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

The tutorial is done for those old designers who used in the past this efficient CAD.

In the second row, the tutorial is addressed to those young people who want start designing electronic boards, simply, elegant and **without any restriction**.

The initial installation procedure used 6 flopy disks.

The flopy disks came out of use but TANGO continued successfuly working on new windows PC generations, the folders being transferred by the help of CD, memory stick, etc.

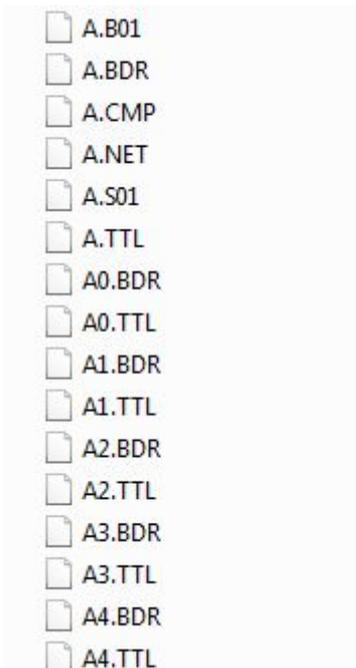If you have not TANGO, you can successfuly use our configuration.

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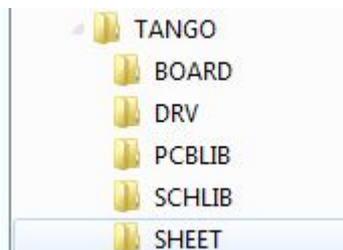
- BOARD containes own user's previously made .PCB files.
- DRV contains drivers with .DRV extension. It's important to be contained VESA800.DRV, VESA1024.DRV and VESA1280.DRV files.
- PCBLIB contains both PCB system libraries and user's own previous libraries.
- SCHLIB contains both SCH system libraries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

TANGO mainly containes system files:

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

```
A.B01
A.BDR
A.CMP
A.NET
A.S01
A.TTL
A0.BDR
A0.TTL
A1.BDR
A1.TTL
A2.BDR
A2.TTL
A3.BDR
A3.TTL
A4.BDR
A4.TTL
```

- 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

Model	PC	Operation system	Video card	Monitor
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 <> 4/3, geometric distorsions occur inevitably, the circle becomes oval, the square becomes rectangle. These distorsions 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.
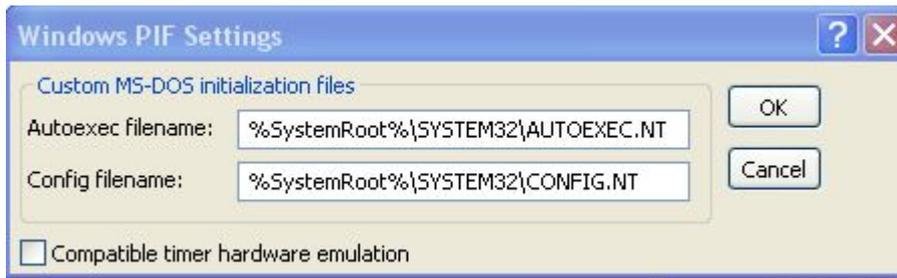

1.1. TANGO schematic installation

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:
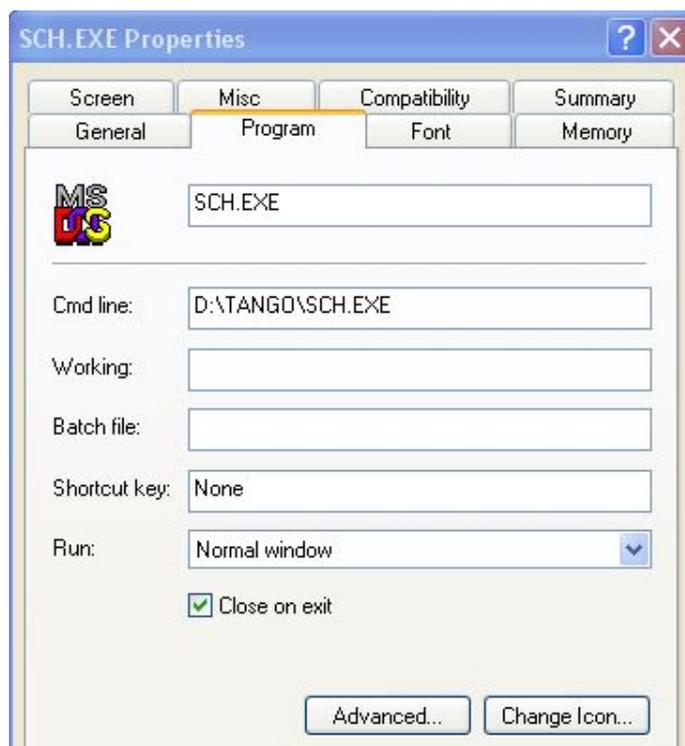
The Advanced option shows:

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).
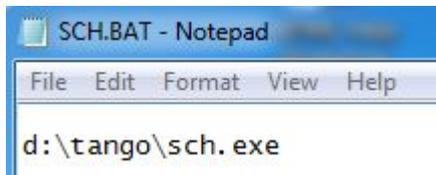

If there is not, make your SCH.BAT file in Notepad and save it in TANGO folder. Double click SCH.BAT.
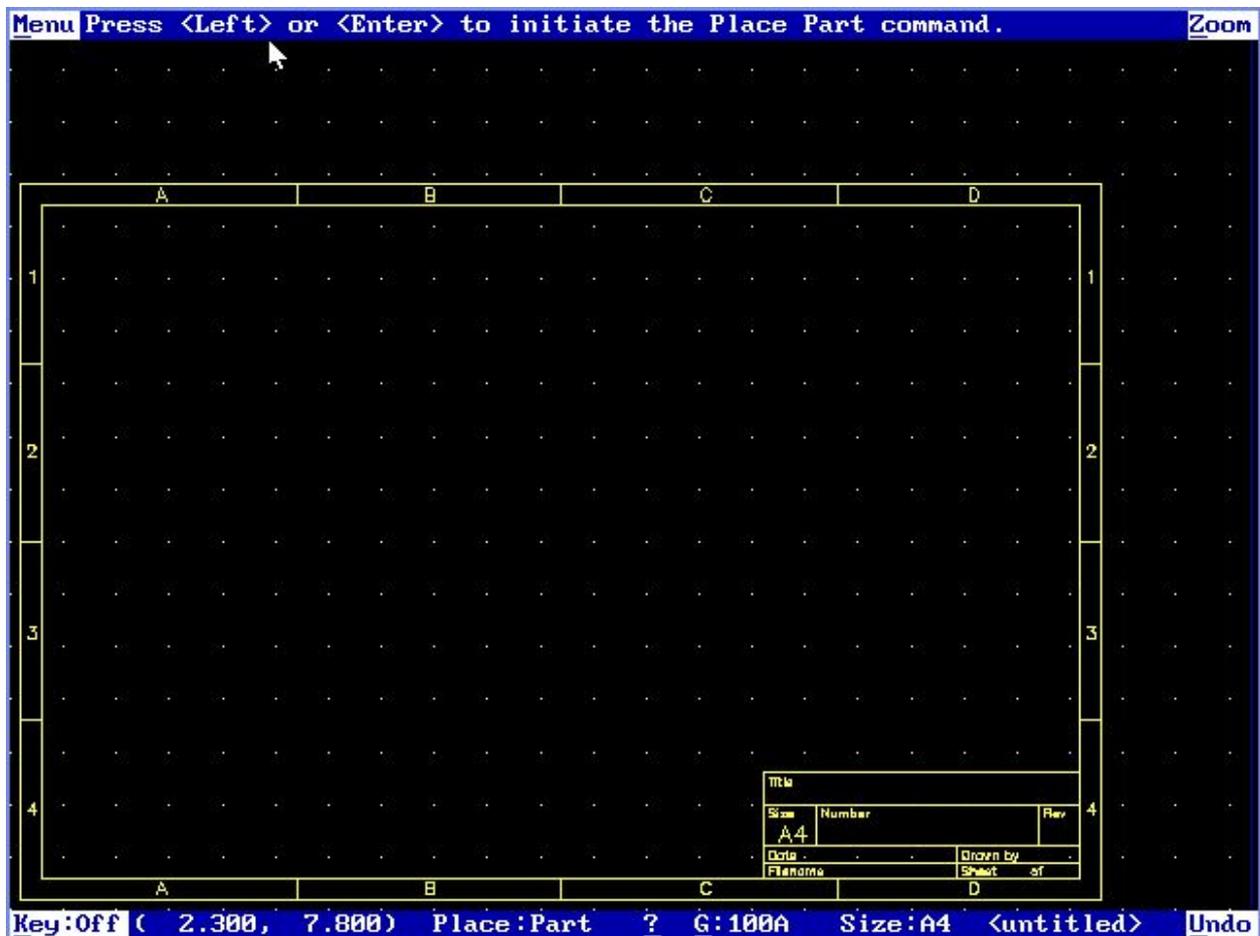
The opened application has lowest EGA 640x480 resolution. There is only the yellow border.

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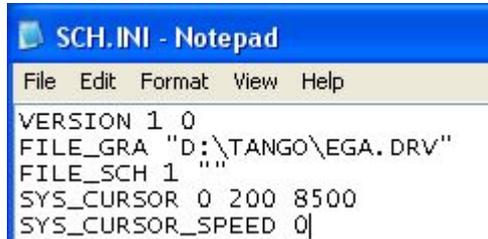
```
SCH.INI - Notepad
File  Edit  Format  View  Help
VERSION 1 0
FILE_GRA "D:\TANGO\EGA.DRV"
FILE_SCH 1 ""
SYS_CURSOR 0 200 8500
SYS_CURSOR_SPEED 0
```

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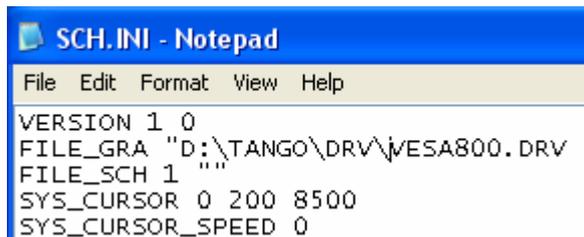
```
SCH.INI - Notepad
File  Edit  Format  View  Help
VERSION 1 0
FILE_GRA "D:\TANGO\DRV\VESA800.DRV"
FILE_SCH 1 ""
SYS_CURSOR 0 200 8500
SYS_CURSOR_SPEED 0
```

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 suported only VESA800.DRV.

Put SCH.BAT shortcut on the desktop. Open the application again. Open any .S01 file contained in SHEET folder.
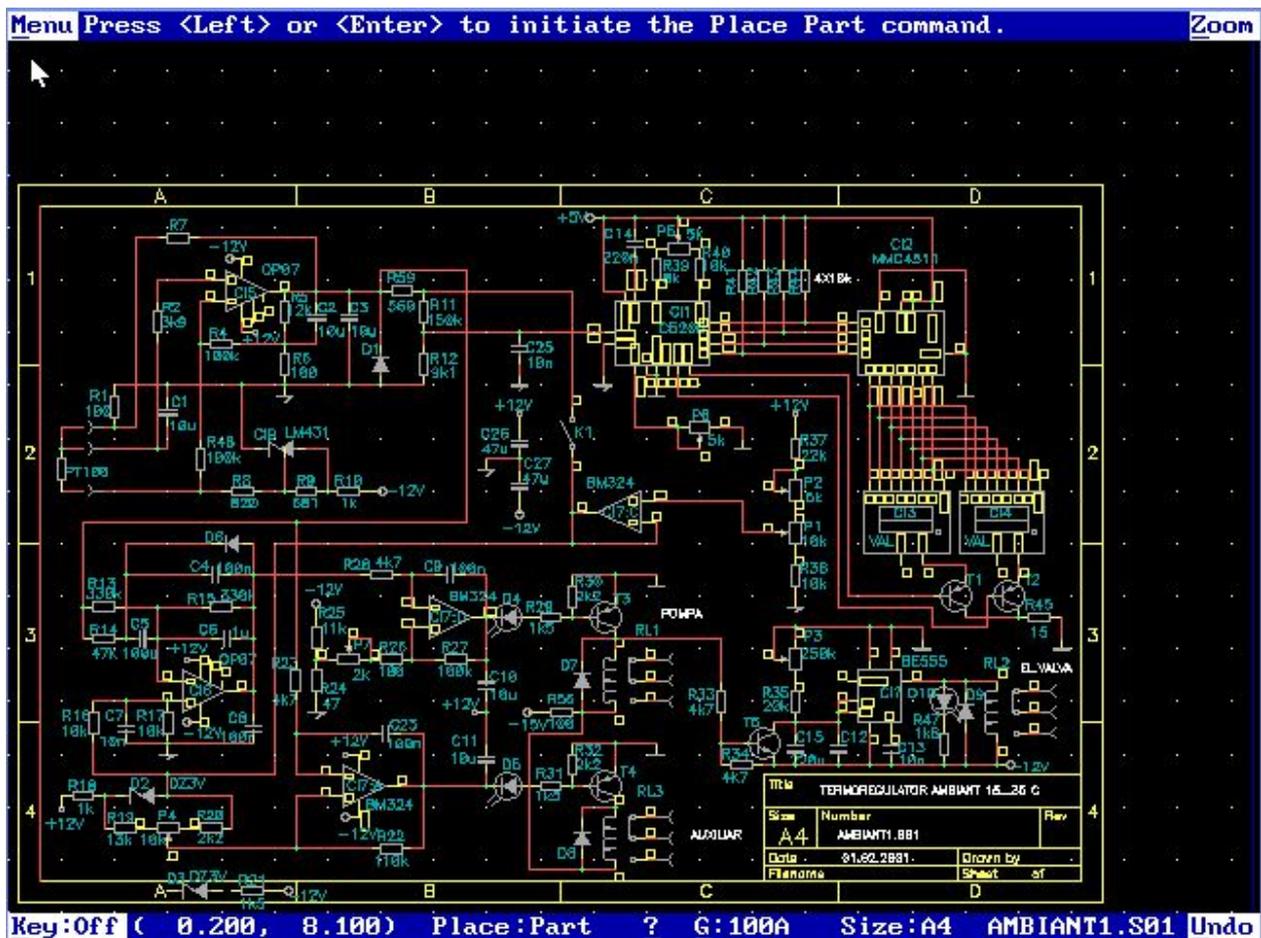
Next install the libraries and perform other settings.

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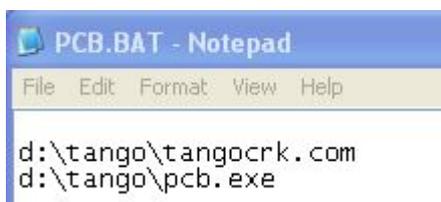
In case you have no PCB.BAT you must do it with Notepad in TANGO folder.

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

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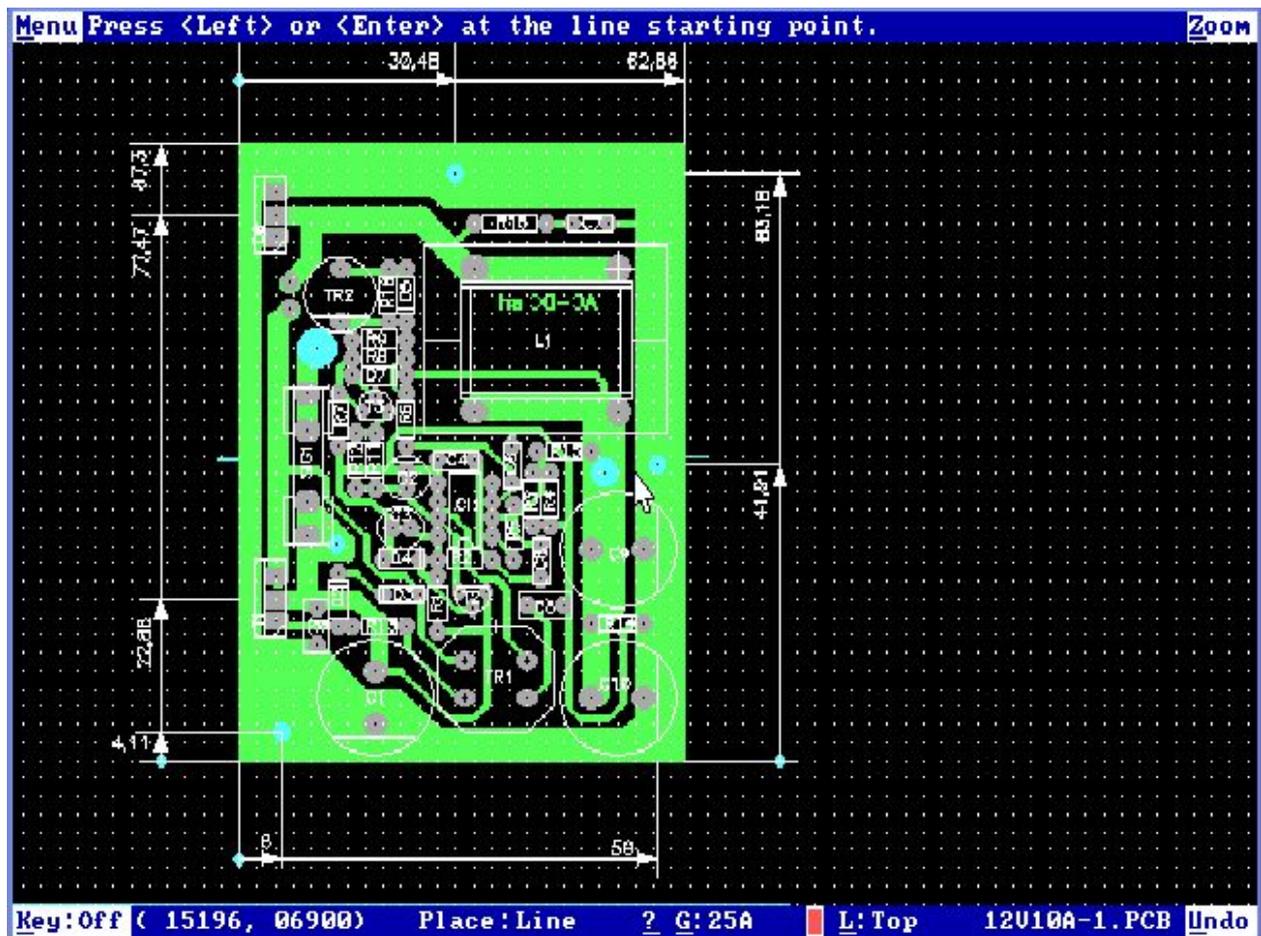

Note that EGA.DRV is used by default and produces lowest 640x480 pixels monitor rezolution, of course not acceptable.

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

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 rezolution, ratio 16/10.

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

2. Indirectly DosBox implementation on 32 and 64 bit machines

The DosBox-0.74 opened source application runs with 16 bit DOS programms on 32 and 64 bit machines. DosBox emulates a DOS virtual entvironment 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 asignes 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=max
- 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.
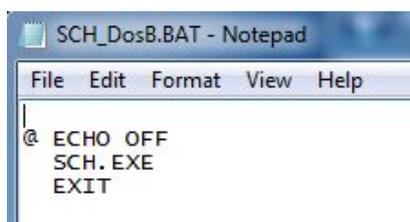
Observation: The 16 bit DOS applications only support the 8.3 definition. The folders and files names cannot exceed 8 characters and 3 chars for extension. In our case the SCH_DosB name has 8 characters and there are 3 characters in BAT extension name. The same limits are for folders.

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

On the desktop, the DosBox-0.74 shortcut is as follows:
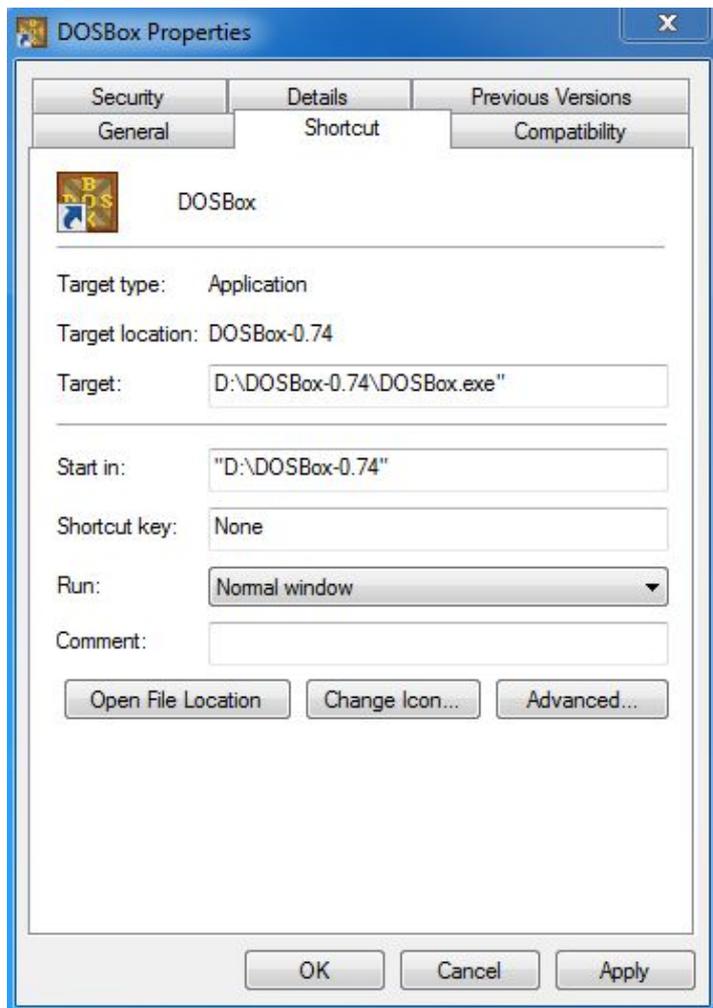
Copy this shortcut on the desktop and rename it Tango SCH. In the Target add:

"D:\DosBox-0.74\DOSBox.exe" D:\Tango\SCH_DosB.BAT

Click Tango SCH shortcut. The screen containes just the border, full screen, lowest EGA rezolution. Close the application, the SCH.INI file is automatically generated.
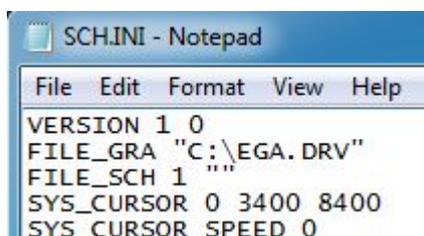
Attention, the virtual disk C:\   from SCH.INI file is the real path D:\TANGO

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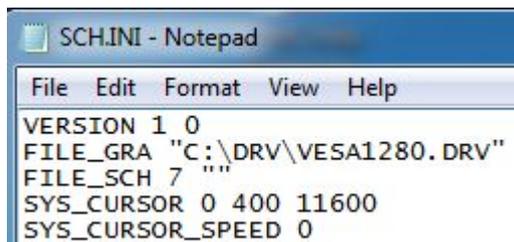
```
SCH.INI - Notepad
File  Edit  Format  View  Help
VERSION 1 0
FILE_GRA "C:\DRV\VESA1280.DRV"
FILE_SCH 7 ""
SYS_CURSOR 0 400 11600
SYS_CURSOR_SPEED 0
```

Load any .S01 file contained in TANGO\SHEET folder. Usually we see geometric distorsions 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 rezolution is x/y = 1920/1080. Observe that monitor's vertical resolution-y (1080) and vertical rezolution-y (1024) of VESA1280.DRV are near close.

We reduce the monitor's horizontal-x rezolution 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 = 1080x4/3 = 1440.

Change   fullresolution=1440x1080

2.1. TANGO pcb installation

Delete PCB.INI, it wil be automatical;ly 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.
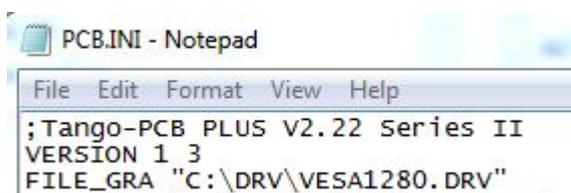

```
PCB.INI - Notepad
File  Edit  Format  View  Help
;Tango-PCB PLUS V2.22 Series II
VERSION 1 3
FILE_GRA "C:\DRV\VESA1280.DRV"
```

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

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

We get   x = 1024x4/3 = 1365.

Change   fullresolution=1365x1024   and all distorsions disappear.

Example 2

We use the model 2. from the table. We have a Windows XP Pro 32 bit laptop Acer 5520G, 1280x800 selected rezolution, ratio 16/10.

Do similar as in chapter 2. In this example the accepted graphic driver is VESA1024, a superior driver comparring with TANGO directly implementation (see chapter 1. example 2).
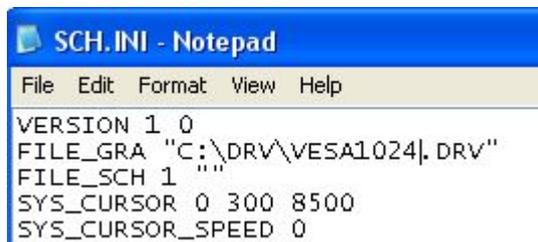
We have to reduce the monitor's horizontal rezolution-x to fit ratio x/y = 4/3.

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

We get   x = 800x4/3 = 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 distorsions 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 rezolution 1280x1024, ratio 5/4.

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

We try to reduce the monitor's vertical rezolution-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 in not compatible with the graphic drivers DOS VESA.
- The fullresolution parameter does nor accept values when the monitor ratio <4/3 (in our case is 5/4). This observation can be a chalenge 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 is accepting by its own fullresolution=original   and there are no geometric distorsion.

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 manual 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 automaticaly 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.