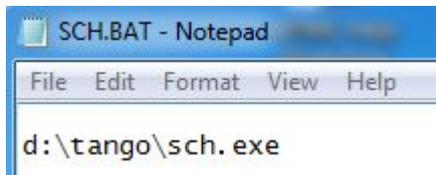


The Advanced option shows:

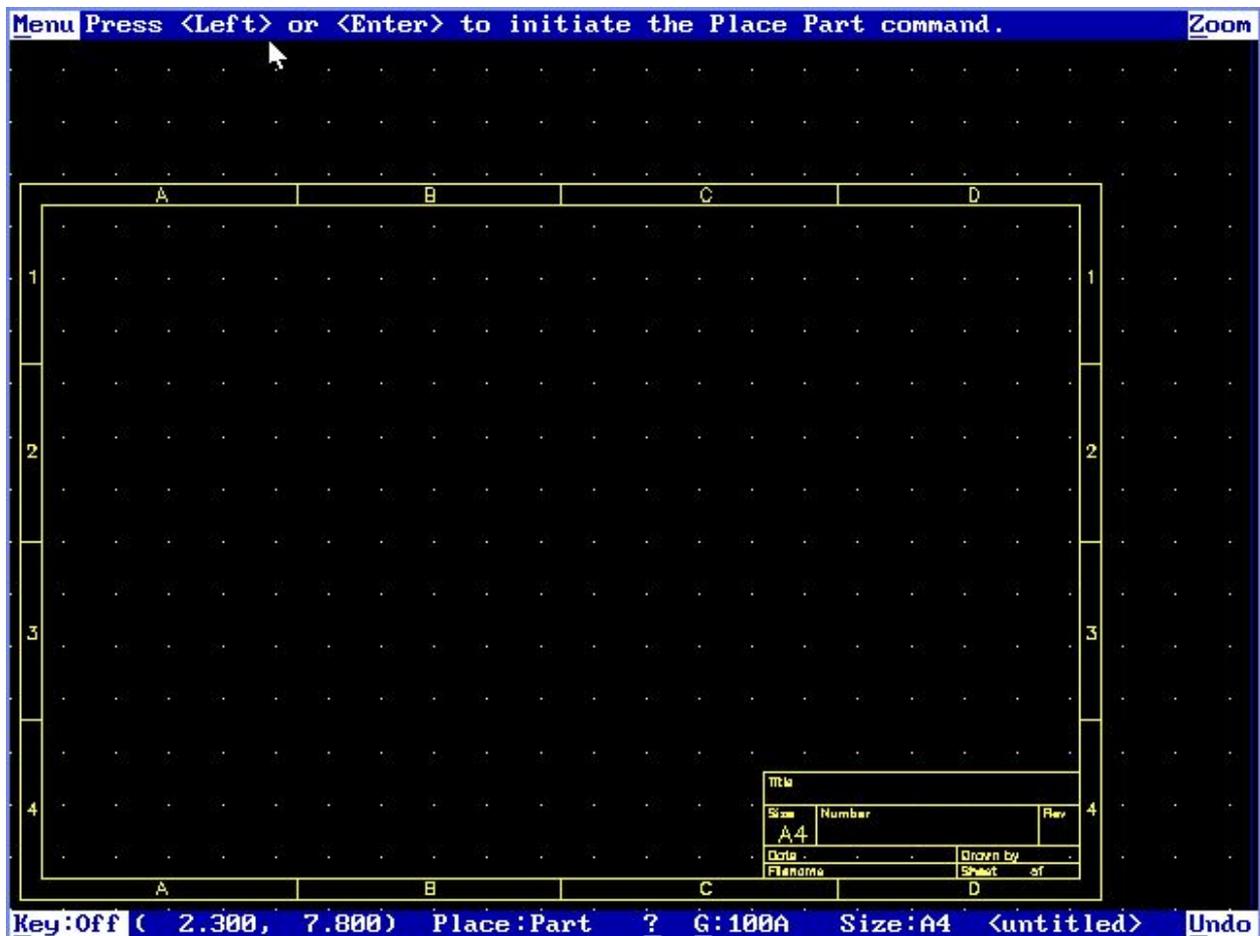


The 16 bit DOS applications are opened with the help of AUTOEXEC.NT and CONFIG.NT files located in Windows\Sistem32 on 32 bit machines. These files are missing in all 64 bit Windows versions.

Although TANGO schematic can be opened by the SCH.EXE executable file, it is better to use SCH.BAT file (it ensures both to open and close the application).



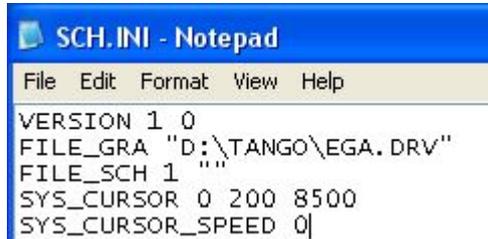
If there is not, make your SCH.BAT file in Notepad and save it in TANGO folder. Double click SCH.BAT.



The opened application has lowest EGA 640x480 resolution. There is only the yellow border.

Concerning monitors' rezolutions it is usefull [this link](#). The EGA standard resolution is unacceptable on any current monitor.

Close the application. The SCH.INI file has been automaticaly generated in the TANGO folder.



```
SCH.INI - Notepad
File Edit Format View Help
VERSION 1 0
FILE_GRA "D:\TANGO\EGA.DRV"
FILE_SCH 1 ""
SYS_CURSOR 0 200 8500
SYS_CURSOR_SPEED 0
```

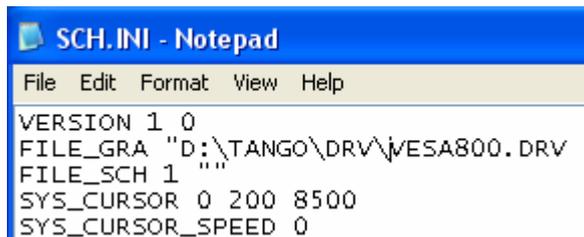
Notice that the default graphic driver is EGA.DRV. TANGO is supporting more graphics drivers, including three main [VESA](#) drivers:

Graphics driver	Horizontal rezolution-x	Vertical rezolution-y	Rezolutions' ratio x/y
EGA.DRV	640	480	4/3
SVGA.DRV	832 (800)	624 (600)	4/3
VESA.800.DRV	832 (800)	624 (600)	4/3
VESA1024.DRV	1024	768	4/3
VESA1280.DRV	1280	1024	5/4

It is important to know the **selected resolution** of the monitor (Control Panel/Display), see [table](#), model 3. CRT cathode ray tube monitors have 4/3 ratio and usually max resolution does not exceeds 1024/768 pixels. The LCD monitors may have a 4/3 ratio or different.

In our example the CRT monitor's selected resolution is 1024x768 pixels, meaning 4/3 ratio.

To improve the monitor's resolution you must experiment VESA800.DRV, VESA1024.DRV and VESA1280.DRV located in TANGO/DRV. Change SCH.INI as follows:

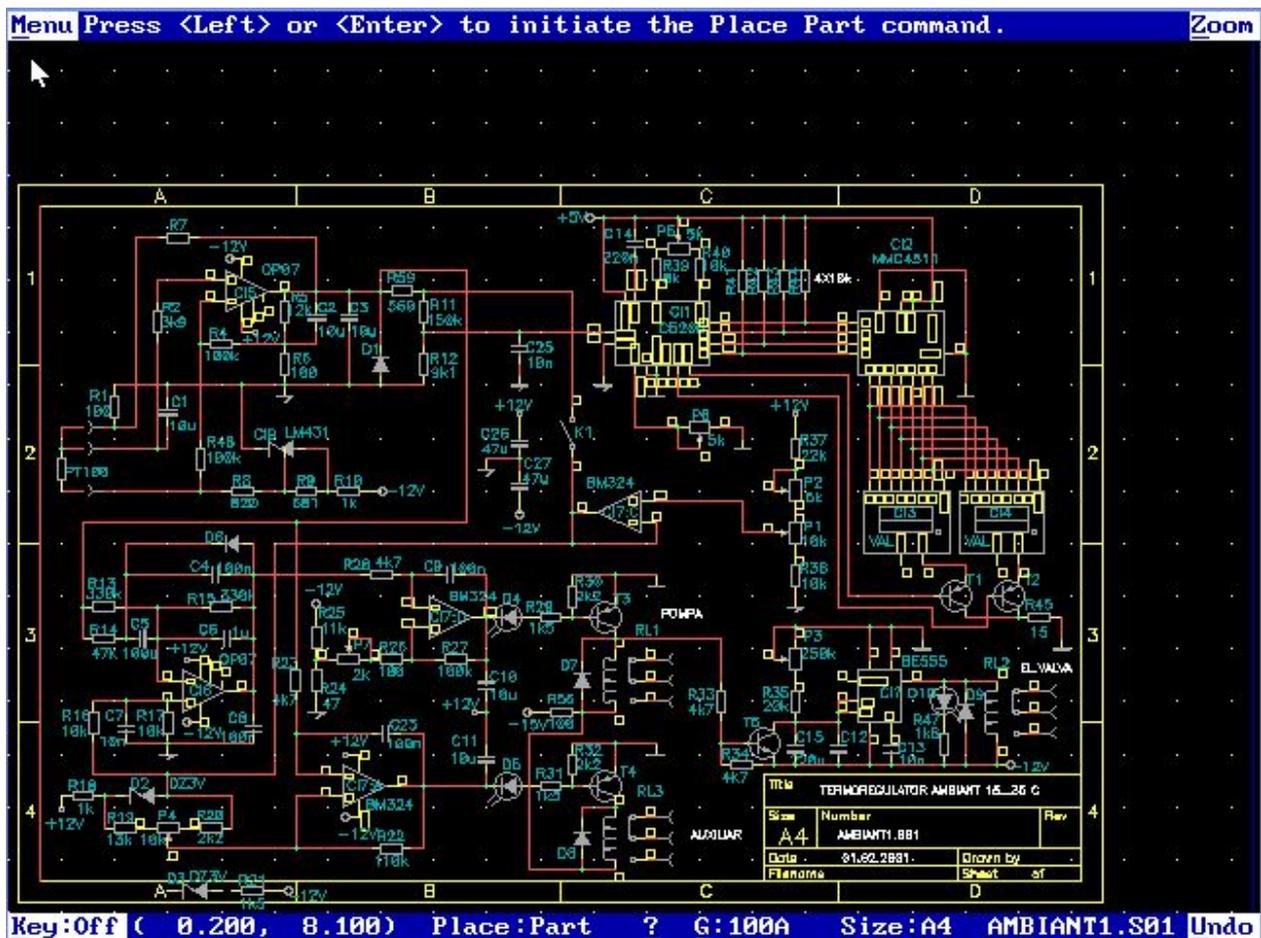


```
SCH.INI - Notepad
File Edit Format View Help
VERSION 1 0
FILE_GRA "D:\TANGO\DRV\VESA800.DRV"
FILE_SCH 1 ""
SYS_CURSOR 0 200 8500
SYS_CURSOR_SPEED 0
```

Open each time TANGO schematic. **The yellow border must be fully visible on the monitor screen.** When the border is only partial visible or the application does not open you must revert to a lower VESA driver.

In this example there is suportod only VESA800.DRV.

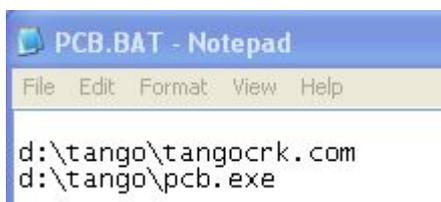
Put SCH.BAT shortcut on the desktop. Open the application again. Open any .S01 file contained in SHEET folder.



Next install the libraries and perform other settings.

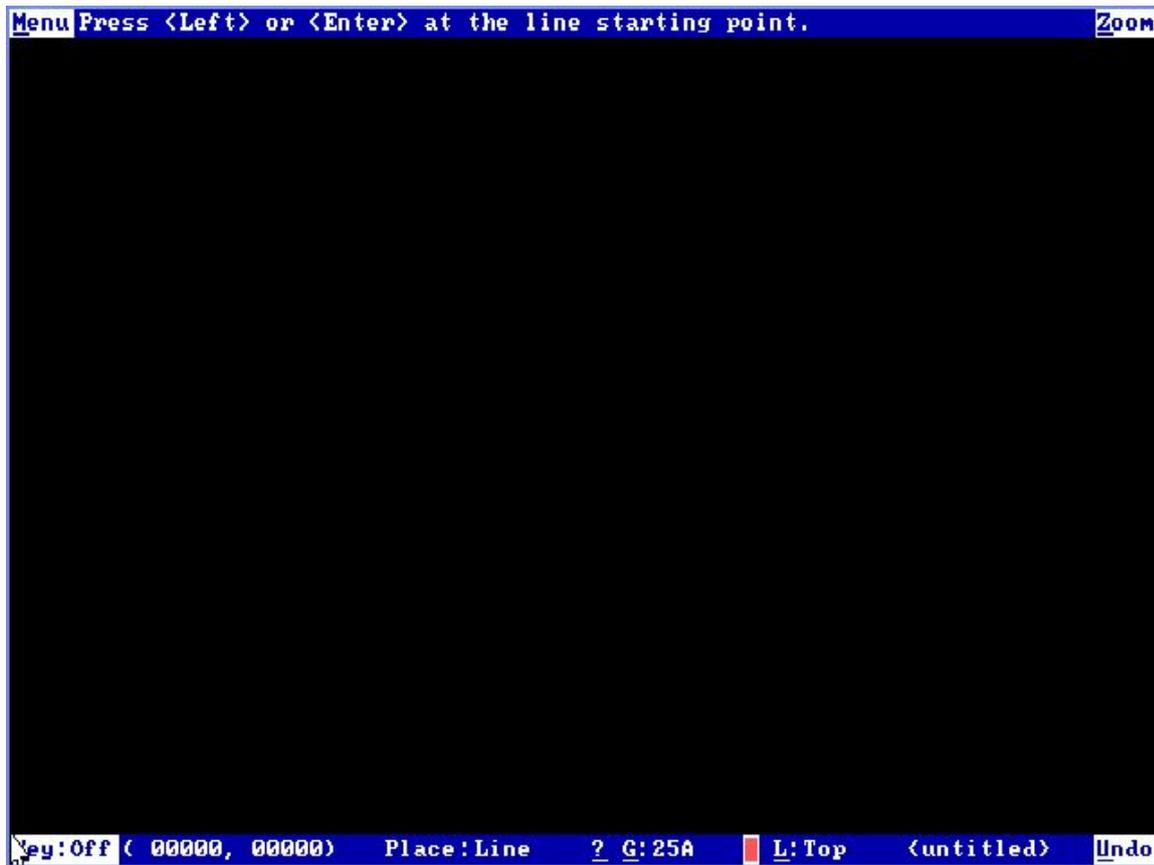
## 1.2. TANGO pcb installation

TANGO pcb installation is done after TANGO schematic is already installed. TANGO pcb does not open in PCB.EXE. TANGOCRK.COM solves an initial hardware key.



In case you have no PCB.BAT you must do it with Notepad in TANGO folder.

Remove PCB.INI in TANGO. The application opening is done with double click on PCB.BAT. The application opens to the lowest EGA 640x480 resolution and presents a blank screen.



Close the application. The PCB.INI file is automatically generated in TANGO folder.

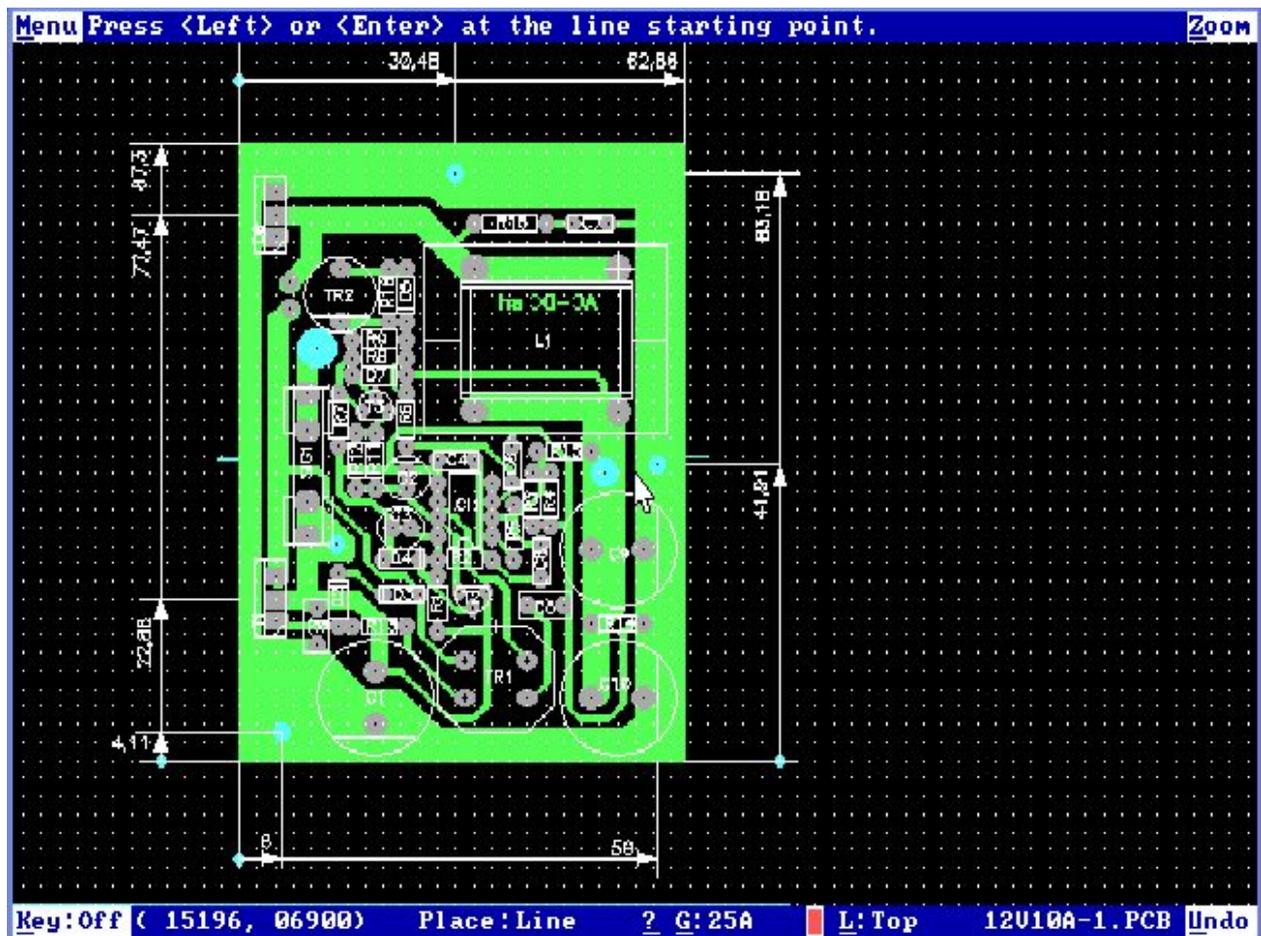
```
PCB.INI - Notepad
File Edit Format View Help
|;Tango-PCB PLUS V2.22 Series II
VERSION 1 3
FILE_GRA "D:\TANGO\EGA.DRV"
FILE_PCB ""
SYS_CURSOR 0 850 22225
SYS_CURSOR_SPEED 0
```

Note that EGA.DRV is used by default and produces lowest 640x480 pixels monitor rezolution, of course not acceptable.

Enter in PCB.INI file the same VESA driver set previously in SCH.INI, in our case VESA800.DRV.

```
PCB.INI - Notepad
File Edit Format View Help
|;Tango-PCB PLUS V2.22 Series II
VERSION 1 3
FILE_GRA "D:\TANGO\DRV\VESA800.DRV"
FILE_PCB ""
SYS_CURSOR 0 75 23500
SYS_CURSOR_SPEED 0
```

Load any .PCB file contained in BOARD folder. Open the application.



**Note:** It is the single example when TANGO directly implementation is operational.

## Example 2.

We use the model nr. 2 of the [table](#). We have a laptop Acer AMD Turion(tm)64X2 Mobile, Windows XP Pro 32 bit, monitor LCD 1280x800 pixels resolution, ratio 16/10.

Directly TANGO implementation is similar to previous example 1. The graphic accepted resolution is also VESA800.DRV. Notice that ratio is bigger than 4/3 and TANGO application shows intolerable geometric distortions.

## 2. Indirectly DosBox implementation on 32 and 64 bit machines

The DosBox-0.74 opened source application runs with 16 bit DOS programmes on 32 and 64 bit machines. DosBox emulates a DOS virtual environment software.

**TANGO runs very well on [DosBox 0.74](#).**

DosBox and TANGO are installed on disc D. DosBox includes two important files:

- User manual - [DosBox 0.74 Manual.txt](#)
- The configuration file - [DosBox 0.74.conf](#)

Concerning DosBox it is important to understand that 16 bit DOS applications are [mounted](#) on a virtual drive C:\. Don't make the confusion between virtual disc C:\ used by [DosBox](#) and the real partition C:\ from the hard disk.

The [DosBox mounting](#) assigns the virtual disc C:\ to the real path D:\TANGO.

To some extent it is useful this [link](#) translated from Portuguese.

In [DosBox 0.74.conf](#) file have to be done some changes:

- fullscreen=false → fullscreen=true
- core=auto → core=normal
- cputype=auto → cputype=pentium\_slow
- cycles=auto → cycles=30000
- cycleup=10 → cycleup=500

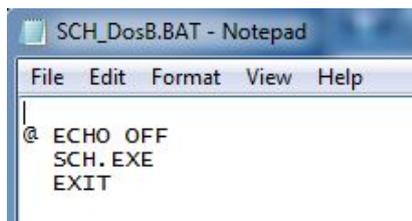
Once configured, the DosBox 0.74.conf file is used by both TANGO schematic and TANGO pcb.

## Example 1

We use the model 1. from the [table](#). We have a Windows 7 Pro 64 bit, monitor LCD Acer V226HQL, interface DVI, 1920x1080 pixels selected rezolution, ratio 16/9.

## 2.1. TANGO schematic installation

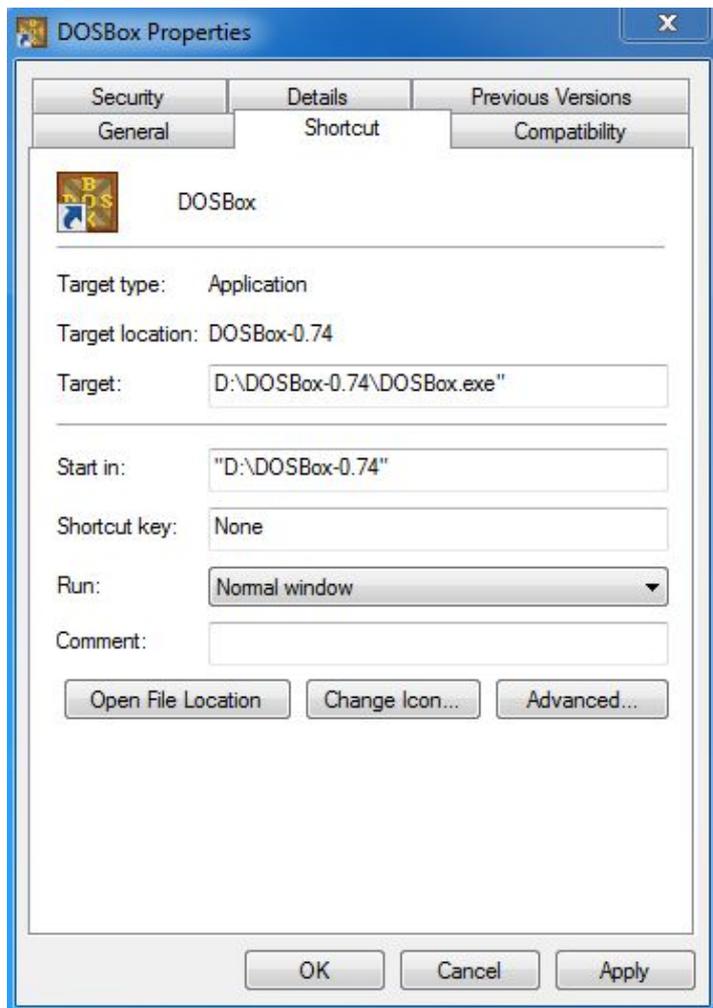
Create a new .BAT file to be run on DosBox. The file is [SCH\\_DosB.BAT](#) made with Notepad, located in TANGO.



**Observation:** The 16 bit DOS applications only support the 8.3 definition. The folders and files names cannot exceed 8 characters and 3 chars for extension. In our case the SCH\_DosB name has 8 characters and there are 3 characters in BAT extension name. The same limits are for folders.

Delete SCH.INI file, it will be automaticaly generated by TANGO.

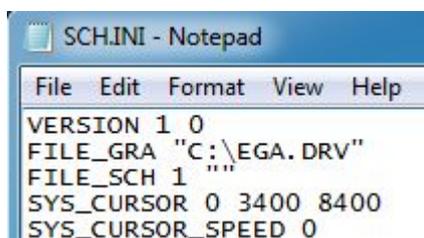
On the desktop, the DosBox-0.74 shortcut is as follows:



Copy this shortcut on the desktop and rename it [Tango SCH](#). In the Target add:

["D:\DosBox-0.74\DOSBox.exe"](#) [D:\Tango\SCH\\_DosB.BAT](#)

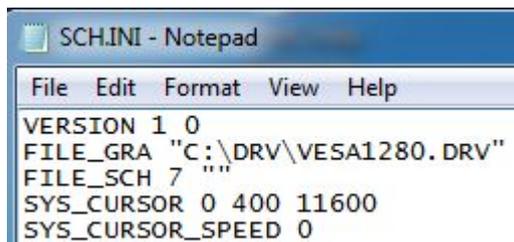
Click [Tango SCH](#) shortcut. The screen contains just the border, full screen, lowest EGA resolution. Close the application, the SCH.INI file is automatically generated.



**Attention**, the virtual disk [C:\](#) from SCH.INI file is the real path [D:\TANGO](#)

According to [chapter 1.1](#), experimental improve the graphic VESA rezolution in SCH.INI file, starting progresiv from VESA800.DRV, VESA1024, VESA1280 until the yellow border remains fully visible, on the full screen.

In this example there is obtained a spectacular max rezolution provided by VESA1280.DRV.



```
SCH.INI - Notepad
File Edit Format View Help
VERSION 1 0
FILE_GRA "C:\DRV\VESA1280.DRV"
FILE_SCH 7 ""
SYS_CURSOR 0 400 11600
SYS_CURSOR_SPEED 0
```

Load any .S01 file contained in TANGO\SHEET folder. Usually we see geometric distortions generated by the monitor's ratio value  $> 4/3$ .

Dos Box is able to change the monitor resolution by the help of **fullresolution** parameter. Initial value is **fullresolution=original**

Control Panel / Display shows that monitor's selected resolution is  $x/y = 1920/1080$ . Observe that monitor's vertical resolution-y (1080) and vertical resolution-y (1024) of VESA1280.DRV are near close.

We reduce the monitor's horizontal-x resolution to fit ratio  $x/y = 4/3$ .

We take as reference the monitor's vertical resolution-y in this case 1080 pixels.

We get  $x = 1080 \times 4/3 = 1440$ .

Change **fullresolution=1440x1080**

## 2.1. TANGO pcb installation

Delete PCB.INI, it will be automatically generated by TANGO.

Create a new .BAT file to be run in DosBox. This file is **PCB\_DosB.BAT** made with Notepad in TANGO.

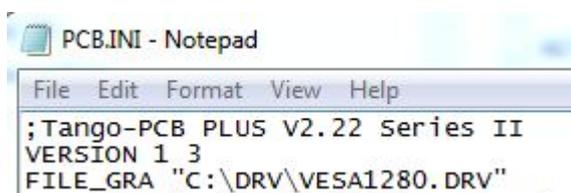


```
PCB_DosB.BAT - Notepad
File Edit Format View Help
@ ECHO OFF
tangocrk.com
pcb.exe
EXIT
```

Copy the **DosBox-0.74** shortcut on the desktop and rename it **Tango PCB**. In the Target add:

**"D:\DosBox-0.74\DOSBox.exe" D:\Tango\PCB\_DosB.BAT**

Configuring PCB.INI file is similar to [chapter 1.2](#). Once TANGO pcb is released from PCB\_DosB.BAT, The application presents a blank screen and lowest EGA resolution. Enter the same VESA driver as set in SCH.INI.



```
PCB.INI - Notepad
File Edit Format View Help
;Tango-PCB PLUS V2.22 Series II
VERSION 1 3
FILE_GRA "C:\DRV\VESA1280.DRV" ..
```

Geometric distortion are more easy to be seen in TANGO pcb. In this case there are distortions which were not previously observed in TANGO schematic.

This time we take as reference the VESA1280 resolution-y, in our case 1024 pixels.

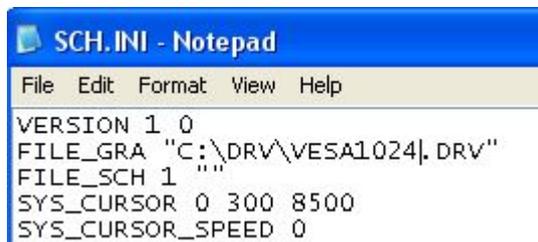
We get  $x = 1024 \times 4/3 = 1365$ .

Change `fullresolution=1365x1024` and all distortions disappear.

## Example 2

We use the model 2. from the [table](#). We have a Windows XP Pro 32 bit laptop Acer 5520G, 1280x800 selected resolution, ratio 16/10.

Do similar as in [chapter 2](#). In this example the accepted graphic driver is VESA1024, a superior driver comparing with TANGO directly implementation (see [chapter 1](#), example 2).



```
SCH.INI - Notepad
File Edit Format View Help
VERSION 1 0
FILE_GRA "C:\DRV\VESA1024.DRV"
FILE_SCH 1 ""
SYS_CURSOR 0 300 8500
SYS_CURSOR_SPEED 0
```

We have to reduce the monitor's horizontal resolution-x to fit ratio  $x/y = 4/3$ .

We take as reference the monitor's resolution-y in this case 800 pixels.

We get  $x = 800 \times 4/3 = 1066$

Change `fullresolution=1066x800`

**Observation:** This example shows that DosBox is providing two advantages in contrast with directly implementation:

- Allows the use of a VESA superior graphic driver.
- Solves the geometrical distortions when LCD monitor's ratio  $>4/3$ .

## Example 3

We use the model 4 of the [table](#). We have a Windows XP and a LCD monitor with the selected resolution 1280x1024, ratio 5/4.

The accepted driver is VESA1280.DRV, resolution 1280x1024.

We try to reduce the monitor's vertical resolution-y to fit the ratio  $x/y = 4/3$

`fullresolution=1280x960` is not accepted by DosBox.

We return to the initial `fullresolution=original`. Geometric deviations are small scale and can be tolerated.

## Observations:

- This example shows that DosBox ensures TANGO implementation even if the video card is not compatible with the graphic drivers DOS VESA.
- The [fullresolution](#) parameter does not accept values when the monitor ratio  $<4/3$  (in our case is  $5/4$ ). This observation can be a challenge to improve DosBox itself in the future.

## Example 4

Use model 5. in the [table](#), a performant HP Pavilion 15-n001sq Notebook PC, Windows 7 Home Premium, monitor LCD selected resolution 1366x768, ratio 16/9.

The accepted graphic driver is VESA1024.

**Observation:** The AMD Radeon HD 8670M video card is so performant that it is accepting by its own [fullresolution=original](#) and there are no geometric distortions.

## 3. Printing CAD documents

TANGO is successfully used for over 20 years because it was equipped with the last up to date utilities of the 1993 year when, unfortunately it was abandoned.

We remember the 600 DPI resolution provided by HP LaserJet 4P printers, parallel port.

Nowadays we use USB printers. TANGO is able to save .PS (post script) files.

To do this, select Rotate in TANGO schematic, Plot/Print window. The files have .P01 extension and are by default saved in TANGO folder. We must manually change the extensions from .P01 to .PS.

In TANGO pcb the files may have .PS extension and are by default saved in the same folder as .PCB file, in the above example the BOARD folder.

The .PS files can be converted in .PDF files and can be printed in Adobe Professional ([Create PDF from file](#)) using USB printers.

## 4. The achievement of the Gerber files

TANGO pcb generates Gerber 374D files accordingly to our [tutorial](#) .

[It is possible](#) the conversion of Gerber 374D files to 374X files.

## 5. Conclusions

The DOSBox virtualization is the best solution to use and keep alive TANGO on the current systems Windows 32 and 64 bit. DOSBox provides the software emulation of DOS VESA graphic drivers and corrects the LCD monitor's resolution to 4/3 ratio.

TANGO is still remaining an effective CAD tool, ensuring comfort, elegance and a wide freedom in design.

TANGO is mainly used in the case of uniques, prototypes, small series with manual soldering. TANGO does not provide the documentation for automatically solder. The solution is to convert the TANGO file in PCAD files, a follower of TANGO..

Our experiments shows that [Windows XP mode](#) although is valid only for Windows 7 64 bit Professional, Enterprise and Ultimate does not ensure the TANGO optimized installation.

Our experiments shows that the more performant is the machine on which TANGO is DosBox implemented, the more simple is the implementation itself, with maximum resolution and without geometrical distorsions.

Although we had not a PC Windows 8 for testings, we suggest users to experiment themselves, there are high chances for good results.