

TI-59 Emulator

User's Manual

www.claudiolarini.altervista.org

1. REQUIREMENTS

The "TI-59 emulator" program, initially written for the TI-59 and then subsequently extended to other models of the Texas Instruments of the years 1975-1983, is available in two versions and precisely:

- a **16-bit** version written in Microsoft **Basic P.D.S. 7.1** and consists of 14 single emulation programs and 3 utility programs. The software has been tested under MS-DOS 6.22 and various versions of Window (3x, 9x, NT/2000/XP, Vista and 7/8/10 32 bit) via command prompt; as known 16-bit executables don't work under 64-bit Operating System and you need a virtualization software (like *VM player*);
- a **32/64-bit** written using **QB64** (current version used is **1.50**), which allow to be executed under any modern environment (from Win XP SP3 and up), keeping in the meantime the total compatibility with the original 16-bit version. Every executable files have their name ending with "**-64**".

Note: 16-bit executables don't work correctly under DosBox 0.74.

Important: English version of the emulation programs is obtained with the **/ENG** switch (see § 4.1)

2. INSTALLATION

All the software is contained in a single compressed file, *ti59emul.rar*. For installation it is enough to unzip it in the root directory of any available device (usually hard disk C:); it's created - or overwritten if already existent – the \TI59 folder with the following sub-folders:



Note for Windows Operating Systems: No icon will be created on the user desktop.

The **executables**, according to the last available version, are in two folders: the emulation programs are highlighted in **red**, in **brown** those with the new memory model, in **blue** the utility programs, in **green** the programs that make up *BAX59*, the cross-compiler from BASIC Dartmouth to TI-59 AOS and the one from *Limace* (a BASIC-like language) to TI-57 AOS.

Installation drive
▼

Il volume nell'unità X è HD_250
Numero di serie del volume: 0CF0-4490

Directory di X:\TI59

14/05/2024	20.53	2.853.376	57TO59-64.EXE
14/05/2024	21.59	103.694	57TO59.EXE
14/05/2024	21.02	2.697.216	BUILDER-64.EXE
15/05/2024	11.26	58.770	BUILDER.EXE
22/05/2024	16.36	3.098.112	CC5B-64.EXE
22/05/2024	16.29	103.722	CC5B.EXE
25/05/2024	10.04	2.767.360	ELIMACE2-64.EXE
25/05/2024	09.30	71.198	ELIMACE2.EXE
18/05/2024	13.57	2.718.208	IMPORT-64.EXE
18/05/2024	10.34	63.274	IMPORT.EXE
14/05/2024	21.59	116.326	KC.EXE
14/05/2024	21.01	2.675.200	LEGGIMI-64.EXE
15/05/2024	11.25	54.468	LEGGIMI.EXE
15/05/2024	09.00	160.538	NEWT58CX.EXE
15/05/2024	09.17	143.182	NEWTI57.EXE
15/05/2024	09.00	152.224	NEWTI58C.EXE
14/05/2024	21.50	157.528	NEWTI59.EXE
14/05/2024	21.51	157.742	NEWTI59A.EXE
14/05/2024	21.52	162.936	NEWTI59G.EXE
14/05/2024	21.53	147.548	NEWTI66.EXE
14/05/2024	22.02	113.814	SEP.EXE
07/05/2024	15.38	67.836	SR50.EXE
14/05/2024	21.56	138.582	SR52.EXE
14/05/2024	21.57	127.012	SR56.EXE
14/05/2024	21.59	141.036	SR60A.EXE
14/05/2024	21.15	114.188	TI53.EXE
14/05/2024	21.16	127.122	TI55.EXE
14/05/2024	21.17	130.910	TI55II.EXE
15/05/2024	09.17	142.830	TI57.EXE
16/05/2024	17.30	130.672	TI57LCD.EXE
15/05/2024	08.58	151.616	TI58C.EXE
15/05/2024	08.58	160.074	TI58CX.EXE
14/05/2024	21.22	156.850	TI59.EXE
14/05/2024	21.23	157.072	TI59ALT.EXE
14/05/2024	21.24	162.492	TI59GR.EXE
14/05/2024	21.25	137.136	TI62.EXE
14/05/2024	21.26	147.388	TI66.EXE
14/05/2024	21.27	127.040	TIMBA.EXE
14/05/2024	21.27	109.844	TIPROG.EXE
16/05/2024	10.37	88.452	ZONE.EXE

41 File 21.085.884 byte

Directory di G:\TI59\EXE64

14/05/2024	20.54	2.970.624	KC-64.EXE
14/05/2024	21.02	3.198.464	NEWTI57-64.EXE
15/05/2024	09.08	3.596.800	NEWTI58C-64.EXE

15/05/2024	09.07	3.675.648 NEWTI58CX-64.EXE
14/05/2024	20.48	3.688.448 NEWTI59-64.EXE
14/05/2024	20.49	3.690.496 NEWTI59ALT-64.EXE
14/05/2024	20.50	3.748.352 NEWTI59GR-64.EXE
14/05/2024	20.50	3.427.840 NEWTI66-64.EXE
14/05/2024	20.54	2.913.280 SEP-64.EXE
14/05/2024	21.01	2.735.616 SR50-64.EXE
14/05/2024	20.51	3.319.808 SR52-64.EXE
14/05/2024	20.51	3.155.456 SR56-64.EXE
14/05/2024	20.52	3.313.664 SR60A-64.EXE
14/05/2024	20.16	2.946.048 TI53-64.EXE
14/05/2024	20.17	3.074.560 TI55-64.EXE
14/05/2024	20.17	3.063.296 TI55II-64.EXE
14/05/2024	20.33	3.197.440 TI57-64.EXE
16/05/2024	17.28	3.031.040 TI57LCD-64.EXE
15/05/2024	09.06	3.589.632 TI58C-64.EXE
15/05/2024	09.06	3.622.912 TI58CX-64.EXE
14/05/2024	20.37	3.678.208 TI59-64.EXE
14/05/2024	20.38	3.676.672 TI59ALT-64.EXE
14/05/2024	20.38	3.736.064 TI59GR-64.EXE
14/05/2024	20.39	3.134.976 TI62-64.EXE
14/05/2024	20.42	3.428.864 TI66-64.EXE
14/05/2024	20.42	3.121.664 TIMBA-64.EXE
14/05/2024	20.44	2.911.232 TIPROG-64.EXE

28 File 92.365.312 byte

Totale file elencati:

69 File 113.460.423 byte
0 Directory 73.657.122.816 byte disponibili

An emulator for an "extended" TI-58C has also been implemented with additional features: its file name is *TI-58CX.EXE* (or *TI58CX-64.EXE* – see §5.4).

Files starting with "NEW" constitute an even more adherent implementation of the real machines, using a new memory model: for this reason they have their own support files that differ from those relating to "standard" emulators.

3. AVAILABLE EMULATORS

The emulated calculators are:

- **TI-59** with **PC-100C** printer
 - **TI59.EXE** (standard)
 - **TI59ALT.EXE** (functionally equivalent, but with a different skin)
 - **TI59GR.EXE** (that implements "graphics" on the PC-100C printer – see § 7.2)
- **TI-58** with **PC-100C** printer [included in TI-59 emulator]
- **TI-58C** with **PC-100C** printer
 - **TI58C.EXE** (standard)
 - **TI58CX.EXE** (extended emulator – see § 5.4)
- **TI-57**
- **TI-57LCD**
- **TI-66** with **PC-200** printer
- **TI-55**
- **TI-55 II**
- **SR-52** with **PC-100A** printer
- **SR-56** with **PC-100A** printer
- **TI-53**
- **TI MBA** (financial),
- **SR-60A** (in absolute world preview)
- **SR-50**
- **TI Programmer LCD**

The last two are NOT programmables. There also two emulators for non-TI calculators:

- **Netronics NX3000**
- **Sinclair Enterprise Programmable.**

3.1. COMPATIBILITY WITH THE REAL CALCULATORS.

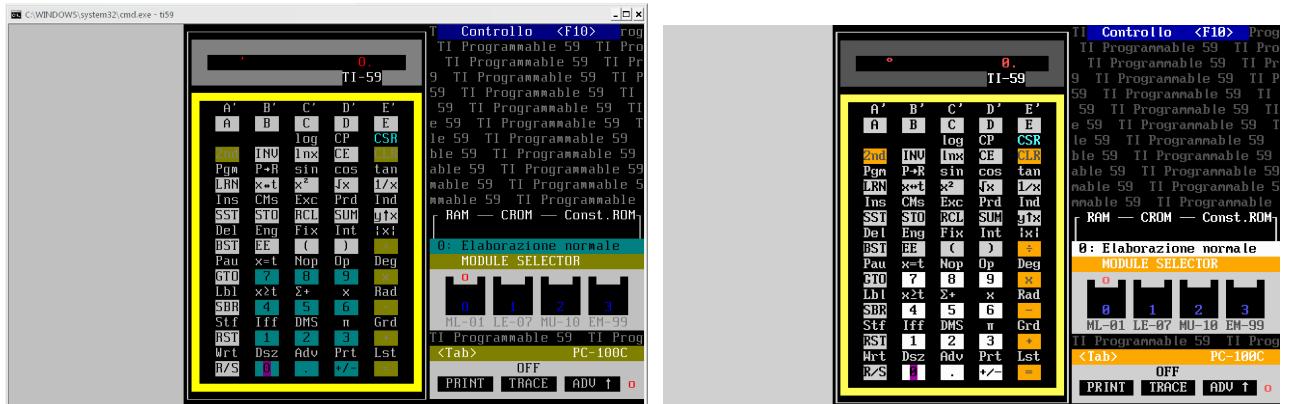
All emulators aren't based directly on the emulation of the machine' ROM, and occasionally it is possible that some real program, despite the care taken in realizing the software, may not run properly and minor changes would be necessary. At the moment these modifications concern particular cases only and they are noticed in the *PROG* folder files. In any case, all the (few) blocking situations of real machines have been corrected such as the sequence **21 38** [2nd sin] encountered in a program on the SR-52, TI-59 and TI-58 or the (apparently harmless) operation **1 EE 99 +/- x 0 =** on the TI-57.

Also, due to some "bugs" of QB64, some (very few) results provided by 32/64-bit programs may be different (wrong) from those provided by **16-bit** programs (right), which therefore remains the **reference version**.

4. RUNNING THE EMULATOR

Every program is executed as any other DOS/Windows application and it can be run or in a window or in "all-screen" mode (if the graphic card and/or the Operating System consent this).

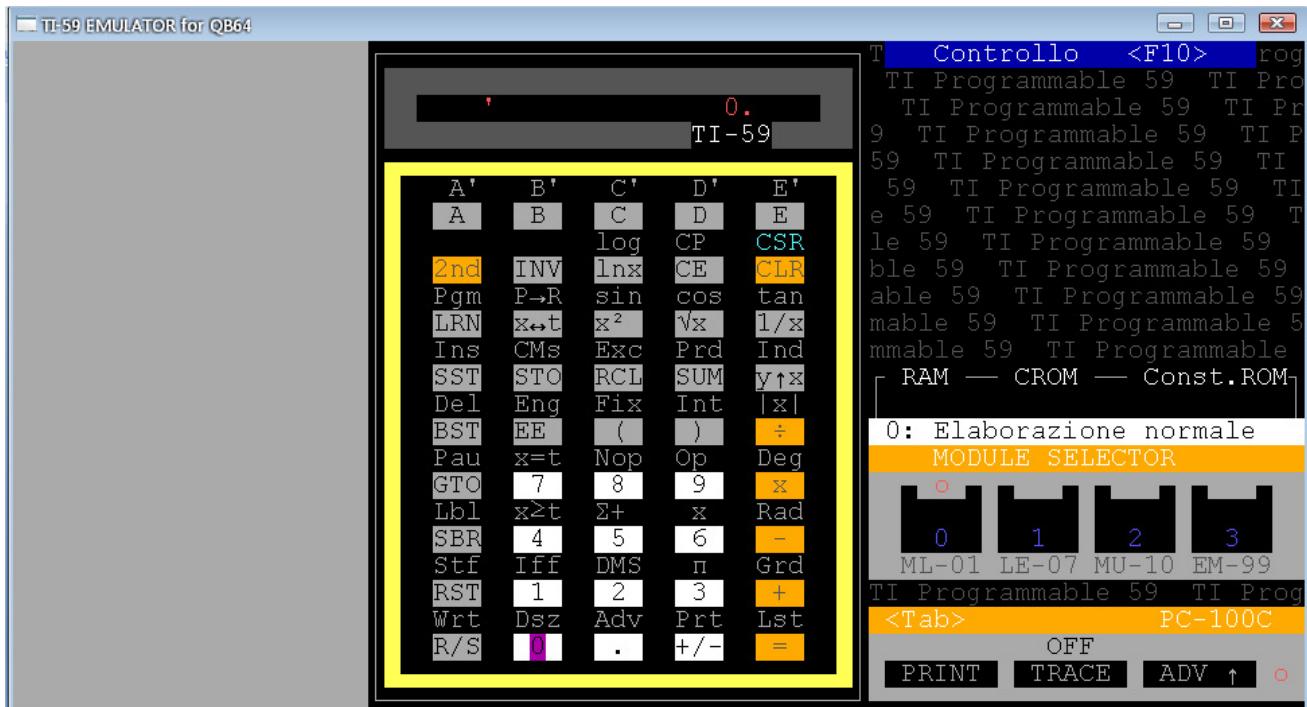
Important: The 16-bit versions are programmed to run in full screen, because they manipulate the color palette. Running these applications instead through the Windows Command Prompt that does not manipulate the color palette, we may have chromatically inadequate screens – it is therefore advisable to use the 32/64 bit versions that behave correctly.



The colors of the 16-bit version for TI59.EXE: on the left in a window instead on the right in full screen mode: note that the Windows Command Prompt does not handle the color palette.

All versions use **codepage 437**, which must be active before execution.

Below there is a run of the 32/64 bit version, which can only be performed in a window (resizable as desired) **preserving the color palette**.

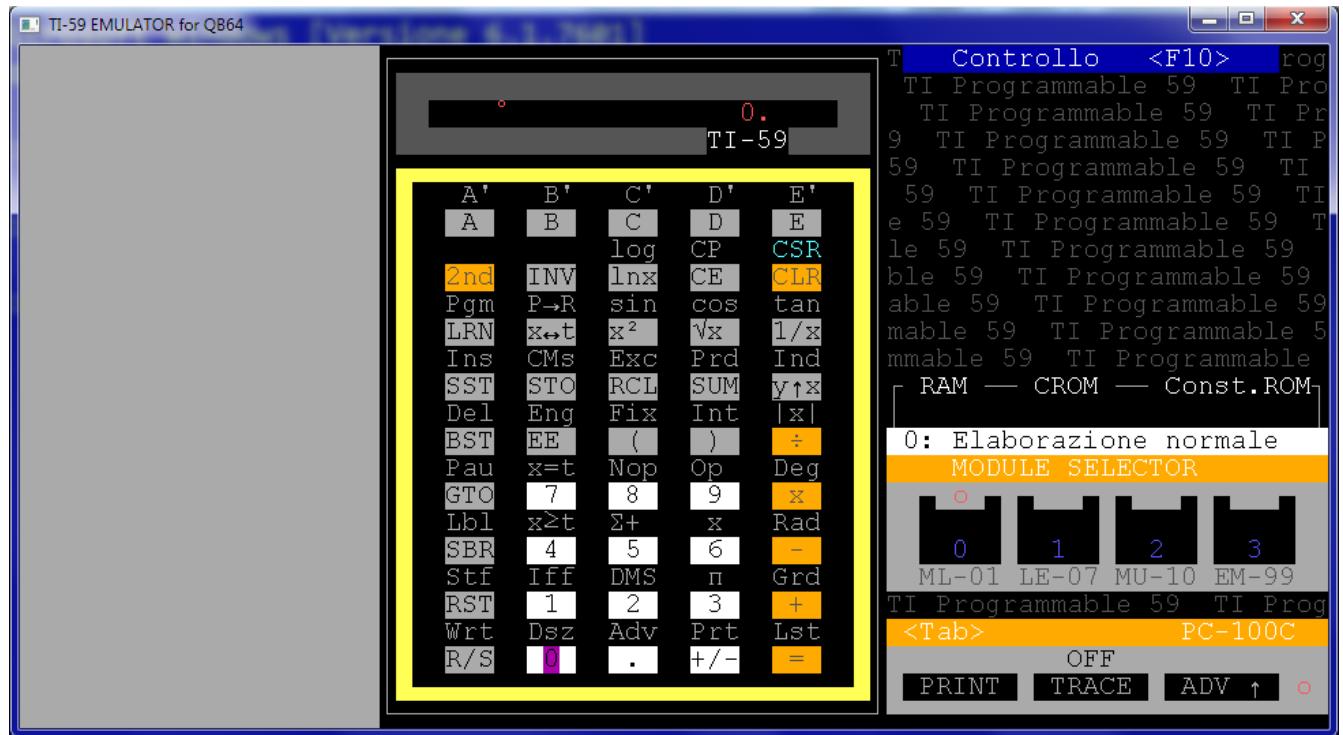


Note: The 64-bit versions must be executed in \TI59 folder as **EXE64\file_name**

4.1 THE COMMAND LINE AND THE SUPPORT FILES.

The complete command line for every emulator is the following:

- **TI59** [/P1|/P2|/P3] [/58] [/58X] [/D] [/A] [/ENG] [/?]
(for **TI59ALT** and **TI59GR** too)
- **TI58C** [/P1|/P2|/P3] [/D] [/A] [/ENG] [/?]
- **TI57** [/S] [/D] [/ENG] [/?]
- **TI55** [/D] [/ENG] [/?]
- **TIMBA** [/D] [/ENG] [/?]
- **TI55II** [/NUM] [/ENG] [/?]
- **TI57LCD** [/NUM] [/EXT] [/ENG] [/?]
- **TI66** [/P1|/P2|/P3] [/HEX] [/N] [/D] [/A] [/ENG] [/?]
- **TIPROG** [/ENG] [/?]
- **SR52** [/P1|/P2|/P3] [/EXT] [/D] [/A] [/L] [/ENG] [/?]
- **SR56** [/P1|/P2|/P3] [/D] [/A] [/L] [/ENG] [/?]
- **SR60A** [/P1|/P2|/P3] [/A] [/?]
- **SR50** [/A] [/?]



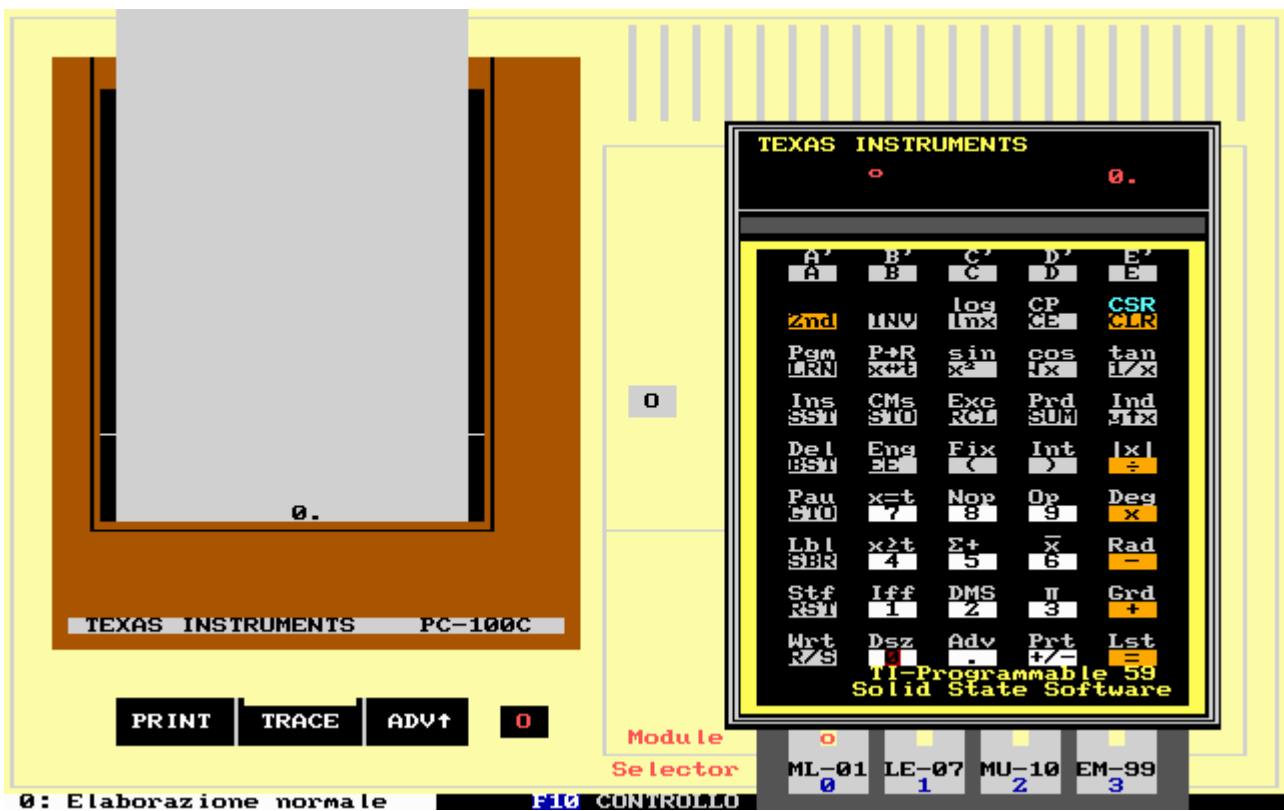
TI59-64.EXE in execution

with the following meaning:

- **/P1, /P2, /P3** allow to redirect emulator printings on a PC printer (real or virtualized with a NET USE command) respectively connected on LPT1:, LPT2:, LPT3: by default printouts are

directed to a specific file .PRN (*TI59.PRN*, *TI58.PRN*, *TI58X.PRN*, *TI58C.PRN*, *TI66.PRN*, *SR52.PRN*, *SR56.PRN* e *SR60.PRN*).

- /A (all models with printer) allow to “append” the printouts to the previous .PRN file, otherwise every time you run the program, the content of the . PRN file is cleared.
- /58 for the TI-59 allows to emulate a TI-58 while with /58X it allows to emulate an "extended" TI-58 with 4 memory chips. For a better usage, two batch files (TI58.BAT e TI58X.BAT) for the 16 bit version are provided and two others for the 32/64 bit version (TI58-64.BAT e TI58X-64.BAT in EXE64 folder).
- /S for the TI-57 allows to view the intermediate results during a program execution as in the real machine.
- /HEX for the TI-66 allows to list the program on PC-200 printer with the hexadecimal codes of the instructions.
- /N for the TI-66 allows you to perform the emulator at "normal" speed: by default the speed is in "turbo" mode.



TI59ALT.EXE in execution: it is functionally equivalent to TI59.EXE

- /EXT for the TI-57LCD emulates the "extended" mode (48 bytes of memory more than the real calculator) in order to be able to perform the programs of the TI-57 LED.
- /NUM for the TI-57LCD and the TI-55 II activates the numerical LRN-Mode (that of the real machines): the emulator has, by default, the alphanumeric mode as on the TI-66 for practicality of use. It is possible, during execution, to change from alpha-numeric LRN-Mode to standard numerical one (and vice versa) by pressing Alt+S.
- /EXT for the SR-52 emulates the “extended” mode (on the real machine it was possible to add two other memory chips that brought the overall memory equal to that of TI-59, though differently organized).
- /L (for SR-52 and SR-56) allows you to obtain the programs list on PC-100A as on the real machine, that is, without mnemonics: by default the printing is the same as that obtained by the TI-58/58C/59 on the PC-100C.

- /A, for the SR-50 only, allows to emulate the SR-50A calculator, which has only a different keyboard layout.
- /D (for various emulators) allows to view the numbers' positions of the display.
- /ENG allows you to view the simulators' messages in English.

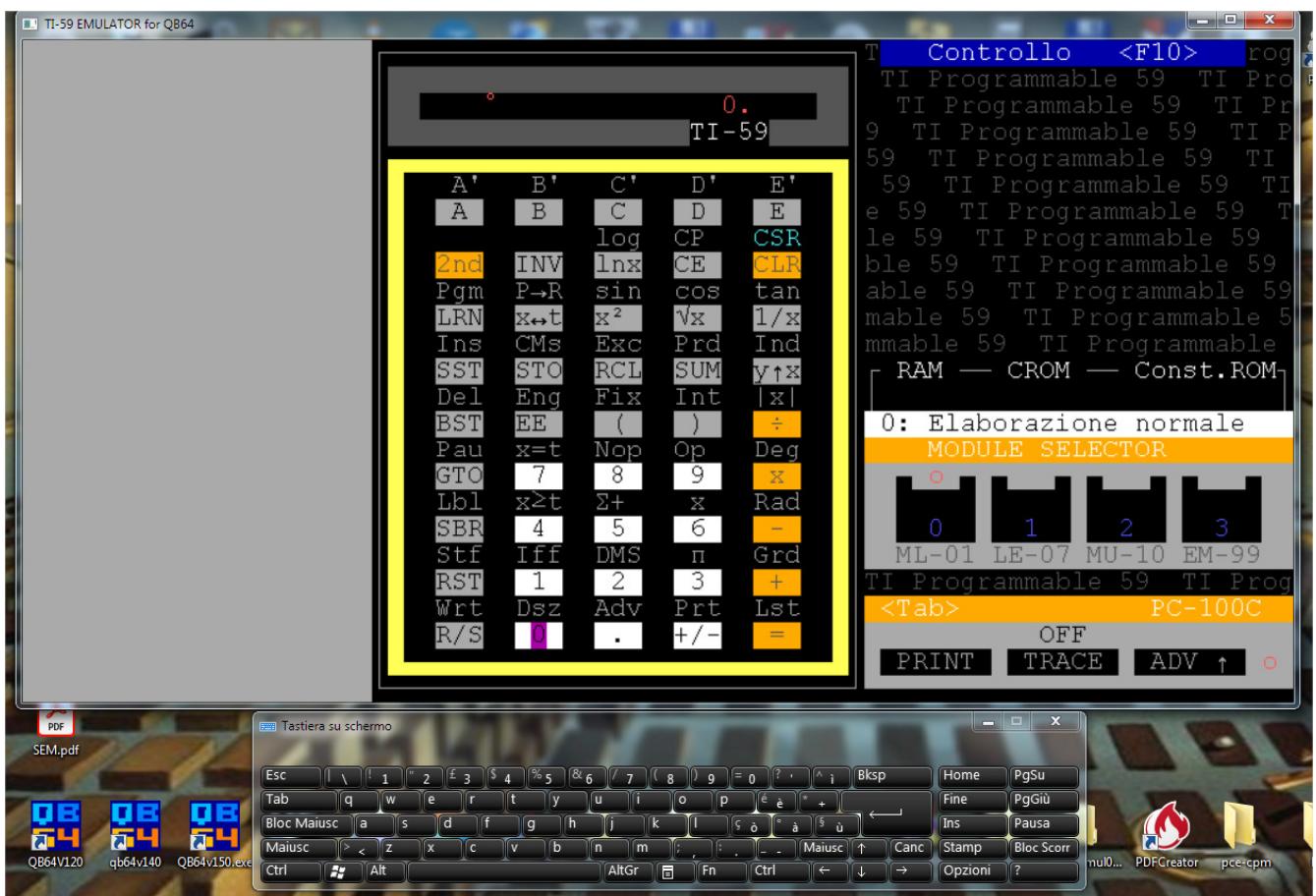
Each emulator relies on two files with the same name as the emulator and with extensions, **.INI** and **.MEM** which contain, respectively, the configuration settings for the emulator and the constant memory of the machine itself. For example, in the case of the TI-59 we will have:

TI59.INI

0 ← status of the PC-100C **TRACE** key
 5913DGT ← name of the help file of the program currently resident in memory (can be recalled with Shift + F1).

TI59.MEM

constant memory of the TI-59, in accordance with the memory model used by the emulator (saved at the exit of the emulation program).

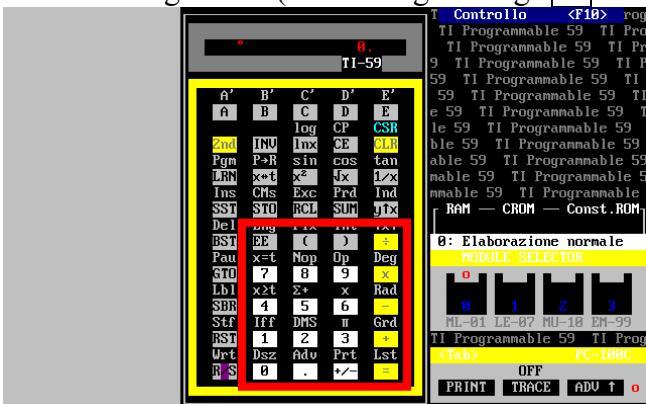


TI59-64.EXE in execution with "on-screen keyboard" under Windows7-64bit

5. USING THE EMULATOR

The emulators can be used, for the moment, only with the keyboard - *except SR50 emulator* - , namely:

- **cursor keys** for movement on the keyboard: at the start the cursor is positioned on **[0]** key);
 - **Enter** key selects the object under the cursor;
 - **Home** key brings the cursor back to **[0]** key;
 - the keys from **0** to **9**, **•**, **+**, **-**, *****, **/**, **^**, **=**, **(**, **)**, ****, **lower e** directly activate the numerical section of the emulating model ('****' is the sign change **+/-** and **e** is **EE**);



- **function keys** access to special functions (each model has its own specific) including **F10** to access the Control menu: the choice of the menu items is done with the cursor + <Enter>;
 - **Tab** accesses the PC-100A/C printer keys (where applicable);
 - **Esc** stops long elaborations (all models) – as **R/S**;
 - **Alt+S** modifies angular mode selector (Deg ↔ Rad sulla SR-52 e Deg ↔ Grad sulla SR-56) during program execution;
 - **Alt+T** switches the **TRACE** button of the PC-100 A/C printer during program execution.
 - **Alt+G** shows display during program execution (on TI-57/58/58C/59 is equivalent to holding down **GTO** key)– on TI-66 is **Alt+R**, for **RST**.

The movement on the keyboard is circular (from the last line you can go to the first and from the first column to the last and vice versa). It's also possible to use the Windows application "On-Screen Keyboard" (*osk.exe*) to be able to use only the mouse, even if not expected in the application.

Pressing **2nd** or **INV** keys is indicated with a "*" above the key and also the angular mode with ° for Deg, ' for Rad and " for Grad - as on the TI-30.

Note: In models with LCD display these features are highlighted in the bottom row of the display itself, as on real machines.

All printouts made using the emulators of the models equipped with a printer (TI-58, TI-58C, TI-66, SR-52, SR-56) are both shown on the screen and written to their own .PRN file (e.g. TI59.PRN for TI-59). These files are deleted each time the emulators are reused, so to keep old printouts, you must rename or copy this file under another name before reuse, or run the emulator with the /A switch.

All models emulated by the program, contrary to some real calculators such as the TI-57, TI-58, TI-59, SR-52 and SR-56, have **constant memory**, which means that programs, data and some parameters (decimal fix and angular mode) are retained from one execution to other of the emulator.

It's possible to save a particular calculator's status saving this file with another name and manually recover it when it needs.

5.1. FUNCTION KEYS

The meaning of the function keys is the following (Shift + function key is showed as **f**):

- **F1** → help system (callable from the Control Panel too): it is organized as a textfile which can be viewed with the cursor keys up and down; with Esc you exit the option.
- **F2** → conversion utility between printers' codes (PC-100C for TI-59/58/58C or PC-200 for TI-66) and ASCII and vice versa: it's useful if you do not have in hands the table of alphanumeric coding (*TI-59/58/58C/66 only*).
- **F2** → Conversion of TI-57 program to TI-58/58C/59 (*TI-57 only*).
- **F3** → show the internal stack used by the emulator (allowing you to build the TI internal registers)
- **F4** → keycodes table (42 STO, 43 RCL ecc..)
- **F5** → reference tables (HIR suffixes, Op instruction list, CROM module list.....)
- **F6** → “cut” PC-100C/PC-200 paper tape.
- **F7** → import and management of the .SOA text files (see 1.6)
- **F8** → allows to store "synthetic" (not-standard) codes in program memory: it's active for TI59GR.EXE, TI66.EXE, TI57.EXE and SR52.EXE only.
- **F9** → DOS Shell (access the command prompt for housekeeping operations).
- **F10** → control menu (see §5.2).
- **F11** → activate graphic mode for PC-100 printer (for TI-59 only).
- **F12** → activate CROM Emulator device (for TI-58/58C/59).
- **f1** → show help (if exist) for the program loaded with Import function (**F7**). For example, if you load the sample file *59FACT.SOA* the part marked in red is shown when you press **Shift F1**.

{ Factorial calculation }
{ To execute: n A }

LBL A STO 01 RCL 01 * DSZ 01 00 04 1 = R/S

- **f2** → shows help of the CROM Module program actually in use (if activated) in a manner like the non-magnetic card provided by Texas Instruments. For the TI-66 **f2** shows help of the CRAM module actually in use.
- **f3** → sets the path used by Import utility (see F7).
- **f4** → shows the contents of the internal memory used by the emulator, according to the memory model.
- **f5** → allows import/export for files in .M59 format (used in Hrast Programmer TI-59E emulator).
- **f6** → allows to select the active port of ‘Module Selector’ (for TI-59/58/58C only).

- **f7** → access to BAX-59 cross compiler.
- **f9** → quits the emulator without using the appropriate item in the Control menu (where it exists).
- **f10** → resets memory emulator (for TI-57/58/58C/59/SR-52 only).

For convenience we report, in the Appendix, also a sticker (in Italian and in English) with the meaning of the function keys.

5.2 THE CONTROL MENU

F10 access the control menu. Every model has its own items. For the TI-59 emulator the following are available:

- **Status Panel** → shows the contents of the TI-59 internal registers and the main settings (angle unit, partition, decimal fix ...)
- **Change CROM** → allows you to "load" a CROM module – actually all standard modules: **Master 01**, **Applied Statistics 02**, **Real Estate/Investment 03**, **Surveying 04**, **Marine Navigation 05**, **Aviation 06**, **Leisure 07**, **Securities Analysis 08**, **Business Decisions 09**, **Math/Utilities 10**, **Electrical Engineering 11**, **Agriculture 12**, **RPN Simulator 13**, **Structural Enginerring 14** and **Surveying II 15**. Two special CROM modules are also provided: **00** (NOCROM) indicating the empty module and **99** (EMULCROM - for its use see § 1.9).
- **CROM Port Nbr (f6)** → allows to select active port of 'Module Selector' (0 to 3).
- **PC-100C ON/OFF** → enable/disable the PC-100 (TI-58/58C/59/SR-52/SR-56) or the PC-200 (TI-66) printers.
- **Read Card** → allows reading a magnetic card (see below)
- **Keycode overlay ON/OFF** → enables/disables the display of the numeric key codes (like the "keycode overlay" provided by Texas Instruments).
- **HIR & Flag List** → prints the content of HIR registers and the flags status (TI-58/58C/59/SR-52/SR-60A). Note: For TI-66, SR-52 and SR-60A only the flags status is printed.
- **Firmware List** → prints the list of the firmware coded in AOS (TI-58/58C/59 & SR56).
- **On-display List** → lists program codes on the display step by step (TI-58/58C/59).
- **CROM Emulator List** → prints the list of the program loaded in CROM Emulator mode (TI-58/58C/59).

Control <F10>	
Status Panel	
Change CROM	
CROM Port Nbr	f6
PC-100C	ON
Read Card	
Card Index	
Keycode overlay	OFF
HIR & Flag List	
Firmware List	
On-display List	
Help System	F1
PC 100↔ASCII	F2
Keycodes Table	F4
Cut printer tape	F6
OS Prompt	F9
.M59 Imp/Exp	f5
BAX-59	f7
TI Reset	f10
O F F	f9

- **Help System (F1)** → emulator general help based on a text-file. Other helps are available for user program currently in memory (**Shift F1**) or for the CROM programs, when selected with **Pgm** instruction. (**Shift F2**).
- **PC100↔ASCII (F2)** → conversion utility between PC-100C codes (or PC-200 for TI-66) and ASCII and vice versa (useful if you don't have on hand a table of alphanumeric codes of PC-100C or PC-200).
- **Keycodes Table (F4)** → keycodes table (42 STO, 43 RCL ecc..)
- **Cut printer tape (F6)** → “cut” paper tape of the printer (PC-100A for SR-52 and SR-56, SR-60A internal printer, PC-100C for TI-58/58C/59 and PC-200 for TI-66).
- **OS Prompt (F9)** → access the command prompt for housekeeping operations.
- **.M59 Import/Export (f5)** → allows import/export for files in .M59 format (used in Hrast Programmer TI-59E emulator).
- **BAX-59 Compiler (f7)** → access to BAX-59 cross-compiler (or LIMACE-57 Compiler for the TI-57).
- **TI Reset (f10)** → resets the calculator (with confirmation).
- **OFF (f9)** → quits program. Calculators with the **OFF** key (eg. TI-57LCD or TI-55II) are simply turned off by selecting the above key.

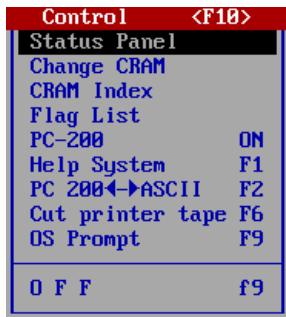
PANNELLO DI CONTROLLO TI58/TI59					
15	0 15	0 H8	0000000000000000	0 Ripartizione	: 879.09
H1	1	1	0000000000000042	8 Modo Angolare	: DEG
H2	2	2	5922750001551676	Num. decimali (Fix):	9
H3	3	T	0000000000000000	9 Stato dei flag	: -----
H4	4		0000000000000000	CROM attivo	:MASTER 01
H5	5		0000000000000000	10 N. programma attivo:	0
H6	6	SBR	0000000000000000	Parentesi aperte	: 0
H7	7	stk	0000000000000000	11 Operaz. in sospeso	: 0
Reg. 0-7 TMC0582				Subroutine aperte	: 0
Reg. 8-15 TMC0583		R01	1711224524264980	12 Stato di PC-100C	: ON
X 0000000000000000		R02	0000000000000000	Notazione tecnica	: OFF
Reg. A TMC0501		R03	1000000000000000	13 Trace	: OFF
				Memoria protetta	: OFF
		15	0000000000000000	14	15 0
		R00	2050303841579660	R00	2050303841579660
		15	0000000000000000	R04	1711224524264980
				Σy	Σx
				Σy ²	Σx ²
				R05	0000000000000000
				N	Σxy
				R06	0000000000000000

A Control Panel screen

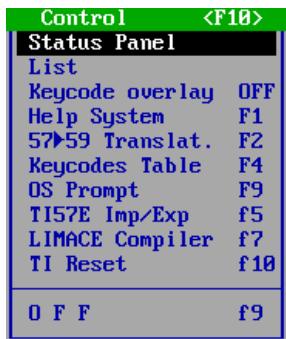
For each model, the Control menu items are stored on a file in the MENU folder. Some of them are reported in the next page.



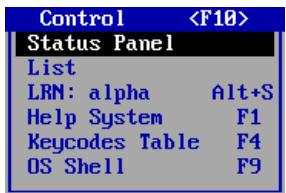
TI-58C



TI-66



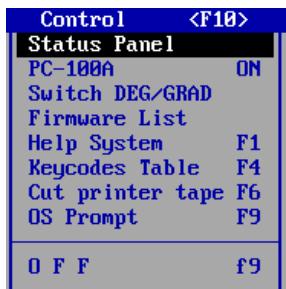
TI-57



TI-57 LCD



SR-52



SR-56

5.3. UTILITY PROGRAMS

As said before, we have three utility programs available, namely:

- **IMPORT** which manages (as seen before and for all models) import of .SOA files in the various emulation programs. Its use is automatically managed by the emulators themselves (see § 6.3 and following);
- **57TO59** that allows you to "translate" a TI-57 program in its corresponding TI-58/58C/59: this conversion allows you to replicate the behavior of the TI-57 when using the t-register and the statistical instructions which, as it is known, have a different registers' use in the two models (see § 10.1);
- **BUILDER** that allows you to "build" a custom CROM module or examines an existing one (see § 7.2).

5.4 NEW FEATURES

Some new features have been implemented (also existing in other models), namely:

- **CSR** (code 20) replaces **2nd Pgm 01 SBR CLR**: this is an instruction existent on the TI-66—(for TI-58/58C/59);
- **CP** (code 10) clears the TI-57 program memory in “LRN mode” mode as in the TI-57LCD: it wasn’t present on the original machine because it was enough to turn it off;
- **x!** on the TI-66 (the factorial instruction is present only on SR-52, TI-57LCD, SR-60A);
- **HIR Ind** is available as instruction in a program with codes 82 40 XX: on real models this was possible from keyboard only (for TI-58/58C/59);
- **INV Op 00** prints a list with the meaning of Op codes (for TI-58/58C/59/66);
- **OFF** has been made programmable (for TI-57LCD, TI-55II and TI-62)_that is, it is possible to turn off the calculator by program unlike real machines;
- some “synthetic” functions, obtained by using sequence of “unorthodox” keystrokes, are available for TI59GR.EXE, TI66.EXE, TI57.EXE e SR52.EXE: these functions are generated with the **F8** function key (see § 7.3 for an example);

A separate case is the “extended” emulation of the TI-58C (*TI58C.EXE* and *TI58CX-64.EXE*) which allows, for EXPERIMENTAL PURPOSE only, the use of new plausible instructions without “distorting” the emulation and that Texas Instruments could have easily added by optimizing the ROM of its calculators:

- **x!** (implemented as **[INV] [1/x]**) – see SR-52 and TI-57II;
- **MOD** (implemented as **[INV] [÷]**) - the remainder of division - which the HP-41 has as a standard instruction;
- **extended BST** that allows the complete editing of the number currently in input;
- **integer powers of negative bases**, as on the HP. For example $5^{+/-} [y^x] 3$ supplies -125 and not 125 with flashing display as on real models.

Everything else is in Texas Instruments manuals “*Personal programming*”. “*Introduction to Programming*”, “*TI-66 Sourcebook*”,

5.5 MY POINT OF VIEW ON TI-59 EMULATION PROGRAMS

There are various TI-59 “emulators” (and also for TI-58/58C), available on the net both for Windows and for other platforms, which distort the real calculators by introducing absurd features (like 1000 program steps and 10000 registers ??) without setting any memory partition and/or equally imaginative instructions that have nothing to do with the factual reality of the TI world: from my point of view these programs (although graphically more attractive and more “user friendly” than the emulators treated in this manual) remain personal experiments of the authors and therefore I can safely call them **pseudo-emulators**.

Therefore, I think that a passage from these pseudo emulators to any TI-58C or TI-59 for those who have never known the real calculators will be traumatic and didactically fruitless. To demonstrate this thesis in the *PROG* folder I inserted a small program, called **59TEST.SOA**, and taken from TI-PPC Notes:

```
{ Test for *real* emulators!  From TI-PPC Notes V5 N4/5 P8 }
{ List all keycodes in step 478: press A to start }
```

```
LBL A 7 OP 17 1 0 0 STO 00 9 . 2 0 0 7 6 0 8 6 9 STO 60 LBL A' 6 OP 17
SBR 04 75 7 OP 17 . 0 0 1 SUM 60 DSZ 00 A' R/S
```

which produces the output shown below.

478 00 0	478 34 √X	478 68 NOP
478 01 1	478 35 1/X	478 69 OP
478 02 2	478 36 PGM	478 70 RAD
478 03 3	478 37 P/R	478 71 SBR
478 04 4	478 38 SIN	478 72 ST*
478 05 5	478 39 COS	478 73 RC*
478 06 6	478 40 IND	478 74 SM*
478 07 7	478 41 SST	478 75 -
478 08 8	478 42 STO	478 76 LBL
478 09 9	478 43 RCL	478 77 GE
478 10 E'	478 44 SUM	478 78 Σ+
478 11 A	478 45 Y^X	478 79 Xm
478 12 B	478 46 INS	478 80 GRD
478 13 C	478 47 CMS	478 81 RST
478 14 D	478 48 EXC	478 82 HIR
478 15 E	478 49 PRD	478 83 GO*
478 16 A'	478 50 IXI	478 84 OP*
478 17 B'	478 51 BST	478 85 +
478 18 C'	478 52 EE	478 86 STF
478 19 D'	478 53 (478 87 IFF
478 20 CSR	478 54)	478 88 DMS
478 21 2ND	478 55 ÷	478 89 π
478 22 INV	478 56 DEL	478 90 LST
478 23 LNX	478 57 ENG	478 91 R/S
478 24 CE	478 58 FIX	478 92 RTN
478 25 CLR	478 59 INT	478 93 .
478 26 2ND	478 60 DEG	478 94 +/-
478 27 INV	478 61 GTO	478 95 =
478 28 LOG	478 62 PG*	478 96 WRT
478 29 CP	478 63 EX*	478 97 DSZ
478 30 TAN	478 64 PD*	478 98 ADV
478 31 LRN	478 65 x	478 99 PRT
478 32 X:T	478 66 PAU	
478 33 X ²	478 67 EQ	

At the moment, **only** the Hrast Programmer emulator (which is based on the direct emulation of the ROM microcode) and mine, treated in this manual, are able to overcome this “pico-test”....

6. USER'S PROGRAMS MANAGEMENT

This chapter is dedicated to the management of user programs by the emulator.

6.1 PROGRAM LOADING

Generally you can load the programs in three ways:

- 1) by keyboard, entering LRN-mode and inputting the program;
- 2) by magnetic card, using the appropriate option in the Control menu. Magnetic cards are, obviously, virtual and recorded as files (in *SCHEDE59* or *SCHEDE52* or *SCHEDE60* folder, according to the model) as *SCHEMA.XXX* with *XXX* between 000 and 999. The program also requires the side of the card (side A or side B). For a correct loading of the card, it is necessary to respect what has been said in chapter VII of the TI-59 manual (partition of memory, decimals fixing, etc ...). In the same folder it's contained a file named **INDEX** that provides a list of the contents of the magnetic cards.

(*Note*: file INDEX update is **not** automatic and is therefore user-care).

SCHEMA.XXX files of the TI-59 are formed by **two** blocks of **256** numeric codes (between 00 and 99) each, with the following meaning:

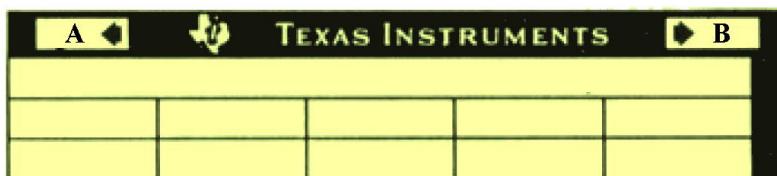
code #1	- protect memory (0=free,1=blocked)
code #2	- program partition (in block of ten register)
code #3	- number of saved
code #4	- data type on the card (10=program 11=data reg. dati or mixed program/data reg.)
code #5	- block checksum for hardware control: sum of the 240 codes (between #16 and #255) MOD 100
code #6	- block checksum (copy of code #5)
code#7-#15	- not used
code#16-#255	- memory content relevant to the selected block

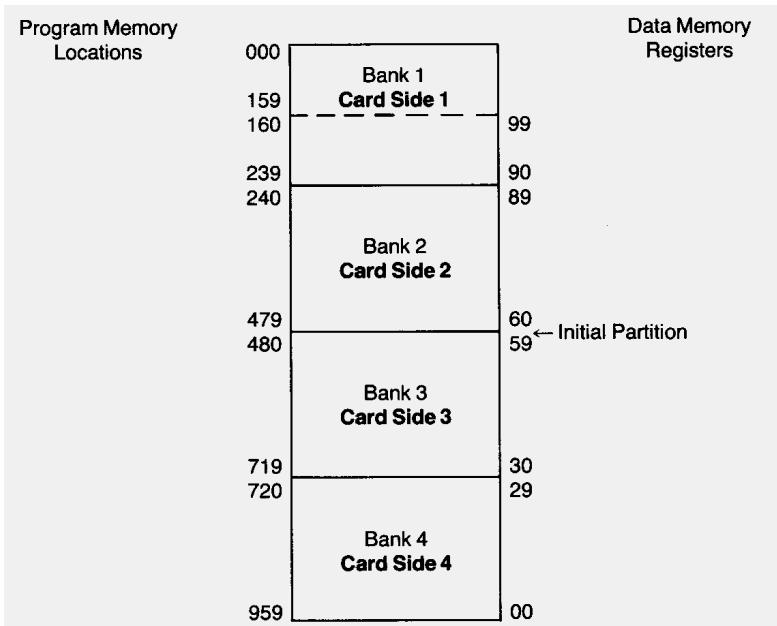
For SR-52 cards we have **two** blocks of **128** codes and for SR-60A two blocks of **512** codes.

- 3) by Import function (with the **F7** key) which allows you to import (and to manage) text files having **.SOA** extension. Note: **SOA** is the abbreviation for Italian “*Sistema Operativo Algebrico*”; **AOS** “*Algebraic Operating System*” in English.

6.2. SAVING ON CARD

- As in the real TI-59 you can save programs and/or data using magnetic cards: to do this just use the instructions *n 2nd Write* (directly) and *n INV 2nd Write* (in program mode): the emulator, as above, will require a card number (000-999) and the side (A or B). **n** is, as in Texas Instruments standards, from 1 to 4 (see picture below).

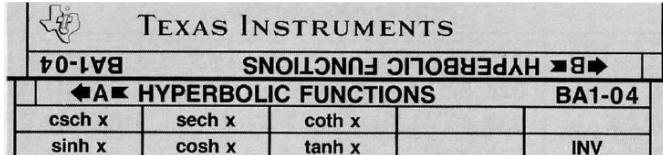




For the SR-52, on the other hand, the procedure listed in chapter IX of the SR-52 manual must be followed, note that there is an internal flag by which you read/write side A or side B of a magnetic card. It will be enough to do:

- For writing: **CLR** (reset the internal flag) **INV** **2nd** **Read** (side A) **INV** **2nd** **Read** (eventual side B)
- For reading: **CLR** (reset the internal flag) **2nd** **Read** (side A) **2nd** **Read** (eventual side B)

An **HLT** instruction after the first **2nd** **Read** blocks the ongoing action and allows you to read the side B only .



For the SR-60a follow the instructions of chapter V of the manual: keep in mind that each side of the card can contain 480 steps of programs or 60 data registers.

Programs can be saved with **RESET** **Write** (side "A" – steps 000-479 passi and side "B" – steps 480-959) followed by more **Write** instructions (at 480 steps block). It's possible to reposition the program counter to begin saving at the desidered location.

For example, a 1200-steps program can be saved using due cards as:

RESET **Write** (first card side "A" - first 480 steps) **Write** (first card side "B" – second 480 steps)
Write (second card – step 960-1200)

For reading, instead, just press **RESET** **2nd** **Read** and the prompt mechanism, typical of the SR-60a, takes over. Note: Card reading is automatically terminated when a NULL instruction is encountered.

The registers can be read/saved with the **CLR** **2nd** **Read**/**2nd** **Write** ... 60 **2nd** **Read**/**2nd** **Write** sequence and so on, 60 registers at a time.



6.3 SOA FILES AND THEIR STRUCTURE

.SOA files are basically textfiles and can be edited using any text editor (the program attempts to recall the program indicated by IMPORT.INI file which, usually, is *EDIT* for MS-DOS/Windows or *NOTEPAD* for a 64-bit Windows version) respecting these simple rules:

- A. Import will usually begin at step 000. It's possible, for the TI-59 only, to set the import step with an [ORG: xxx] where xxx is the step number required.
- B. Recognized keywords are encoded in the various **CNVxx.CSV** files (where xx is 52, 53, 55, 55II, 56, 57, 57LCD, 58, 59, 62, 66, MBA, 60 - one for each emulated model of TI) in "numeric code;mnemonic" format (one per line). This file can be modified and/or expanded losing compatibility, however, with the standard. For example, the file **CNV59.CSV** for the TI-59 is the following (the columns layout is only for convenience):

00;0	25;CLR	50;IXI	75;-	00;00	25;25	50;50	75;75
01;1	26;2ND'	51;BST	76;LBL	01;01	26;26	51;51	76;76
02;2	27;INV'	52;EE	77;GE	02;02	27;27	52;52	77;77
03;3	28;LOG	53;(54;)	78;STA 79;AVG	03;03 04;04	28;28 29;29	53;53 54;54	78;78 79;79
04;4	29;CP						
05;5	30;TAN	55;/	80;GRD	05;05	30;30	55;55	80;80
06;6	31;LRN	56;DEL	81;RST	06;06	31;31	56;56	81;81
07;7	32;X:T	57;ENG	82;HIR	07;07	32;32	57;57	82;82
08;8	33;X^2	58;FIX	83;GO*	08;08	33;33	58;58	83;83
09;9	34;SQR	59;INT	84;OP*	09;09	34;34	59;59	84;84
10;E'	35;1/X	60;DEG	85;+	10;10	35;35	60;60	85;85
11;A	36;PGM	61;GTO	86;STF	11;11	36;36	61;61	86;86
12;B	37;P/R	62;PG*	87;IFF	12;12	37;37	62;62	87;87
13;C	38;SIN	63;EX*	88;DMS	13;13	38;38	63;63	88;88
14;D	39;COS	64;PD*	89;PI	14;14	39;39	64;64	89;89
15;E	40;IND	65;*	90;LST	15;15	40;40	65;65	90;90
16;A'	41;SST	66;PAU	91;R/S	16;16	41;41	66;66	91;91
17;B'	42;STO	67;EQ	92;RTN	17;17	42;42	67;67	92;92
18;C'	43;RCL	68;NOP	93;..	18;18	43;43	68;68	93;93
19;D'	44;SUM	69;OP	94;+/-	19;19	44;44	69;69	94;94
20;CLR'	45;Y^X	70;RAD	95;=	20;20	45;45	70;70	95;95
21;2ND	46;INS	71;SBR	96;WRT	21;21	46;46	71;71	96;96
22;INV	47;CMS	72;ST*	97;DSZ	22;22	47;47	72;72	97;97
23;LNX	48;EXC	73;RC*	98;ADV	23;23	48;48	73;73	98;98
24;CE	49;PRD	74;SM*	99;PRT	24;24	49;49	74;74	99;99

Furthermore, for the TI-58/58C/59/66, it is possible to directly write any text string to be printed by enclosing it between two quotes. The length of the string is that accepted by the Op instructions of the respective models (4 for the TI-66, 5 for the others): longer strings will be truncated. For example

{ Test for IMPORT – you can write directly alpha strings}

LBL A
"TEST" OP 01 OP 05
RTN

- C. The separator used in the .SOA files is the *blank character*: absolute jump addresses should be written in groups of two. For example *GTO 528* has to be written as *GTOb5b28*. Even the numbers must be written digit by digit: -1.35 will be entered as *-b1b.b3b5*).
- D. **[BEGIN]** signals the begin of program text.
- E. **[DATA]** indicates the contents of the data registers in the format ***nn:content*** (one per line), and it's mandatory to place it **after** the program.
- F. **[END]** ends the useful content of the program; everything else is considered comment and it is, of course, excluded from the translation.
- G. You can insert comments within the program using the { character at beginning until to the end of line (you can terminate the comment for the sake of readability even with } although it is not mandatory). Initial comments are also used to build the program's help file - for consultation with the **Shift + F1** key.

The structure of a generic .SOA file is the following:

.SOA file	Type	Remarks
{ { etc.	Initial remarks: used to build the help file available with Shift + F1	<i>Optional</i>
[ORG: xxx]	Sets the initial step from which import begins. Usually this step is zero.	<i>Optional</i> : it has effect on a TI-59 only.
[BEGIN]	Indicates the beginning of the text of the program	<i>Optional</i> : it also signals the end of the initial comments.
.SOA program text	In the above format according to <i>CNNxx.CSV</i> file. It can be mixed with remarks - a remark begins with the { character to the end of line.	<i>Mandatory</i> → create IMPORT. OUT file
[DATA] XX:valore - <i>repeated n times</i>	Registers to be loaded in the format <i>register number:value</i>	<i>Optional</i> : → create DATA. OUT file
[END]		<i>Mandatory</i> only if it's not the last line of .SOA file
Free text		<i>Optional</i> , it's not considered by F7 - Import: if exists it must be anyway preceded by [END].

Note: The file **IMPORT.INI** is composed of two lines; the first line contains the name of the editor program used for the 16-bit version (**EDIT** is proposed) while the second one the editor program for 64-bit version (**NOTEPAD** is proposed). It is assumed that both files are executable from the folder \TI59.

6.4 .SOA FILES TRANSLATION

The translation, depending on the emulated calculator type, can be **normal** (each keyword and / or address and / or numerical data is translated as a program step) or **grouped** (for TI 57, TI 57 and TI 62 LCD - every composite instruction incorporates the following token). For example STO 05 in the TI 59 are two steps (42 and 05) while in the TI 57 is only one (32 5).

The .SOA files are generic, so it is possible (length permitting) to import files created, for example, for the TI-59 on the TI-66, unless they don't contain specific instructions for that model. For example, if you use in a program **Pgm 20** instruction, the corresponding .SOA file can be imported successfully only on the TI-58/58C/59 because **Pgm** is possible only on those models: so it will be convenient to use a significant name in these cases or to put a few final notes. The translation will still be tried, but will provide error.

Output will provide three files:

- *IMPORT.LOG* that contains four lines
 - the number of errors;
 - the name of the relevant help files;
 - a list of the .SOA files line numbers in which errors occurred (in any);
 - the initial step from which import begins. Usually this value is zero and can be set only for a TI-59 program.
- *IMPORT.OUT* that contains the .SOA file translated files into numerical codes;
- *DATA.OUT* that contains the values of registers to be loaded.

Pressing **F7** the content (possibly divided into pages) of the folder pointed to by the import path (which, let's remember, can be modified with the function key **f3**) is displayed:

The following operations are possible:

- <cursor keys> <PgUp> <PgDn> keys allow to move the selection bar;
- <Return> select the file under the selection bar;
- <E> edit an existing file;
- <N> creates a new file (name is given without the .SOA extension, it is automatically created) that can be edited using DOS/Windows EDIT or NOTEPAD for 64-bit Operating systems;
- <Canc> clears a file (with confirmation);
- <Esc> exit without making imports (the emulator report an error anyway).

Nota: F7 manage a maximum of 1200 files in the import folder.

In *PROG\ITMAG* folder there are several files marked *MPnn-xx.DOC* and *MCnn-xx.SOA*: these files come from programs published in two Italian magazines “**Micro & Personal Computer**” (1979-1983) and “**MC Microcomputer**” (1981-1984): *nn* is the number of the magazine, while *xx* is the progressive number of the programs published within the same number (if *xx* is below 10 programs are for the TI-58/58C/59, if greater than or equal to 10 programs are for the TI-57).

GESTIONE FILE .SOA		DINAMICO FILE DISPOSIBILI	
SOTH1.SOA	SOTH2.SOA	SOTHX8.SOA	SP00.SOA
57-10000.SOA	57CALCRA.SOA	57E.SOA	57EIGHTQ.SOA
57EXTFCI.SOA	57FACT.SOA	57FACT2.SOA	57FERMAT.SOA
57HAPPYN.SOA	57IICUBI.SOA	57IERON.SOA	57IIHILO.SOA
57ITART.SOA	57MATTR.SOA	57MOD.SOA	57NGAMMA.SOA
57PASCAL.SOA	57PCCNOT.SOA	57PI.SOA	57POLYG.SOA
57PRIMI.SOA	57PRM19.SOA	57PTERM.SOA	57QUAD.SOA
57SECRET.SOA	57SFF.SOA	57ULAM.SOA	58BASECU.SOA
58FORZA4.SOA	58HEXGN3.SOA	58NCRUNC.SOA	58PERM.SOA
5913DGT.SOA	59ALLARG.SOA	59AUTOPR.SOA	59BRSIFIT.SOA
59CALEND.SOA	59CALPPX.SOA	59CERCAQ.SOA	59CGRAPH.SOA
59CHECKR.SOA	59CUBI.SOA	59CUBIC.SOA	59DAMA.SOA
59DAMAN.SOA	59DATES.SOA	59DET.SOA	59EAST2.SOA
59EASTER.SOA	59FACT.SOA	59FERMAT.SOA	59F2A4-1.SOA
59GAMMA.SOA	59HAPPYN.SOA	59HEXCOD.SOA	59HEXGN4.SOA
59INDSTI.SOA	59JIUET.SOA	59KIBUR.SOA	59KIHIST.SOA
59LIST1.SOA	59LIST2.SOA	59MAN-01.SOA	59LIFEID.SOA
59MILLER.SOA	59MMIND.SOA	59MYST.SOA	59MCARLO.SOA
59NUM2LT.SOA	59NUMBER.SOA	59NUMPIT.SOA	59NIM.M.SOA
59PI.SOA	59PLOT60.SOA	59POLYG.SOA	59PHTRIS.SOA
59PUZZLE.SOA	59QBENCH.SOA	59QBOARD.SOA	59PRM19.SOA
59RM2AR.SOA	59RPN3.SOA	59SAUTEM.SOA	59REVERS.SOA
59SS.SOA	59SUMSUP.SOA	59TEST.SOA	59SHELL.SOA
59TTT3.SOA	59TTT4.SOA	59TTTX.SOA	59TIITI2.SOA
59UBOOT.SOA	59ULAM.SOA	59VERIFY.SOA	59IWOUAR.SOA
66CUBIC.SOA	66DET.SOA	66TRPASC.SOA	66COMB.SOA
B59CUBI.SOA	B59I4SQR.SOA	B59SMP01.SOA	B59SMP09.SOA
B59SMP16.SOA	BLISS.SOA	BUFPC100.SOA	CALCRACE.SOA
EE19-1NP.SOA	EE19-NAM.SOA	FRAZIONI.SOA	CIFRE-E.SOA
GAMMA-C3.SOA	HANHOI.SOA	INDNUM.SOA	GAMMA-C1.SOA
KPRIMES.SOA	KULO.SOA	MANDEL_F.SOA	JEU-P3.SOA
MC02-01.SOA	MC05-11.SOA	MC05-12.SOA	MAXSORT.SOA
MC07-02.SOA	MC08-11.SOA	MC08-12.SOA	MC07-01.SOA
MC15-12.SOA	MC18-01.SOA	MC18-11.SOA	MC12-11.SOA
MC19-02.SOA	MC20-01.SOA	MC20-02.SOA	MC18-12.SOA
MC26-01.SOA	MC28-01.SOA	MC29-01.SOA	MC21-01.SOA
MFIBO.SOA	MILK.SOA	MP01-11.SOA	MC23-01.SOA
MP04-01.SOA	MP04-02.SOA	MP06-01.SOA	MPFACT.SOA
MP08-01.SOA	MP10-02.SOA	MP12-01.SOA	MP03-01.SOA
MP14-01.SOA	MP17-01.SOA	MP20-01.SOA	MP07-01.SOA
OTH-1211.SOA	OTH6X6.SOA	PC100C.SOA	MP06-02.SOA
PH-LRN.SOA	PRIMI.SOA	PRTBUFF.SOA	MP13-02.SOA
RABBIT.SOA	RELAX.SOA	SCH08A.SOA	MP13-01.SOA
SCH37A.SOA	SCH37B.SOA	SCH38A.SOA	MUGWUMP.SOA
SCH54A.SOA	SCH68-69.SOA	SCH71A.SOA	NPR-OI.SOA
SCH74B.SOA	SCH76.SOA	SCH78.SOA	PERM.SOA
SIM57X.SOA	SU749.SOA	SWAPDGT.SOA	PTERM2.SOA
UANDERM.SOA			QUARTO.SOA

><PgUp PgDn=Muovi <RETURN>=import <N>=nuovo <E>=edit <Canc>=cancella <Esc>=esci

A IMPORT screen

6.5. WHAT TO DO IF IMPORT GIVES AN ERROR

Usually import errors are due to typos in the text but **IMPORT** asks you immediately if you want to correct the SOA file to be imported: if your answer is negative, the import program ends with the final diagnostics that provide the total number of errors only, otherwise the chosen editor is launched – the one indicated in IMPORT.INI - on the SOA file and on IMPORT.OUT which reports the untranslated tokens followed by the string “<=====” thus allowing the corrections. After this step has been carried out, the import will be retried.

For example, if the file is *59FACT.SOA*

```
{ Factorial import test: press n A to calculate n!
{ It contains an intentional error !!! }
```

LBL A STO 01 RCP 01 * DSZ 01 00 04 1 = R/S

the corresponding IMPORT.OUT (the red part is an explanation remark) will be

```
76
11
42
01
RCP <===== not found in CNV59.CSV file, then it's highlighted
01
65
97
01
```

00
04
01
95
91

Clearly in this case RCP must become RCL (with code 43) in the FACT59 file. SOA: as mentioned before, you will be able to correct the program directly.

N.B.: If you abort the import with <Esc>, the emulator situation will not be changed.

6.6 STANDALONE USAGE OF ‘IMPORT’ PROGRAM

You can use *IMPORT.EXE* (or *IMPORT-64.EXE*) as a standalone program, with its own switches: the complete syntax is è

IMPORT file_name /model /CROM /V /PATH=path /ENG

where

"filename"	is the name of the file to be converted (with or without .SOA extension)
"model"	can be /57 /58 /59 /66 /57LCD /55 /52 /56 /55II /62 /53 /MBA /60 /KC /SE: it's the only mandatory.
/CROM	allows the use of CROM Emulator (solo per /59, /58C e /58)
/V	displays the translation in progress
/PATH=	allows you to define a new import path. If absent, predefined path is used.
/ENG	displays messages in English

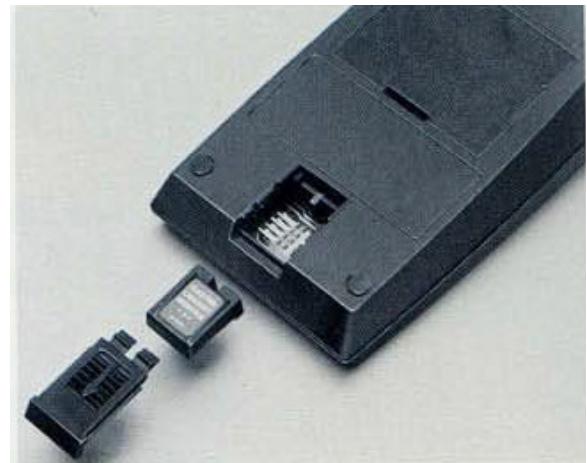
Important: Switches (except /model) can be in any position.

7 TI-59/58/58C EMULATORS

The hardware of the TI-59/58/58C is more complex than that of the other models, especially for the ge-style of the peripherals and their operating methods, namely the CROM modules ("Module Selector" and "Crom Emulator")) and the extensive management of the PC-100C printer, which are the subject of the rest of the chapter. Statistical and conversio funztion are implemented using the internal firmware, written in AOS language and 512 bytes long – included the “infamous” instruction HIR 20: this scheme was derived from the one used in the SR-56.

7.1. CROM MODULES MANAGEMENT

The TI-59 (and the two minor “sisters” 58 and 58C) have a slot on the back of the calculator itself which allows the insertion of **one** CROM module that can be selected from those produced by Texas Instruments or those produced by third parties (“custom” modules). In order to get more modules online (such as the HP-41C/CV that has four slots available) a third company⁽¹⁾ has developed a device called “**Module Selector**” (available in two versions - one *manual* and one *automatic*) that allows to have online **up to four** CROM modules.

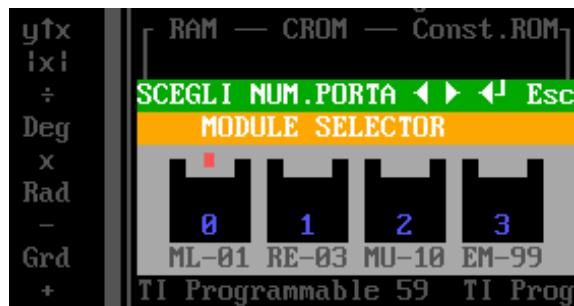


The emulator implements both *automatic* and *manual* versions. The first is used in the same way as the original through the sequence **X 77 Op 04 Op 06** which allows you to select the X slot (0 to 3). This sequence can be used by keyboard or by program.

CROM number:	[0-15:99]
Slot number:	[0-3]

GTO	7	8	9	x
Lbl	x≥t	Σ+	x	Rad
SBR	4	5	6	-
Stf	Iff	DMS	π	Grd
RST	1	2	3	+
Wrt	Dsz	Adv	Prt	Lst
R/S	0	.	+/-	=

Instead the second mode is activated with **Shift + F6** which displays the following small menu (in green):



with the left and right cursor keys you select the port by confirming with **Return** or quitting the operation with **Esc**.

Another device connected to the CROM modules is available with the emulator: the "**CROM Emulator**" (2) which allows you to test the operativity of a CROM module prior its final commercialization. Such device (to my knowledge) has **never** been commercialized and it was probably only available at Texas Instruments; the emulator allows you to use it by following these steps:

- 1) Load the special module **EMULCROM** (number 99) and activate the slot that houses it.
- 2) With **F12** key recall program to be executed. The names of these programs, for convenience, begin with the "\$" character to visually distinguish them from the others, although this is not, obviously, mandatory.
- 3) Program is now available with the usual commands preceded with Pgm 01.

All this means, given the greater capacity of a module CROM than the RAM of the TI-59, you can run long programs up to 5000 steps using contemporaneously up to 100 data registers (60 for 58 / 58C). This method has certainly been used for the realization and the testing of "*Structural Engineering*" (or "*Civil Engineering*") module that has two programs that exceed 1000 steps.

Contrary to programs contained in "normal" CROM modules, it's possible using **TRACE** when you run programs in this mode.

An example of a program executable in this mode only is '\$SCACCO3.SOA' that plays a final chess game and can be found, as usually, in the '*PROG*' folder.

Note: In order to be able to run correctly in 'CROM emulator' mode, a program must be written according to Texas Instruments rules, i.e. no R/S (use RTN instead), execution of the various functions using the user definable keys (from A to E and from A' to E'), partition of the calculator memory adjusted to the maximum number of registers used by the program.

7.2 THE 'BUILDER' UTILITY PROGRAM

A utility related to the management of CROM modules is **BUILDER** that allows you to create a custom CROM module to be used later with the emulator or to view an existing one. For using

BUILDER, just go to OS Shell with the **F9** key and invoke the utility: the complete command line is

BUILDER [/?] [CROM_file]

The **/?** switch displays, as usual, the modes of use, while following a file name, the program enters in "view" mode and allows you to see the content of the module. Each color represents a different part, as highlighted in the 25th row of the screen. For example with

BUILDER CROM \MASTER.01

you get the screen shown on the next page. The cursor, Pag ↑ and Pag ↓ keys allow the cursor ◀ to be moved, while **Esc** allows exit.

Instead, invoking **BUILDER** without options, you enter 'create' mode. The number of programs to be inserted with their respective lengths, the number to be assigned to the module and the name of the file containing the numerical codes (one per line) are requested: obviously any anomaly is reported. Once the input data has been accepted, BUILDER automatically switches to 'view' mode and the **F10** key allows the module to be saved. (Be careful not to overwrite a standard form!!)

Note: It is recommended that you use the CROM folder for all BUILDER operations.

```

CROM BUILDER/VIEWER [CROM\MASTER.01]

1  25 00 00 54 02 43 11 41
2  14 15 15 82 17 01 19 51
3  20 29 21 73 22 91 24 14
4  26 09 27 64 29 52 30 95
5  32 31 33 63 34 80 36 51
6  42 40 44 31 45 26 46 20
7  46 72 47 68 48 92 76 24
8  00 42 09 60 58 09 76 25
9  29 06 42 01 00 72 01 97
10 01 00 15 92 76 95 71 24
11 05 32 03 00 37 78 22 37
12 78 69 12 88 78 69 11 22
13 88 22 78 69 14 53 24 75
14 36 15 71 88 54 52 22 52
15 32 03 07 07 93 02 05 08
16 00 09 05 00 67 96 00 35
17 76 96 69 00 01 03 03 06
18 03 07 01 07 03 05 69 04
19 03 00 69 03 69 05 01 99
20 92 76 11 98 99 62 00 11

    CLR 0 0 ) 2 RCL 11 SST
    D E E HIR 17 1 D BST
    CSR CP 2ND RC* 22 R/S CE D
    2ND 9 INV PD* 29 EE TAN =
    X:T LRN X^ EX* 34 CRD PGM 51
    STO 40 SUM 31 Y^X 2ND INS CSR
    INS ST* 47 NOP EXC 92 LBL CE
    0 STO 09 DEG FIX 09 LBL CLR
    CP 6 STO 01 0 ST* 01 DSZ
    01 00 15 RTN LBL = SBR CE
    5 X:T 3 0 P/R Σ+ INV P/R
    Σ+ OP 12 DMS Σ+ OP 11 INV
    DMS INV Σ+ OP 14 ( CE
    PGM 15 SBR DMS ) EE INV EE
    X:T 3 7 7 . 2 5 8
    0 9 5 0 EQ WRT 0 1/X
    LBL WRT OP 00 1 3 3 6
    3 7 1 7 3 5 OP 04
    3 0 OP 03 OP 05 1 PRT
    RTN LBL A ADV PRT PG* 00 A

Page : 0          Esc  exit
# of prg  protect  pointer  code  empty  CROM #

```

BUILDER in 'view' mode

7.3 "GRAPHICS" MODE ON PC-100C PRINTER

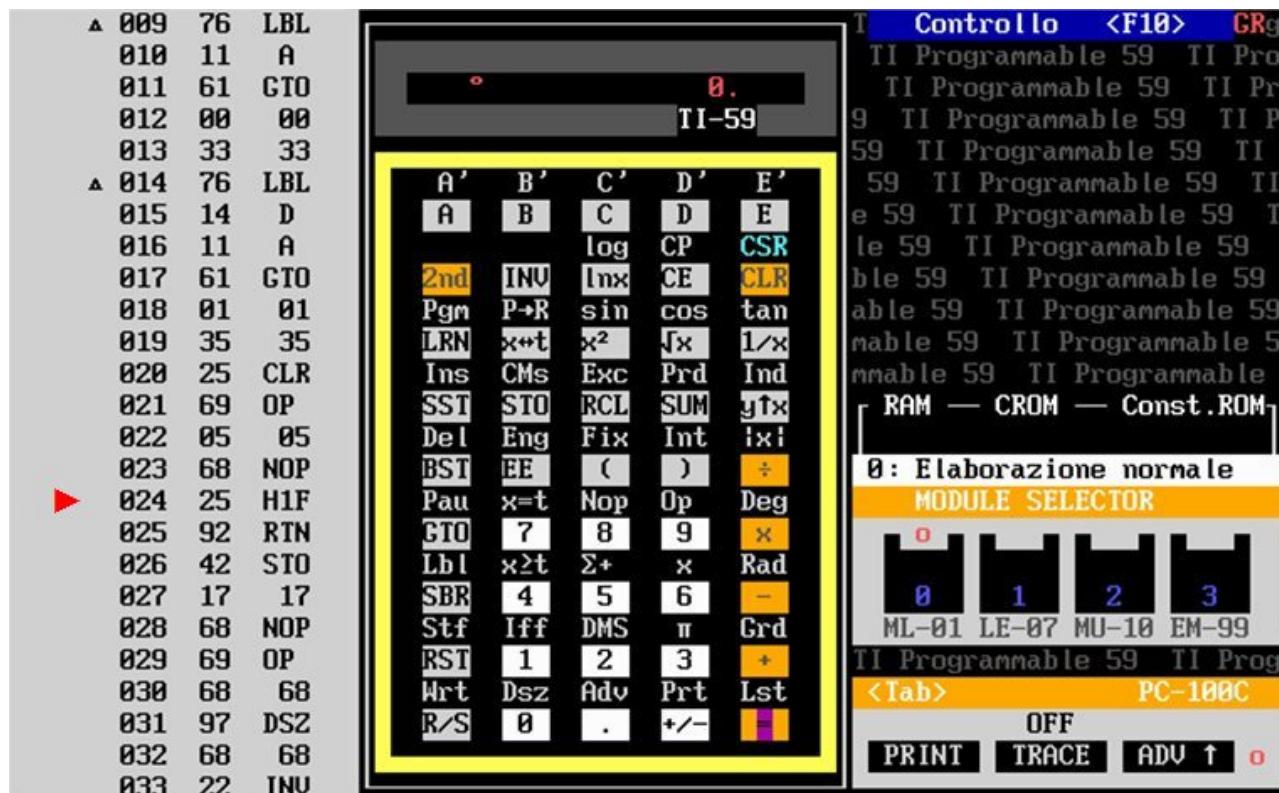
The PC-100C printer (and earlier models A and B) are thermal printers for plain text and commands for their use are widely explained in the manuals of Texas Instruments. In fact you can use the PC-100 in "graphics mode" with a programming techniques that use the generation of hexadecimal codes by using sequence of "unorthodox" keystrokes. The result is that the hex code **h25**, entered in RAM in a step multiple of eight, can control the single point of your printer. "PLOT60" program, appeared on the bulletin *TI PPC Notes*, can in this way generate graphs of functions.

Using the emulator is decidedly less difficult than the procedure to be followed on a real TI-59 and consists simply, using the **F8** key (*synthetic codes*), of introducing in a program step multiple of 8 (as in the real machine) the h25 code. In this listing it appears as "**H1F**". After running the program, it appears the normal result and pressing **F11**, however, appears the graphic result that is clearly more "squashed" than text (see next page).

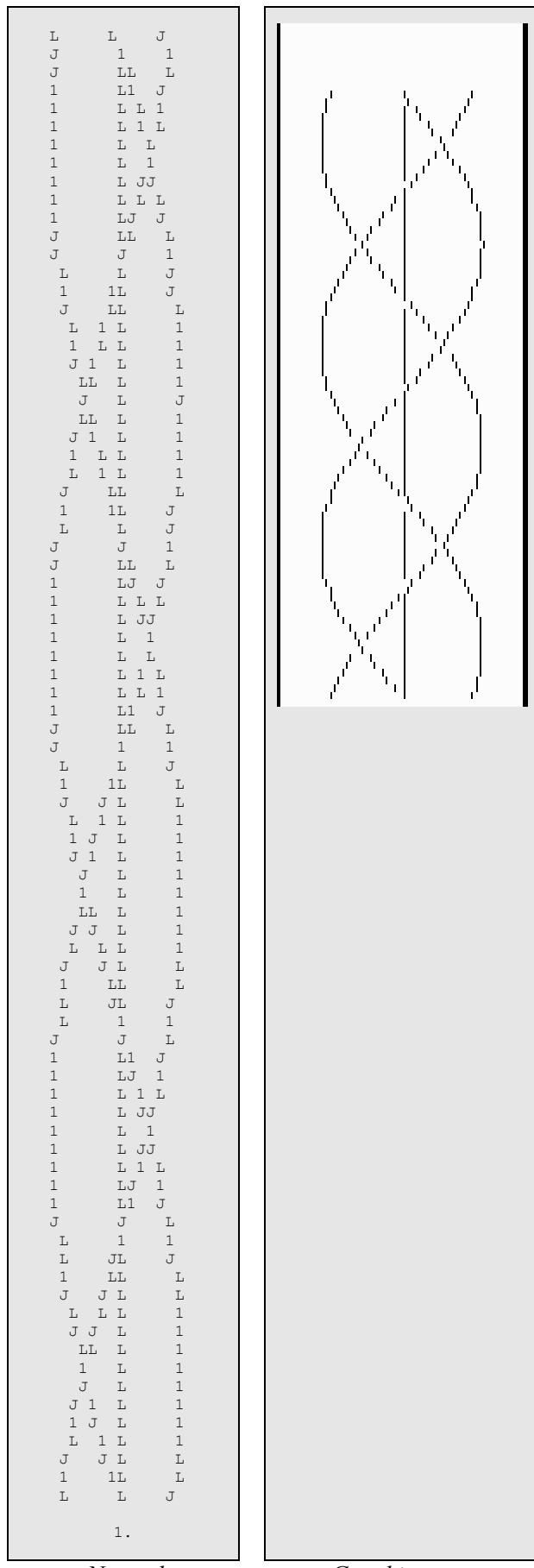
Note: The **F8** key also works on **TI57.EXE**, **TI66.EXE** and **SR-52.EXE** to generate synthetic codes typical of these models, according to the following table:

TI57	11, 12, 16, 17, 21, 31, 0A .. 0F
TI66	0A .. 0F
SR52	31, 62, 63, 64, 71, 72, 73, 74, 82, 84, 92

the meaning of which is explained in the various issues of 52Notes and TI-PPC Notes.



Note the acronym GR in the upper right which identifies the type of TI-59 emulator



PLOT60 example execution: with F11 you can obtain the right screen

7.4 TI-59 AND “FAST MODE”

One of the most used techniques in the TI58/59 programs for the obtaining of higher execution speed was the so-called '*fast mode*'. Clearly the emulator speed on current PC is superior to those of the original TI so that this technique is useless. It's possible to run programs written for the fast mode on the emulator too, ignoring inputs required for this mode. For example, the benchmark program appeared on www.hpmuseum.org web site to compare the speed of various models of calculators (including the TI) using the "Eight Queens" problem has been so written for the TI fast mode:

```
000 R/S
001 CLR STO 10
004 8 STO 11 STO 01
009 1 STO 00
012 RCL 00 X:T RCL 11 EQ 070
020 CLR X:T
022 OP 20
024 RCL 11 ST* 00
028 1 SUM 10
031 RCL 00 STO 09
035 INV DSZ 09 012
040 RC* 00 - RC* 09 = EQ 061
049 |X| + RCL 09 - RCL 00 =
057 INV X=T 035
061 DSZ IND 00 028
066 DSZ 00 061
070 RCL 10 PAUSE RST
...
145 LBL A
147 INV FIX
149 1 0 OP 17
153 CMS . 1
156 √x x2 1/x
159 STF
```

Instructions:

To use the program, press **A** and you will see a blinking **10.** on the display. Press **7** and then **EE** and wait for the completion of the calculation. You can't stop execution if not turning off the calculator.

To use it on the emulator simply replace the part of the program (in red) that begins at step 154 with the sequence **GTO 00 01** so the initialization sequence starts the fast mode at step 001 and to run the program just starting with **A**.

7.5 PC-100C/PC-200↔ASCII CONVERSION UTILITY.

This program allows the conversion between the alphanumeric codes of the PC-100C/PC printers 200 and the ASCII codes. The menu is extremely simple and consists of 3 options:

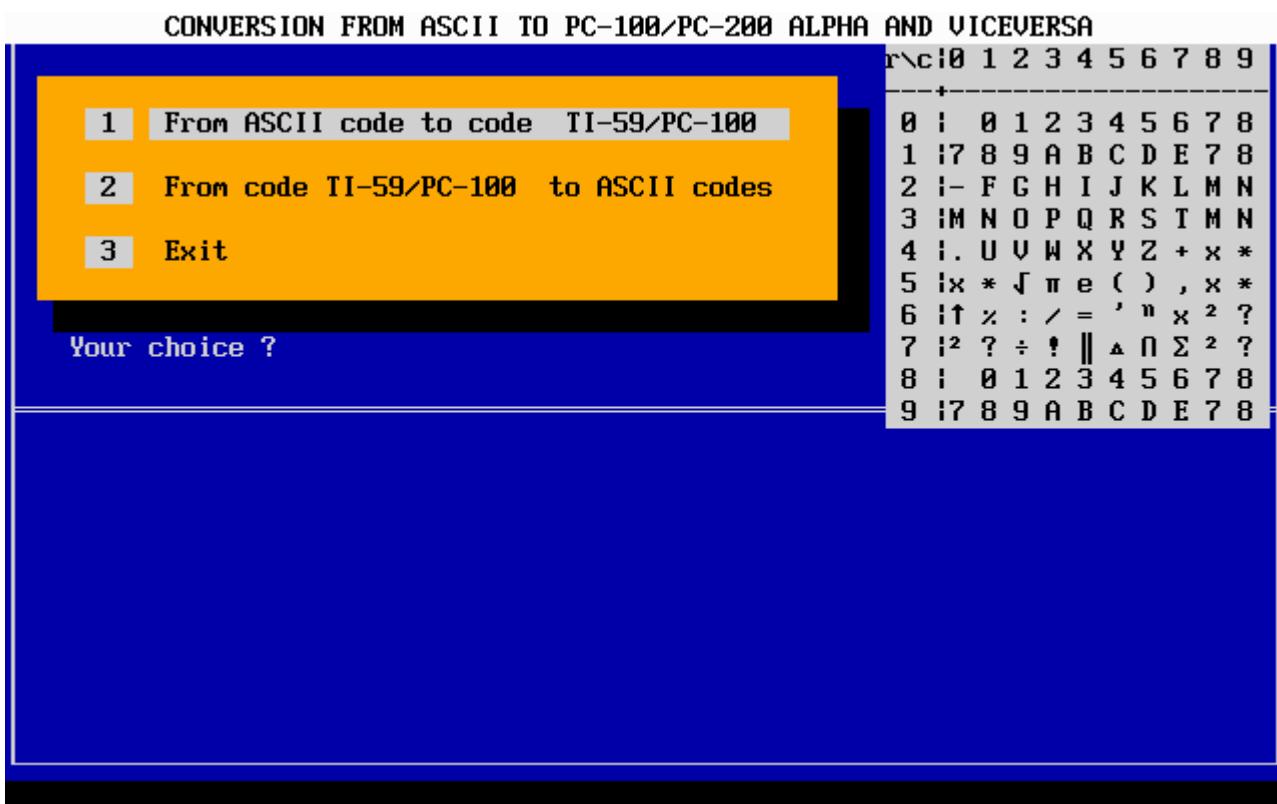
- 1) input a sequence of a maximum of 20 characters (16 for the PC-200) to obtain their respective alphanumeric codes divided by quarter-printing (op 01 ... op 04)
- 2) input 20 (16) PC-100C numerical codes (PC-200) to obtain their respective ASCII codes
- 3) exit and return to the emulator.

Note: the utility manages the extended table of alpha codes.

	0	1	2	3	4	5	6	7	8	9	
0	0	1	2	3	4	5	6	7	8	9	
1	7	8	9	A	B	C	D	E	7	8	
2	-	F	G	H	I	J	K	L	M	N	
3	M	N	O	P	Q	R	S	T	M	N	
4	.	U	V	W	X	Y	Z	+	x	*	
5	x	*	Γ	π	e	()	,	x	*	
6	↑	z	?	÷	⋮	⋮	⋮	=	z	?	
7	z	?	⋮	÷	⋮	⋮	⋮	=	z	?	
8	0	1	2	3	4	5	6	7	8	9	
9	7	8	9	A	B	C	D	E	7	8	

TENS DIGIT	UNITS DIGIT									
	0	1	2	3	4	5	6	7	8	9
0	blank	A	B	C	D	E	F	G	blank	A
1	H	I	J	K	L	M	N	O	H	I
2	P	Q	R	S	T	U	V	W	P	Q
3	X	Y	Z	⋮	⋮	⋮	⋮	⋮	X	Y
4	0	1	2	3	4	5	6	7	0	1
5	8	9	-	+	·	·	?	blank	8	9
6	Σ	()	*	/	!	π	Σ	()
7	*	<	>	≥	%	²	Δ	*	·	<
8	↑	⋮	⋮	⋮	⋮	⋮	⋮	⋮	↑	⋮
9	H	I	J	K	L	M	N	O	H	I

Alpha extended codes tables (PC-100C on the left and PC-200 on the right)



Conversion utility screen

- (1) "Module Selector" was manufactured by "American Micro Products" Inc. – Richardson (TX) in two models: automatic and manual.
(2) "CROM Emulator" functionalities are explained in US patent 4277827.

8. USING BAX-59 COMPILER.

You can now be used directly from within *TI59.EXE* (*TI59-64.EXE*) the **BAX59** cross-compiler that allows you to "translate" in the TI-59 A.O.S. programs written in BASIC Dartmouth. The **Shift F7** key leads to a minimal interface that allows you to organize your work:

The screenshot shows a terminal window with a red header bar containing the text "COLLEGAMENTO CON BAX59 - CROSS COMPILER DA BASIC DARTMOUTH A TI59 AOS". Below the header, there is system information: "Il volume nell'unità G è HD250", "Numero di serie del volume: 0CF0-4490", and "Directory di G:\TI59\PROG\BAX59". Underneath, a file list is shown: "CUBI-BAX.BAS", "OVERSH59.BAS", and "SAMPLE01.BAS", followed by "3 file", "1012 byte", and "1023932928 byte disponibili". At the bottom of the window, there is a blue footer bar with four menu options: "Edit .BAS", "Compila .BAS", "Vedi .SOA", and "Abbandona BAX ==>".

At the top there is the list of .BAS files contained in the *PROG/BAX59* folder; at this point you can use the following keys:

- 'E' to create and / or edit a BASIC file;
- 'C' which allows compiling: if this process is correct at the end the .SOA file will be found in the PROG directory, ready to be imported with the usual Import **F7** key;
- 'V' allow you to view .SOA files;
- 'A' quits and return to the emulation program.

It's well to pay attention that programs written in Basic Dartmouth are not fully compatible with, for example, GWBASIC and therefore may not be possible to make any preliminary test to see if the program is working properly and that, anyway, **BAX59 does not detect all possible errors**.

Overall features of the Basic Dartmouth used by **BAX59** are the following:

- 1) **real** and **integer** variables (with % suffix: they are equivalent to the TI-59 flags) and limited support to **string** variables;
- 2) every program line is numbered;
- 3) a single statement for every line;
- 4) mandatory LET statement use for assignment;
- 5) final END instruction mandatory.
- 6) arrays can be at most bidimensional – it's even accepted the implicit DIM;

- 7) DEF FN functions can also be multi-line with, at most, two parameters;
- 8) IF...THEN (o IF ... GOTO) statement only jumps to a certain line;
- 9) FOR..TO..STEP..NEXT and WHILE..WEND loops;
- 10)seventeen predefined functions: ABS, ATN, INT, EXP, LOG, SIN, COS, TAN, RND, SQR, SGN, COT, TAB, LGD, ASC, CHR\$, FRAC and the PI constant. RND function uses Master Library module; (COT - cotangent, LGD - decimal logarithm and FRAC - fractional part aren't GWBASIC/QBasic standard functions)
- 11)PRINT statement is adapted to the characteristics of the PC-100 printer: so ASCII codes aren't supported but only TI PC-100 codes;
- 12)READ & DATA statements; GOSUB..RETURN for subroutines;
- 13)OPTION statement is **not standard** and it's used to support special features of the TI-59.

In the **BAX59** manual (*BAXMAN59.PDF*) you will find all the features of BASIC language used. The keyword of the language is listed below:

BAX-59 BASIC LANGUAGE KEYWORD

ABS (GOSUB	READ
ASC (GOTO	REM
ATN (IF	RESTORE
CHANGE	INPUT	RETURN
CHR\$ (INT (RND (
CLEAR	LET	SGN (
COS (LGT (SIN (
COT (LOG (SQR (
DATA	NEXT	STEP (BY)
DEF FN	NOT	STOP
DIM (DIMENSION)	ON	TAB (
END	OPTION	TAN (
EXP (PI	THEN
FNEND	PRINT	TO
FOR	PRINT USING	WEND
FRAC (RANDOMIZE (RANDOM)	WHILE

Finally an example of translation (*SAMPLE01.BAS* file taken from BAX-.59 distribution) on the calculation of the Greatest Common Divisor (G.C.D. - M.C.D. in Italian):

BASIC Dartmouth	TI-59 AOS
<pre> 10 PRINT "A", "B", "C", "GCD" 15 FOR I = 1 TO 3 20 READ A, B, C </pre>	<pre> LBL E' 13 STO 13 1 SUM 13 6 0 ST* 13 1 SUM 13 9 0 ST* 13 1 SUM 13 1 2 0 ST* 13 1 SUM 13 3 8 4 5 6 ST* 13 1 SUM 13 6 4 8 7 2 ST* 13 1 SUM 13 9 8 7 6 5 ST* 13 13 STO 13 RTN LBL PRT 1 9 STO 01 RTN LBL ADV (((LOG INT + 1) / 2 + . 5) INT * 2) RTN {BASIC line #10} 1 3 OP 01 OP 05 1 4 OP 01 OP 05 1 5 OP 01 OP 05 2 2 1 5 1 6 OP 01 OP 05 {BASIC line #15} 1 STO 04 {BASIC line #20} LBL A </pre>

```

30 LET X = A
40 LET Y = B
50 GOSUB 200
60 LET X = G
70 LET Y = C
80 GOSUB 200
90 PRINT A, B, C, G
100 NEXT I
105 GOTO 999
110 DATA 60, 90, 120
120 DATA 38456, 64872, 98765
200 LET Q = INT(X/Y)
210 LET R = X - Q*Y
220 IF R = 0 THEN 300
230 LET X = Y
240 LET Y = R
250 GOTO 200
300 LET G = Y
310 RETURN
999 END

```

1 SUM 13 RC* 13 STO 05	
1 SUM 13 RC* 13 STO 06	
1 SUM 13 RC* 13 STO 07	
{BASIC line #30}	
RCL 05 STO 08	
{BASIC line #40}	
RCL 06 STO 09	
{BASIC line #50}	
C	
{BASIC line #60}	
(RCL 10) STO 08	
{BASIC line #70}	
RCL 07 STO 09	
{BASIC line #80}	
C	
{BASIC line #90}	
RCL 05 PRT	
RCL 06 PRT	
RCL 07 PRT	
(RCL 10) PRT	
{BASIC line #100}	
LBL B	
OP 24 RCL 04 X:T 3 GE A	
{BASIC line #105}	
GTO E	
{BASIC line #110}	
NOP	
{BASIC line #120}	
NOP	
{BASIC line #200}	
LBL C	
((RCL 08 / RCL 09) INT) STO 11	
{BASIC line #210}	
(RCL 08 - RCL 11 * RCL 09) STO 12	
{BASIC line #220}	
0 X:T RCL 12 EQ D	
{BASIC line #230}	
RCL 09 STO 08	
{BASIC line #240}	
(RCL 12) STO 09	
{BASIC line #250}	
GTO C	
{BASIC line #300}	
LBL D	
RCL 09 STO 10	
{BASIC line #310}	
RTN	
{BASIC line #999}	
LBL E	
R/S	

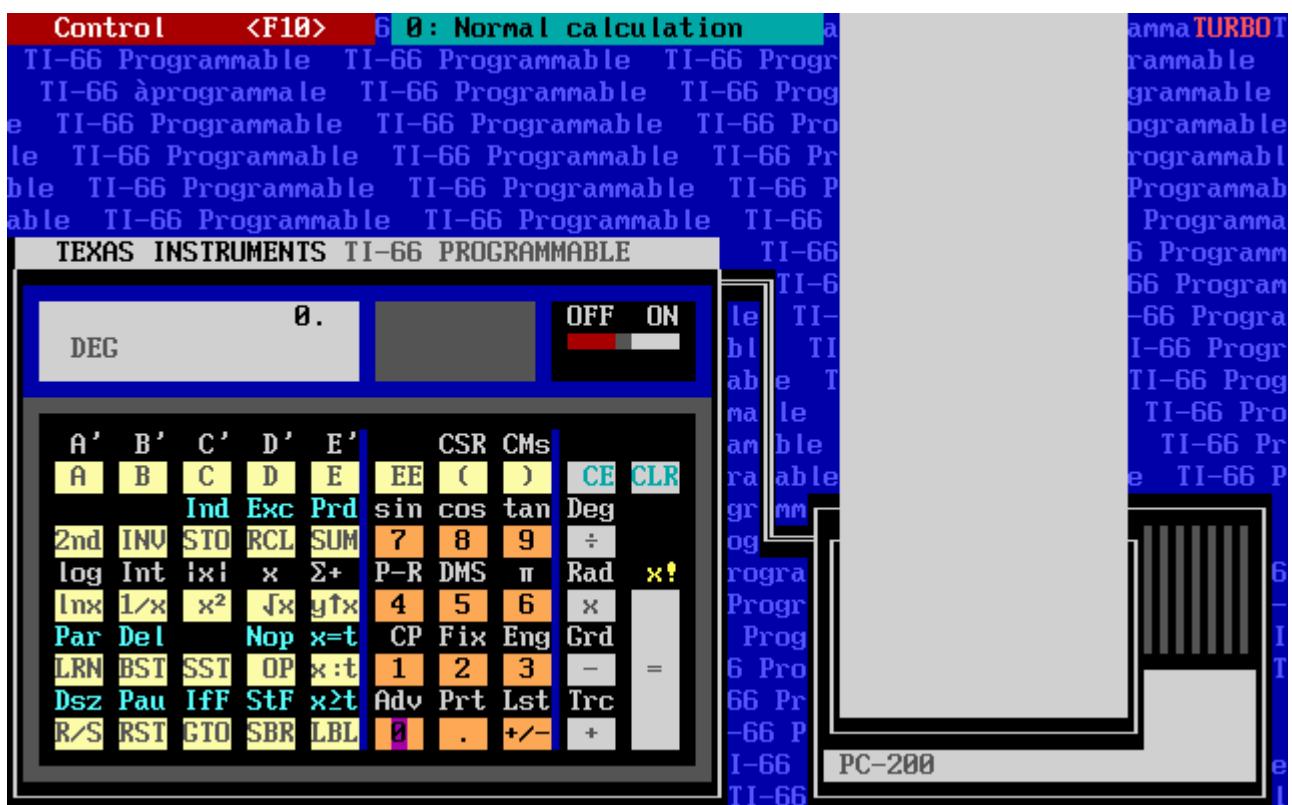
At the end of the compilation phase it is supplied the correct sequence of keys to start the program. You may also notice that each BASIC line is commented in the SOA translated file and at the beginning it's inserted an **initialization sequence** (in green) and a **utility library** (in blue).

Note: Another “high level” language has been implemented also for the TI-57 (**LIMACE-57**): for its features see § 10.2.

9. TI-66 EMULATOR

The TI-66 emulator also faithfully follows the original machine, including abbreviated addressing and synthetic codes 0A-0F, with the addition of the factorial function, implemented as **2nd** **=**. An exception is also the management of the constant memory which also retains the fixing of the decimals and the angular mode, which is not present in the original machine.

The real TI-66 doesn't have the capability to save a program on an external support (magnetic card or tape): to overcome this fact, CRAM modules have been implemented (as on the TI-88) which allow you to have a "mass memory" also on this machine (see next paragraph).



TI-66.EXE (16 bit version - English)

9.1 CRAM MODULES MANAGEMENT

As mentioned above, to make up for the lack in the TI-66 of a permanent storage system like magnetic cards or tape drives, in the emulator has been implemented (as suggested at the time - in 1984 - in an article in TI PPC Notes) the management of so-called CRAM modules that allow you to have more programs available without having to retype them. So you can "save" the situation of memory in a "CRAM module", which is assigned a number.

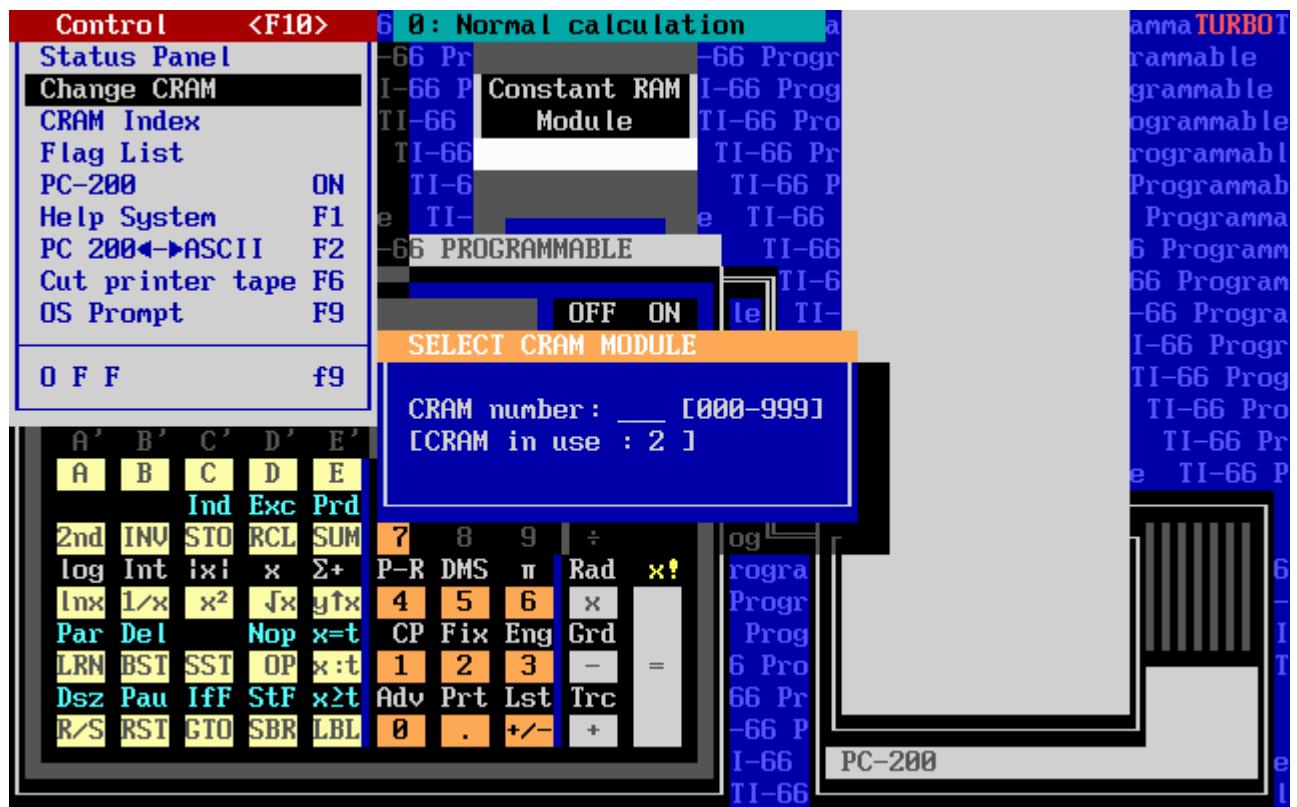
TI66.EXE remembers the last CRAM module used (which it's in memory when the emulator starts) and, via the control menu - **F10 – Change CRAM**, you can choose the new CRAM to load. If the required CRAM does not exist it's "created", from scratch, empty otherwise the requested module is loaded after saving the current one.

In CRAM folder are contained the following files:

- **CRAM.xxx:** contains the source code, with xxx ranging from 000 to 999
- **INDEX:** is the list of CRAMs present in the folder. Its update must be managed by the user.

In a CRAM module, the first line contains the current partition followed by the program memory (512 positions – one keycode for line). By convention, an “empty” CRAM module is identified as 000: it is recommended not to use it for other purposes.

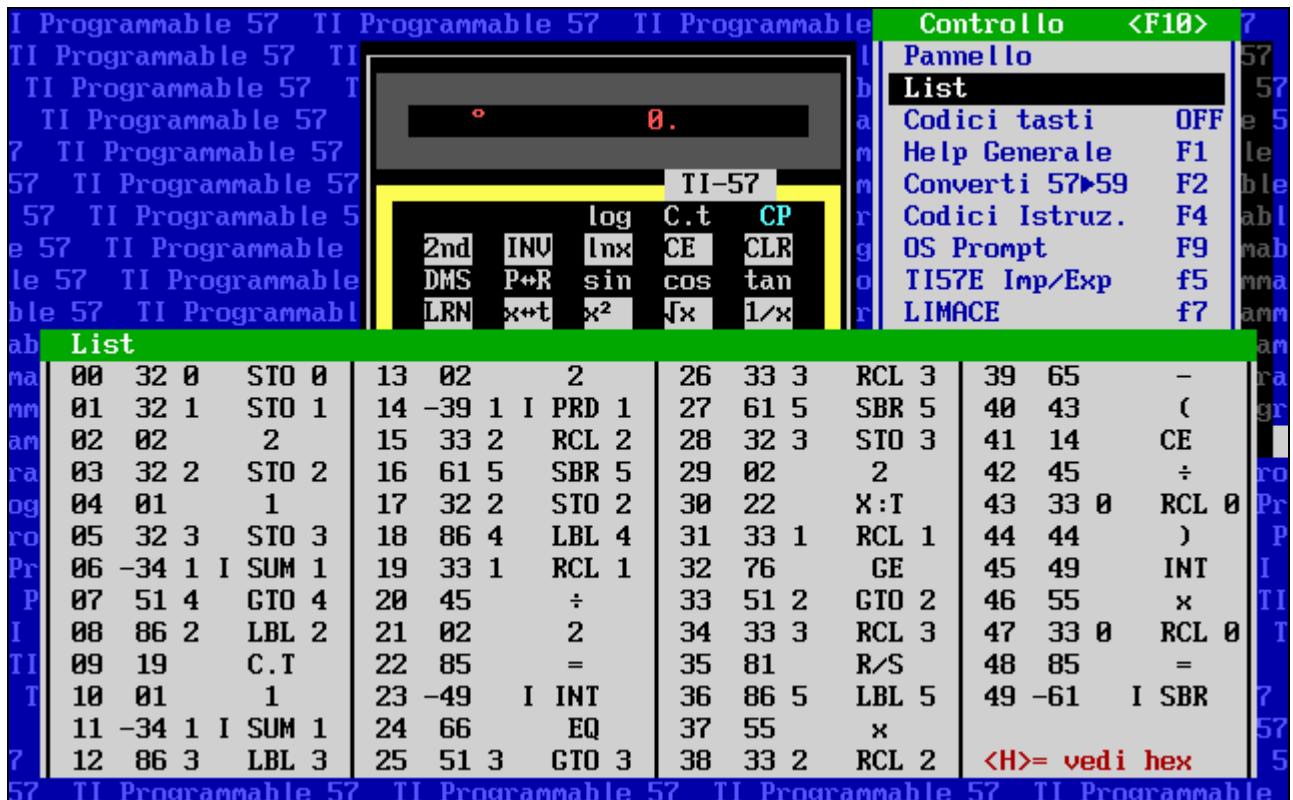
Note: passing from one CRAM to another, the fixing of the decimals and the angular mode are preserved, but not the partition of memory.



Finally, please note that the ALPHA PC200↔ASCII codes conversion is also active for the PC-200 printer (see § 7.4).

10. TI-57 EMULATOR

The TI-57 emulator has the same functionality as that TI-58/58C/59 emulators: differences concern obviously the hardware of the machines. For example, also if the printer is missing, it's possible to have the program listing using the **Control** (Controllo) menu - activable with F10 - either with LRN-mode keycodes either with internal hexadecimal format of the TI-57. The o-called "synthetic codes" have also been implemented, which can be entered directly into a program with the **F8** key.



Listing of the TI-57 program actually in memory

It is also possible to execute the utility "57TO59" (see § 10.1) which, in this case, copy the emulator's program in its own memory. The user programs are loaded/saved in the *57TO59* folder and their format is different from the text format .SOA used by the F7 - Import function.

10.1 THE “57TO59” UTILITY PROGRAM

57TO59 allows you to "translate" a TI-57 program in its corresponding TI-58/58C/59: this conversion allows you to replicate the behavior of the TI-57 when using the t-register and the statistical instructions which, as it is known, have a different registers' use in the two models.

The *Control* menu can be activated (and deactivated) with <F10> and provides the following items:

- **Read program:** load program to be translated.
- **Save program:** save program in memory.
- **List:** list program in memory.
- **Translate** program: translate program in memory to TI-59 format.
- **Save as magnetic card (TI-59):** saves program in memory to TI-59 magnetic card format (in *SCHEDA59* folder).

- **Help:** show main help.
- **CP - Clear program :** deletes the program currently in memory, in order to be able to correctly load another program to be translated.
- **GTO 2nd <nn>:** go to step <nn> (00 to 49).
- **Exit from 57TO59:** quit program.



You can load a program in three different ways:

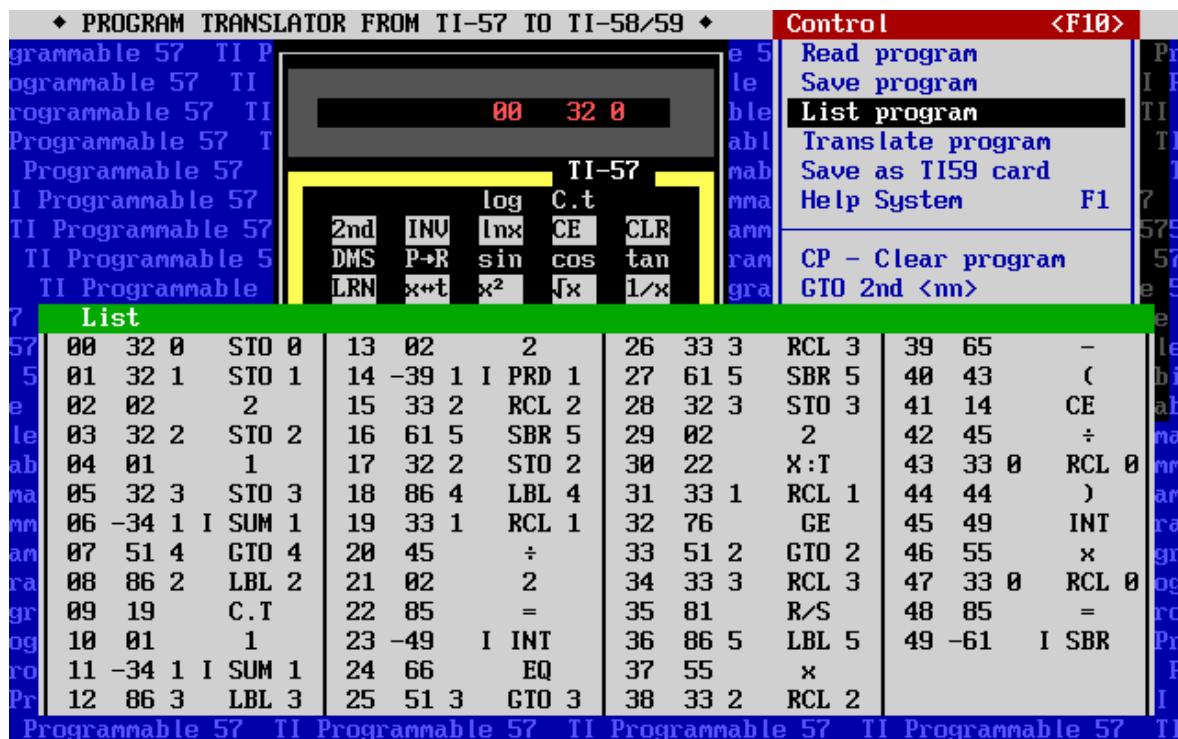
- 1) directly, by calling 57TO59 from the TI-57 emulator;
- 2) using option number 1 of the Control menu;
- 3) manually, possibly using the editing keys (SST, BST, Ins, Del) for corrections.

Note: In the second and third cases, it is recommended to use the CP – Clear Program option first, to clear the memory of 57TO59.

For example, let's use the first menu option to load the *FERMAT.57* program (taken from the February 1985 magazine ‘List’ and which implements the primality of integer numbers according to Fermat):

LIST OF AVAILABLE FILES				
5?LIST.SOA	5?TRADUZ.SOA	EQUAZ.57	EXACT.57	FACT2.57
FERMAT.57	FRAZIONI.57	GIOCO15.57	PR-PROS.57	PRIMI.57
QUADR.57	REVERSE.57	SOMME.57		

List of files in the 57TO59 folder.



while with **T**, we get the translation into TI-59 AOS:

000	42	STO		025	01	1		050	67	EQ		075	16	A'		100	10	10
001	00	00		026	22	INV		051	00	00		076	65	x		101	92	RTN
002	42	STO		027	44	SUM		052	55	55		077	43	RCL		*102	76	LBL
003	01	01		028	01	01		053	61	GTO		078	02	02		103	48	EXC
004	02	2		*029	76	LBL		054	14	D		079	75	-		104	42	STO
005	42	STO		030	14	D		055	43	RCL		080	53	(105	10	10
006	02	02		031	02	2		056	03	03		081	24	CE		106	48	EXC
007	01	1		032	22	INV		057	16	A'		082	55	÷		107	07	07
008	42	STO		033	49	PRD		058	42	STO		083	43	RCL		108	43	RCL
009	03	03		034	01	01		059	03	03		084	00	00		109	10	10
010	22	INV		035	43	RCL		060	02	2		085	54)		110	32	X:T
011	44	SUM		036	02	02		061	71	SBR		086	59	INT		111	92	RTN
012	01	01		037	16	A'		062	48	EXC		087	65	x				
013	61	GTO		038	42	STO		063	43	RCL		088	43	RCL				
014	15	E		039	02	02		064	01	01		089	00	00				
*015	76	LBL		*040	76	LBL		065	22	INV		090	95	=				
016	13	C		041	15	E		066	77	GE		091	92	RTN				
017	82	HIR		042	43	RCL		067	00	00		*092	76	LBL				
018	08	08		043	01	01		068	71	71		093	32	X:T				
019	29	CP		044	55	÷		069	61	GTO		094	42	STO				
020	00	0		045	02	2		070	13	C		095	10	10				
021	42	STO		046	95	=		071	43	RCL		096	43	RCL				
022	07	07		047	22	INV		072	03	03		097	07	07				
023	82	HIR		048	59	INT		073	91	R/S		098	32	X:T				
024	18	18		049	22	INV		*074	76	LBL		099	43	RCL				

Note the 'X:T' (step 92) and 'Exc' (step 102) routines which are added by the translator for the management of the T-register (on the TI-57 it coincides with the memory #7).

Note: The list and the relative translation are stored in two text files (**57LIST.SOA** and **57TRADUZ.TXT**) located in '57TO59' folder.

10.2 THE 'LIMACE' LANGUAGE.

As on the TI-59, a high-level 'language' called LIMACE is also available on the TI-57, born from an idea of the French magazine '*L'Ordinateur Individuel*'.



LIMACE presentation page (from 'L'Ordinateur Individuel' n.7 pag. 48)

Shift F7 calls the programming environment (available both in English and in French version) that allows you (using a text user interface) to create, modify and compile a LIMACE program in the TI-57 AOS.

```
♦ LIMACE FOR TI-57 v 2.0 ♦
HELP - Available Commands

ACTIVE      (A) active .LIM file          (actual: NONAME.LIM)
CLS
COMPILE     (C) compile .LIM file in memory
CREATE [/C]  (CR) write .SOA file (/C to include line remarks)
DELETE      (D) delete a line from program
DOS
FILES       (F) list .LIM files on disk
*FILES      (*F) list .SOA files on disk
HELP [/L]    (H) command summary (/L for language syntax summary)
INSERT      (I) insert a line in program
LIST        (L) list program on screen
LLIST       (LL) list program on printer
LOAD [file]  (LO) load .LIM file in memory
NEW         (N) clear program
PATH        (P) set path for .LIM files      (actual: PROG\ENG\
QUIT        (Q) quit LIMACE
SAVE        (SA) save .LIM file from memory
n           write line #n in program
/25 /43 /50 set screen width
Command>
```

LIMACE programming environment commands (English version).

The main features of the language are:

- 8 variables, from V0 to V7;
- 10 lines callable by GOTO/GOSUB instructions (at maximum);
- WHILE ... WEND loop can use V0 only;

- 999 LIMACE lines (at maximum);
- for LIMACE keywords and functions see the table below.

LIMACE57		
INSTRUCTIONS	-	FUNCTIONS - FONCTIONS
GOTO n GOSUB n IF cond THEN n INITIALIZE [Vi_list/values] INPUT Vi_List OPTION DEG RAD GRAD PRINT [Vi_list] REM(ARK) string RESET RETURN SWAP Vi ,Vj USING n WHILE V0<>0 DO WEND Vi=expr (assignment)	ALLER A m ALLER EN SOUS-ROUTINE m SI cond ALORS m INITIALISER [liste_de_Vi/valeurs] ENTRER Liste_de_Vi OPTION DEG RAD GRAD SORTIR [liste_de_Vi] REM(ARQUE) chaine RESTAURER FIN DE SOUS-ROUTINE ECHANGER Vi ,Vj FIXE n TANT QUE V0<>0 FAIRE FIN	ABS(expr) CHS(expr) COS(expr) EXP(expr) FRAC(expr) ICOS(expr) INT(expr) . ENT(expr) INV(expr) ISIN(expr) ITAN(expr) LN(expr) LOG(expr) PI SIN(expr) SQR(expr) . RAC(expr) TAN(expr)

0≤n≤9; 0≤i,j≤7; 0≤m≤999; relat► = < > = <= > < > arith► + - * / ^

LIMACE language instructions (English and French)

Let's see a practical example of use (we will use EFACT.LIM for the calculation of the factorial of a number). Once the programming environment is excuted, we will load the LIMACE program with

Command > LOAD EFACT

which will be automatically listed:

```
♦ LIMACE FOR TI-57 v 2.0 ♦

Command> LOAD EFACT
OK
1 INPUT V0
2 V1=1
3 WHILE V0<>0 DO
4 V1=V1*V0
5 WEND
6 PRINT V0
7 STOP
Command>
```

We could therefore launch the compilation to verify that everything goes well:

Command > COMPILE

It will be shown a line a time (with the LIMACE source on the left and the AOS trnaslation on the right).

```

♦ LIMACE FOR TI-57 v 2.0 ♦
7 STOP
Command> COMPILE
Device [SCRN:]?
1 INPUT V0
          0      R/S
          1      STO 0
2 V1=1
          2      1
          3      STO 1
3 WHILE V0<>0 DO
          4      2ND LBL 0
4 V1=V1*V0
          5      RCL 0
          6      PRD 1
5 WEND
          7      2ND DSZ
          8      GTO 0
6 PRINT V0
          9      RCL 0
7 STOP
          10     R/S
COMPILE OK
Command>

```

You can therefore save the translated program with

Command> CREATE

that will write EFACT.SOA file ready to be imported and executed in the emulator.

```

♦ LIMACE FOR TI-57 v 2.0 ♦
4 V1=V1*V0
          5      RCL 0
          6      PRD 1
5 WEND
          7      2ND DSZ
          8      GTO 0
6 PRINT V0
          9      RCL 0
7 STOP
          10     R/S
COMPILE OK
Command> CREATE
COMPILE OK
.SOA FILE CREATED!
-----
R/S STO 0
1 STO 1
LBL 0
RCL 0 PRD 1
DSZ GTO 0
RCL 0
R/S
Command>

```

With the Quit command you exit the Limace environment and, upon returning to the emulator of the TI-57, the following warning message will be shown:



Instructions for running the programs compiled on the emulator

EFACT.LIM	EFACT.SOA
7 INPUT V0 V1=1 WHILE V0<>0 DO V1=V1*V0 WEND PRINT V0 STOP	R/S STO 0 1 STO 1 LBL 0 RCL 0 PRD 1 DSZ GTO 0 RCL 0 PAU R/S

Note: 7 is the number of lines of this program

Note: TI-57 emulator uses the English version of LIMACE program environment.

11. TI-57 LCD EMULATOR.

The TI-57 LCD (or TI-57II) emulator tries to overcome two strong limitations of the original machine. As already mentioned in § 4.1, the emulator can be recalled with two main options **/NUM** e **/EXT**, so

- 1) without the **/NUM** switch, it displays instructions in LRN-mode alphanumeric as on the TI-66. However, it is possible, during execution, switch from the alphanumeric LRN-mode to the standard numeric one (and vice versa) by pressing **Alt + S**.
- 2) with the **/EXT** switch, it allows you to have a TI-57LCD with a memory space comparable to that of the TI-57 (LED), that is 96 program steps or 7 memories instead of 48 program steps or 7 memories.

Note: Each of the two memory modes uses its own file for the constant memory.

The recommended command-line for execution is therefore

TI57LCD /EXT (or TI57LCD-64 /EXT)

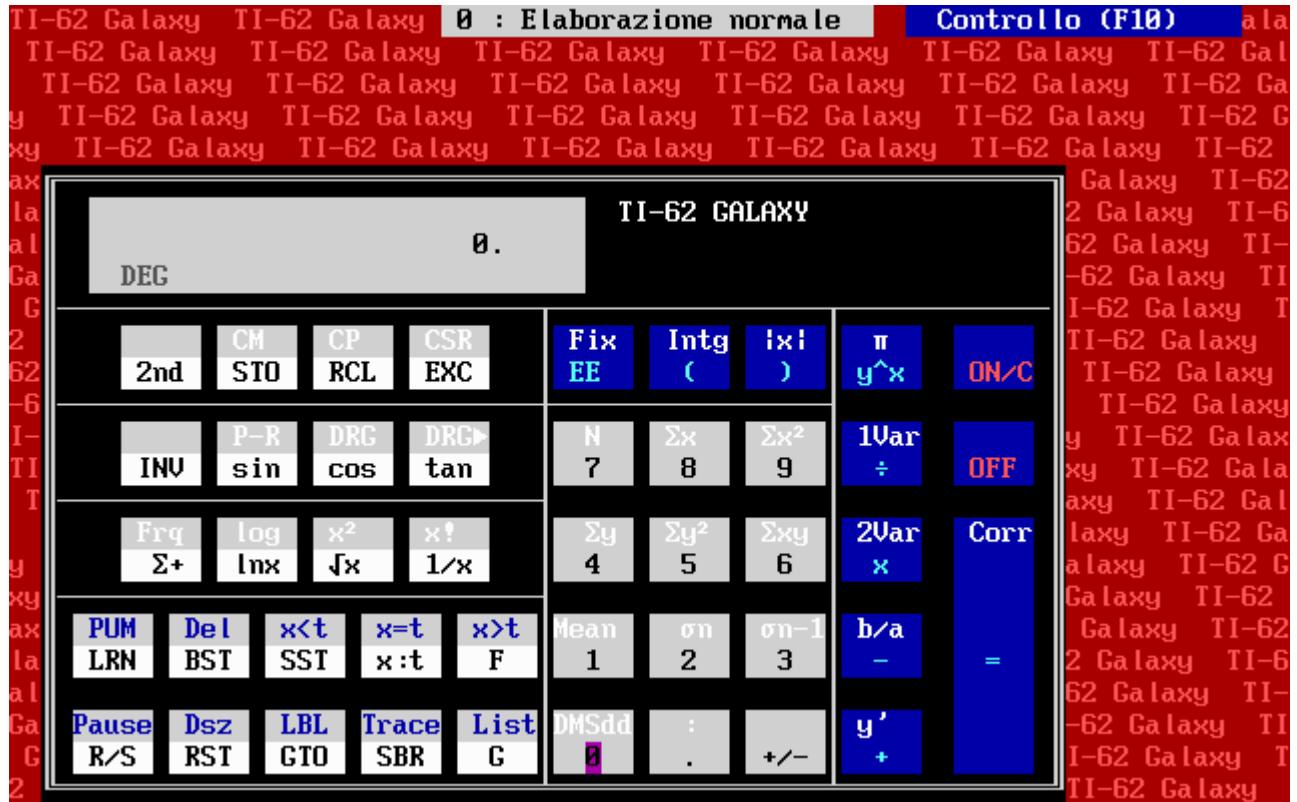
which allows you to have maximum flexibility in the use of the emulator.



TI-57LCD.EXE

12. TI-62 EMULATOR.

The TI-62 emulator faithfully follows the original machine, except for the fact that the system of indicators for the functions of polar/rectangular conversions and for the statistical functions for which the method of the others has not been implemented.



Let's see the differences on two examples.

1) Convert $(45, 60^\circ)$ from polar to rectangular coordinates

[ON/C] [ON/C]	0.	[ON/C] [ON/C]	0.
[INV][x:t]	0.	[INV][x:t]	0.
[2nd][P-R]	ENTER r \Leftrightarrow	45 [x: t]	0.
45 [x: t]	ENTER $\theta =$	60 [2nd][P-R]	22.5
60 [=]	22.5 x \Leftrightarrow	[x :t]	38.97114317
[x :t]	38.97114317 y \Leftrightarrow		

TI-62 real

TI-62 emulated

Note: On the real TI-62 an alternative execution is also possible, as on the TI-58/58C/59, by following the [=] key to [2nd][P-R].

2) Evaluate the following one-dimension statistical data :

13,13,13,15, 16 con media= 14

Frq=3

[ON/C][ON/C] [2nd][CSR]	0.	[ON/C] [ON/C] [2nd][CSR]	0.
[1Var]	0. 1 STAT	[1Var]	0. 1 STAT
13 [Σ^+]	1. 1 STAT ENTER $x \Sigma/\text{Frq}$	[2nd][Frq] 03	FRQ 03 1STAT
3 [2nd][Frq]	FRQ 00 1STAT ENTER $f \Sigma$	13 [Σ^+]	3. 1 STAT
15 [Σ^+]	4. 1 STAT ENTER $x \Sigma/\text{Frq}$	15 [Σ^+]	4. 1 STAT
16 [Σ^+]	5. 1 STAT ENTER $x \Sigma/\text{Frq}$	16 [Σ^+]	5. 1 STAT
[2nd][Mean]	14. 1 STAT ENTER $x \Sigma/\text{Frq}$	[2nd][Mean]	14. 1 STAT

TI-62 real

TI-62 emulated

In the emulated TI-62, the frequency input (Frq) must be done before entering the data, while in the real TI-62 it must be done after. From the method used by Texas Instruments we deduce that the design of these functions has not been done for programming, but for direct calculation only.

13. TI-55 II EMULATOR

The TI-55 II emulator faithfully follows the original machine, except for a few details listed here:

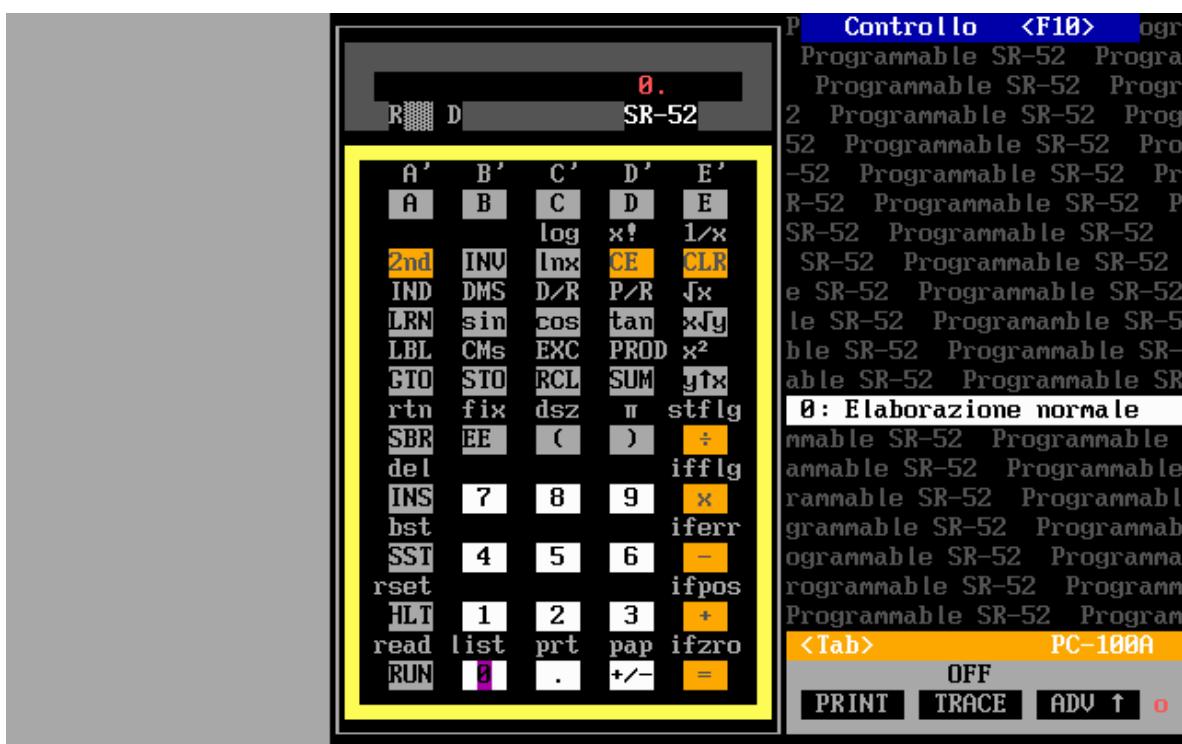
TI-55 II – real	TI-55 II - emulated
<ul style="list-style-type: none"> • RST instruction repositions the program pointer to position 00 and stops program • The OFF key is not programmable • In LRN-Mode the display shows instructions as numerical codes, according to the "Rule of the matrix". • The occupation of the single statistics registers is different from that of the TI-58 /58C /59, which in any case are not accessible during the STAT mode. 	<ul style="list-style-type: none"> • RST instruction repositions the program pointer to position 00 and doesn't stop the program (as on the TI-55). • The OFF key is programmable • In LRN-Mode the display shows instructions in alphanumeric (like the TI-66) but, with the switch /NUM at statring numeric codes are used. As for the TI-57LCD <At+S> allows the transition between the two modes during the use of the emulator. • The occupation of the single statistics registers is the same as that of the TI-58/58C/59, with equal results. The registers remain not accessible directly, but only viewable from the Status Panel.



14. SR-52 AND SR-56 EMULATORS

The SR-52 and SR-56, together with their PC-100 printer, constitute the first generation of programmables from Texas Instruments. Beyond the constant memory, the differences of the emulator compared to the real models have been kept to a minimum, namely:

- 1) The arithmetic of the SR-52 is mixed - 12 and 13 digits depending on whether direct ("display arithmetic") or memory ("memory arithmetic") arithmetic is used. The emulator, on the other hand, always uses 13-digit arithmetic;
- 2) It is possible, with the /EXT switch, to bring the memory capacity to 4 memory chips: as in the real expansion we will have two memory zones, which can be swapped at will (see figure on the next page);
- 3) It is possible to obtain the so-called "fractured digits" through "non-standard" keystrokes.



SR-52.EXE (16 bit)

- 4) For both models the printing possibilities have been extended (unless you use the /L option): it is possible to have the program list in TI-59 format with the mnemonic codes, instead of just the numeric codes. In addition, the list of the contents of the memory registers (with **INV List**) not present in the real models has also been implemented. For the SR-52 only an option of the control Menu ("List Labels" allows to print the labels list of a program (the equivalent of Op 08 for the TI-58/58C/59).
- 5) The SR-56 emulator uses the 256 bytes internal firmware (written in AOS) for the **f(n)** instructions: an anticipation of what will be implemented on subsequent models (TI-58 / 58C / 59)

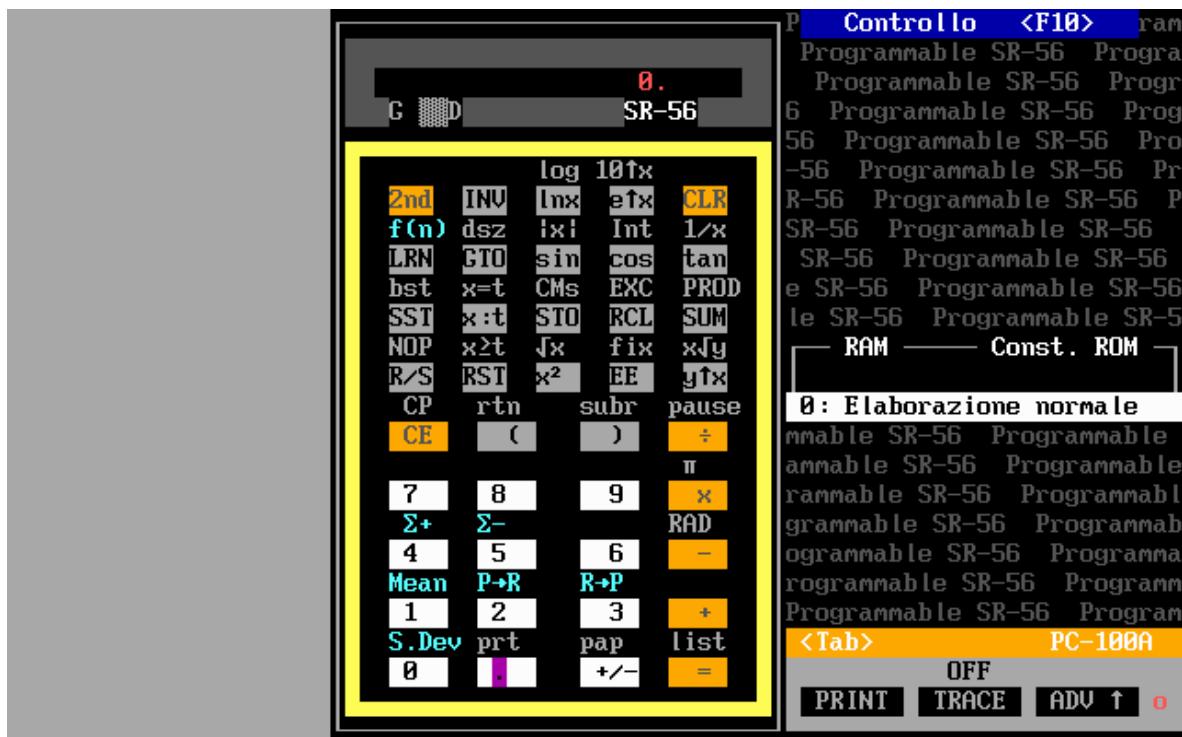
It is possible to import .SOA files with the **F7** key and, in the case of the SR-52, to save the program on a virtual "magnetic card": the format is similar to those of the TI-59 and was previously described in § 6.1.

registers		
Standard Memory	00-19 20-29	RAM 1
	30-59	
Algebraic Stack	60-69	
Program 224 steps	70 89	RAM 2
	90-97 + [98-99 available memories]	
	100-119	

SR-52 standard configuration

registers		
Standard Memory	00-19	RAM 1
	20-29	
Extended Memory	30-59	RAM 2
Algebraic Stack	60-69	
Program #1 224 steps	70 89	RAM 3
	90-97 + [98-99 available memories]	
Program #2 160 steps	100-119	RAM 4

SR-52 extended configuration



SR-56.EXE (16 bit)

15. SR-60A EMULATOR.

It's also available the emulator of SR-60A, a quite unusual machine in the world of programmable calculators of Texas Instruments. It's, indeed, a desktop calculator with all integrated (thermal 20 columns printer and magnetic cards reader/writer) and a large memory capacity (up to 9600 bytes - 10 times greater than TI-59's without Solid State Software module), a keyboard with 95 keys, an alphanumeric display, although the A.O.S. is on the level of that of SR-52 and, therefore, lower than that of the TI-59.



The emulator, unlike those for other models, does not have the constant memory although you can import .SOA files with the usual F7 key, and, not having the real machine, all the information was taken from the operating manual and programming.

APPENDIX – FUNCTION KEYS STICKER

Sh+F1	Sh+F2	Sh+F3	Sh+F4	Sh+F5	Sh+F6
Aiuto per programmi importati	Aiuto per programmi CROM/CRAM	Path per import file .SOA	Vedi Memoria emulatore	.M59 Import/Export	Num. Porta CROM
Aiuto Generale	ASCII <-> PC-100/200	Stack emulatore	Mascherina codici tasto	Tabelle di utilità	"Taglia" carta stampante

F1 F2 F3 F4 F5 F6

Sh+F1	Sh+F2	Sh+F3	Sh+F4	Sh+F5	Sh+F6
Help for imported programs	Help for CROM/CRAM programs	Set Path for import .SOA files	View emulator memory	.M59 Import/Export	CROM Port Number
Main Help	ASCII <-> PC-100/200	Emulator stack	Keycode overlay	Reference tables	"Cut" printer paper

F1 F2 F3 F4 F5 F6

Sh+F7	Sh+F8	Sh+F9	Sh+F10	Sh+F11	Sh+F12
Richiama BAX-59			Reset Calcolatrice		
Import file .SOA	Codici sintetici	O.S. Shell	Menù di Controllo	Usa "CROM Emulator"	Vedi PC-100 in grafica

F7 F8 F9 F10 F11 F12

Sh+F7	Sh+F8	Sh+F9	Sh+F10	Sh+F11	Sh+F12
Recall BAX-59			Reset Calculator		
Import file .SOA	Synthetic codes	O.S. Shell	Control Menu	Use "CROM Emulator"	Show PC-100 graphics

F7 F8 F9 F10 F11 F12

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