Erik Ehrling (Sweden)

A User's Comments on Two HP-42S Emulators

- Emu42 by Christoph Giesselink
- HP-42X by "Hrastprogrammer"

HPCC London
Club Meeting - 12th July 2003

HPCC

Contents…

First, some words about myself…

- **Various interests, both of a mathematical and non-mathematical nature…**
  - BSc/MSc in Engineering Physics (Royal Institute of Technology, Stockholm, Sweden)
  - MSc in Advanced Computing (King's College, London, UK)
  - BSc in Economics (Uppsala University, Sweden)
  - MA in Literature (Stockholm University, Sweden)

- **Acquired my first "real" calculator in 1989 - a HP-42S (replacing a TI-30 Galaxy) - today the collection of HP calculators and handhelds has grown to**
  - 6 HP-42S (2 with 32K – self-performed upgrade)
  - 1 HP-48SX, 1 HP-48G (Double Speed, 1280K – upgrade by Cynox)
  - 3 HP-48GX (2 Double Speed – upgrade by Cynox, 1 Unmodified)
  - 1 HP-100LX (Double Speed – upgrade by Times2Tech)

- **Mostly known in calculator circles for**
  - Having written Minehunt for the HP-42S :-)
  - Posting messages at hpmuseum.com full of support and entusiasm for the HP-42S (!)

- **Beta-tester of Emu42 since December 2002**

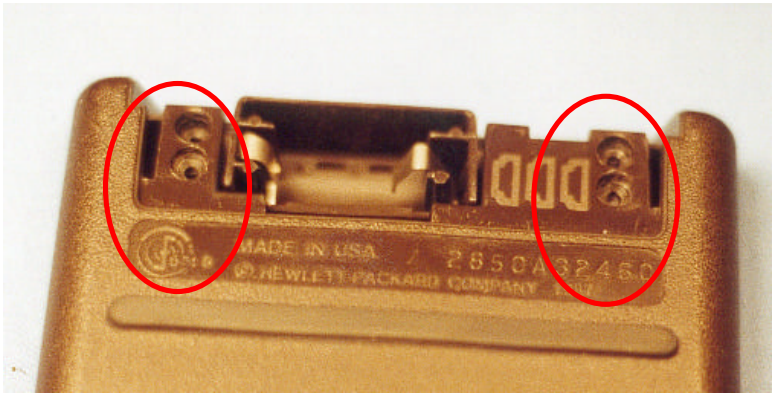
Contents…

Why is HP-42S emulation such an interesting idea?

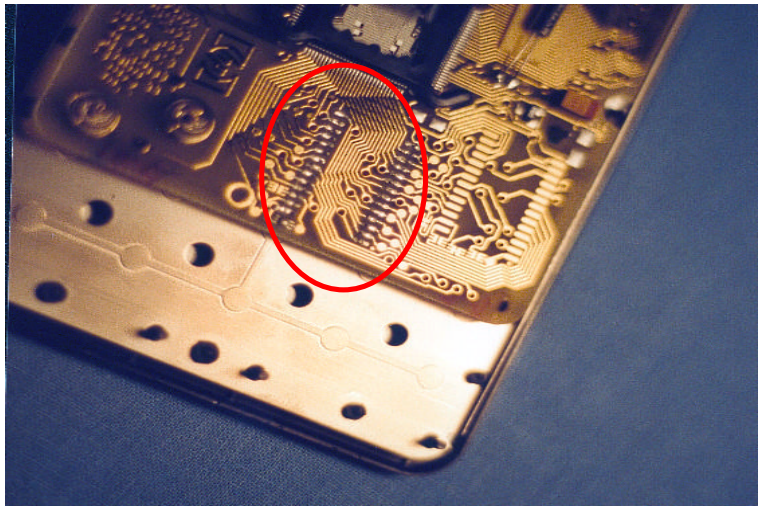
- The HP-42S is the last in a long line of RPN programmables
  - Program compatible with the HP-41C/CV
  - Contains most of the functionality of the HP-41 Math, Stat and Advantage packs (Matrices, Numerical Integration, Solver etc.)
  - Two-line LCD
  - Hardware support of up to 32K RAM (*see next slide*)
- The HP-42S has one serious drawback – the lack of Serial I/O…
  - *Deliberately crippled to not threaten the sales of the HP-48SX?*
- …but an emulator can provide LOAD/SAVE functionality!
  - No longer the need to key in long programs
  - Now it would be possible to build up a library of HP-42S specific programs in binary form!

Increasing the memory size to 32K

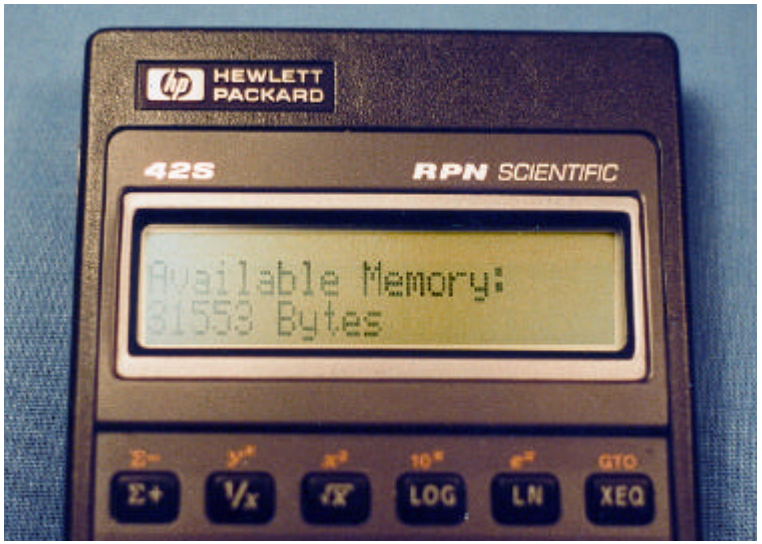
The Tony Duell / Paul Brogger approach from Sept 2001



1) Drill out the rivets holding the upper parts of the case together (and pull apart)



2) Solder a 62256 32K RAM (28-pin, surface-mount) in place of the old 8K RAM



3) Successful memory upgrade – 31553 bytes of available memory!

An excellent step-by-step description by Paul Brogger can be found at www.hpmuseum.com:

www.hpmuseum.org/cgi-sys/cgiwrap/hpmuseum/articles.cgi?read=199

Dumping the ROM

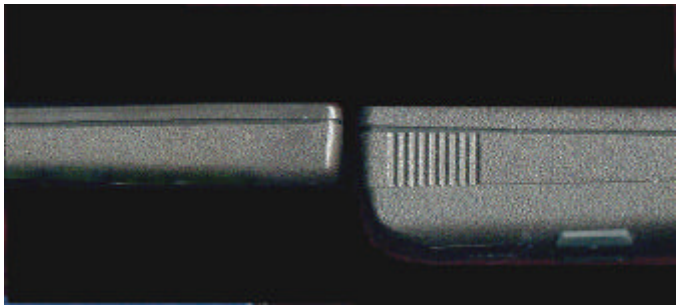
The J-F Garnier approach from Apr 2002

- As opposed to the ROMs of the HP-41 and the HP-48/49 the ROM of the HP-42S is still copyrighted
- However a ROM image is necessary for emulation
- Approach – use a HP-42S and a HP-48
  - On the HP-48 start the INPRT program
  - On the HP-42S enter the HEX-monitor and press COS for every address from 00000h to 1FFFFh (e.g. in 1000h blocks)
  - Transfer the strings to a PC and paste together

```
00000:236B9308DCE30005
00010:B087FB0020386FBF
00020:061371F120051557
00030:D280C322450B0621
00040:B8E042083250B061
```

Total ROM size = 64K

- Slow and tedious process – takes approximately 3-4 hours!



Optimal placement for HP-42S and HP-48 during transfer

The whole process is described in this article by J-F Garnier

www.hpmuseum.org/cgi-sys/cgiwrap/hpmuseum/articles.cgi?read=266

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  - Emu42
  - HP-42X
- Program encapsulation on the HP-42S

Two different kinds of emulators

Emu42
by Christoph Giesselink

- Freeware
- Windows based
- The ultimate Windows calculator replacement!
- Running at roughly 100 times the speed of the original (on a 1GHz PIII)
- Developed out of Emu48

HP-42X
by "Hrastprogrammer"

- Commercial - 60 Euro
- HP-48/49 based
- Runs on HP48SX/GX with 1-2 128K RAM Cards
- Running at roughly the same speed as the original
- Developed out of HP-41X (HP-41emulator for the HP48)

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  - HP-42X
  - Two kinds of emulators - two different purposes
- Program encapsulation on the HP-42S

Emu42 – Features

- Supports 32K RAM
- GUI fully customisable by KML scripts
- Supports saving and loading of calculator state
- Saving and loading of individual RPN programs implemented in unreleased test version
  - Similar to the functionality in V41 by Warren Furlow.
    Note: HP-42S RPN programs are binary compatible to HP-41 programs!
- Built-in disassembler and debugger
- Configurable to be running at either authentic or maximum speed

- *Currently no beeper or infrared printer support*

Emu42 – Emulating even more HP models

Emu42 v0.10beta1 – Official beta

- Supports the following Pioneer models:
  - HP17B (english + international)
  - HP17BII (english + international)
  - HP27S
  - HP42S (8K + 32K)

- Emu42 v0.98-3 – Unreleased test version
- Also supports:
  - HP19BII
  - HP28S

Emu42 – Emulating even more HP models

Image by Christoph Giesselink

Emu42 – Where to download

- Emu42 v0.10beta1 (compiled binary + sources)
  http://privat.swol.de/ChristophGiesselink/Lewis/Hp42demo.zip

- A ROM image CRC checker
  http://privat.swol.de/ChristophGiesselink/Lewis/Lewiscrc.zip

- **Universal image conversation programs (used dumped ROMs into binary format)**
  http://privat.swol.de/ChristophGiesselink/Filetool.zip

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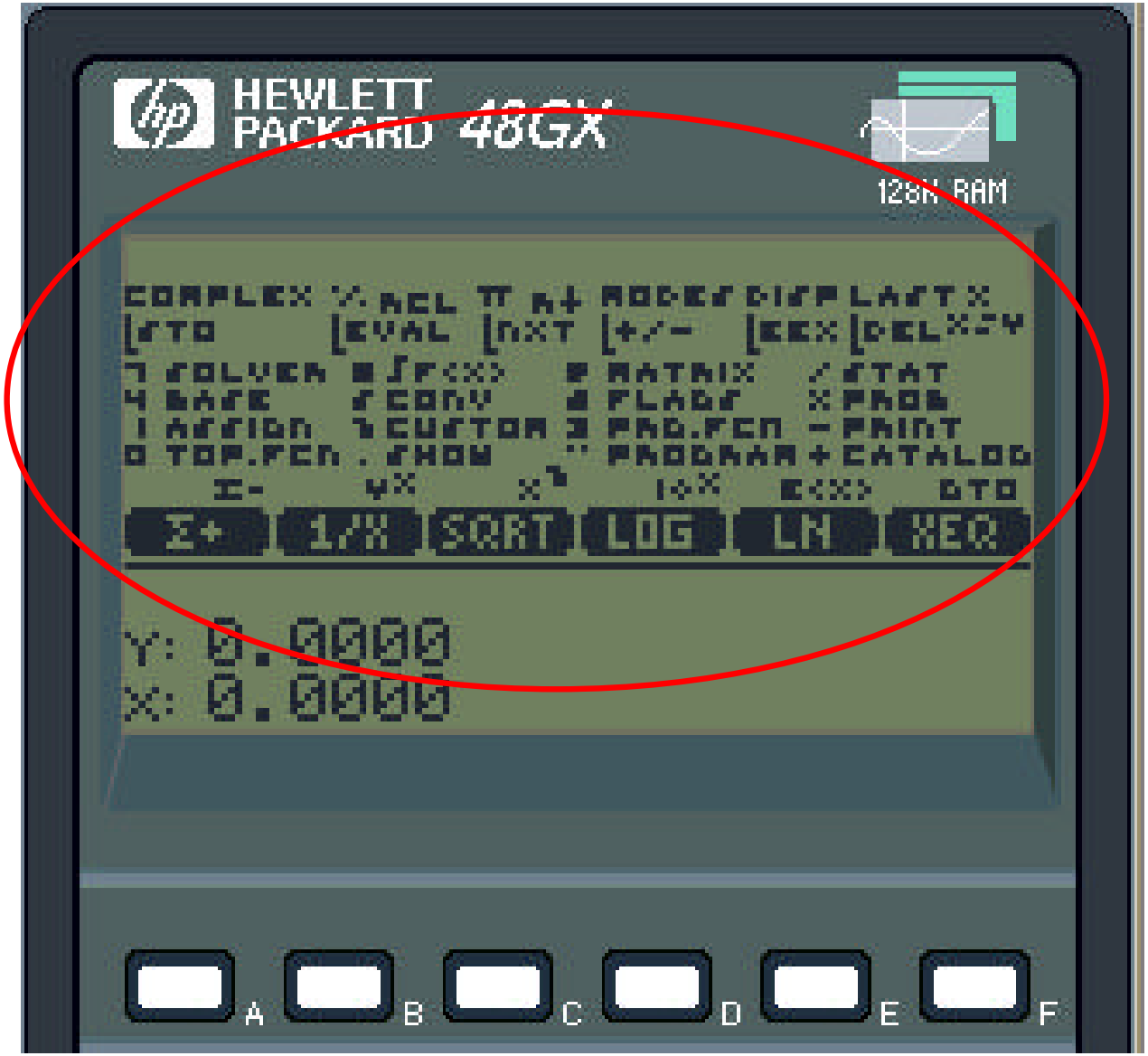
HP-42X – Features

- Supports 96K RAM
- Requires 2 x 128K (One uncovered + one covered port)
- Maps the HP-42S keyboard to the HP-48 keyboard
- Supports saving and loading of calculator state and individual RPN programs.
- Same format for RPN programs as Emu42 except for a 13-bytes header (HPHP48… etc)
- Supports the beeper
- Emulates the IR printer
  - Over the IR or the serial port…
  - …or can be redirected to the upper area of the LCD!

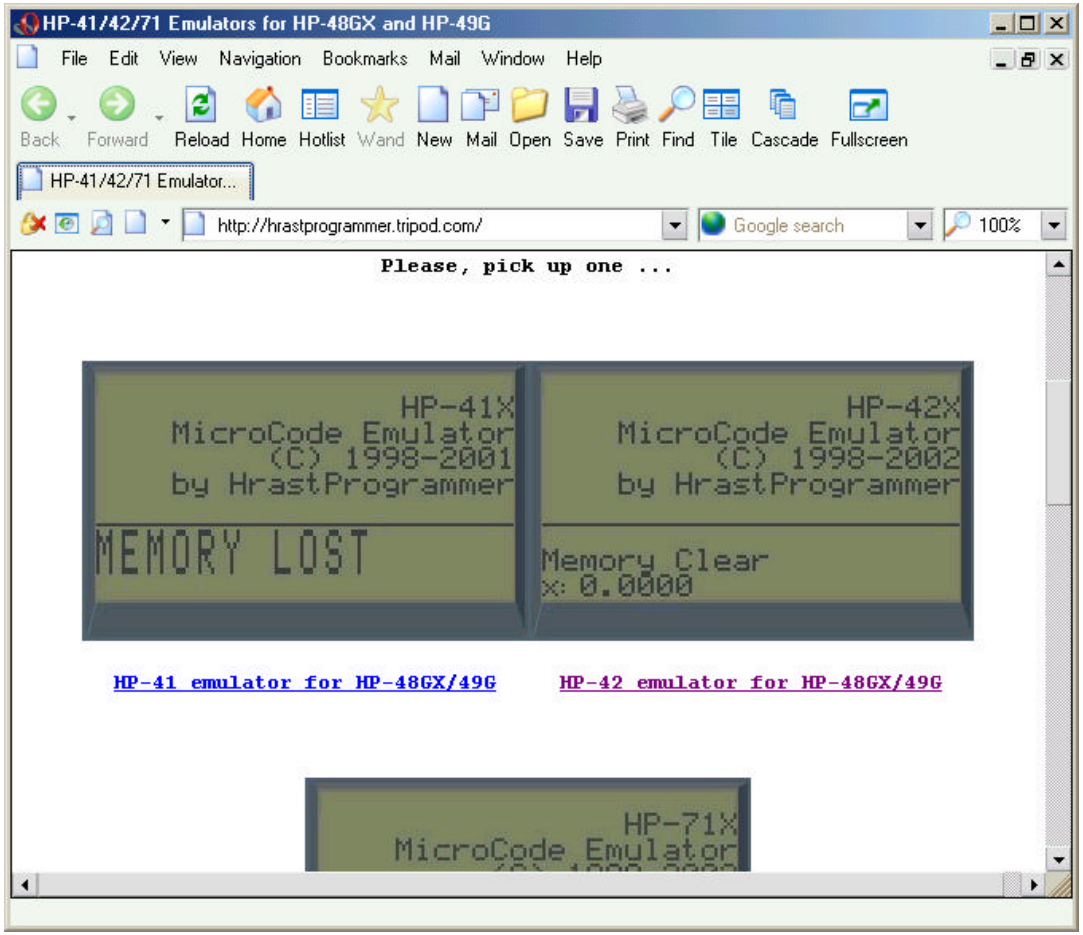
HP-42X – Using the printer emulation for a key map help



- Small RPN prorgram called: *HELP*
- Uses the printer emulation to print the most hard to remember key mappings to the upper area of the LCD

- Overall, fairly easy to get used to the keyboard layout of HP-42X (*not configurable*)

HP-42X – Where to purchase



- Home page
  http://hrastprogrammer.tripod.com

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Two kinds of emulators - two different purposes

- Emu42:
  - As already stated - Emu42 is the ultimate calculator to use on your PC!
    (If you want to load a program into HP-42X on the PC you first have to load it into Emu48 and then into HP-42X from the emulated HP-48)

- HP-42X:
  - HP-42X works both as a portable calculator and as a way to key in programs to run with Emu42.
  - You loose the form factor of the HP-42S but instead you gain the long longed for serial I/O capabilities
  - Very suited to run on an overclocked HP-48GX (e.g. Cynox speed upgrade)

- Both emulators are very stable and have a finished feel to them!

Contents…

Program encapsulation on the HP-42S

- Issue: HP-42S has a global memory model where all variables are global
- One possible resolution – place a small wrapper around each program:
  - Stack contents and REGS are saved to reserved variables at the start of the program
  - At the end of the program REGS and stack contents are restored and the reserved variables are deleted
  - As long as the program uses only numbered registers and numbered + single character labels it will act as if it has a local variable scope

```
01 LBL "QPI"
02 STO "X_QPI"
03 R↓
04 STO "Y_QPI"
05 R↓
06 STO "Z_QPI"
07 R↓
08 STO "T_QPI"
09 LASTX
10 STO "L_QPI"
11 RCL "REGS"
12 STO "R_QPI"
13 SIZE 25
```

Main program

```
103 RCL "R_QPI"
104 STO "REGS"
105 RCL "L_QPI"
106 STO ST L
107 RCL "T_QPI"
108 RCL "Z_QPI"
109 RCL "Y_QPI"
110 RCL "X_QPI"
111 CLV "R_QPI"
112 CLV "L_QPI"
113 CLV "T_QPI"
114 CLV "Z_QPI"
115 CLV "Y_QPI"
116 CLV "X_QPI"
117 END
```