HP Calculator Desktop Applications
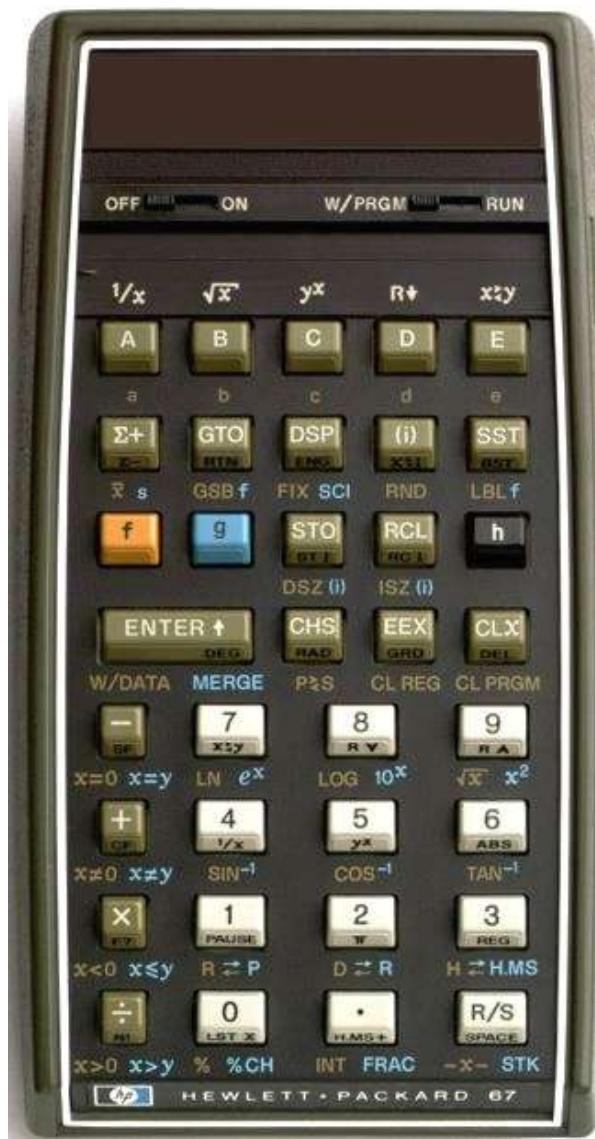
Copyright (c) PANAMATIK 2016
Bernhard Emese, Sept 2016, Rev 1.01

Contents

HP Emulator Manual Revisions

Rev 1.00 June 18th initial release
Rev 1.01 Sept 19th HP-19C, HP-01 added

HP calculator emulators

The use of a vintage HP calculator as a desktop application for doing daily calculations is a beautiful idea. The following emulations give you an as perfect as possible emulation of some of the most famous calculators HP ever made. All of them use the original HP microcode. Therefore every calculation is performed exactly identical as if using the real calculator. For your convenience you can select your own background image of any size and also use transparent images. The detailed description of the configuration file tells you how to achieve this.

Installation

All emulators are written in C#, running under Windows XP/7/8/10 using the .NET 3.5 runtime environment or in the case of the HP-01 the .NET 4.5 version.

There is no installation necessary to run the emulators. However because the executables are .NET 3.5 applications, at least the .NET 3.5 Framework must be installed. In Windows 7 and later .NET 4.5 is already part of the operating system. When using Windows XP you need to install the .NET framework. Go to the Microsoft website for more information.

To install the optional LED 7-segment font just double click on the file "LEDcharset_class.ttf" and you will see the font and the Install button. Also a printer font can be installed for the HP-19C emulator.

HP-67 Emulator

This emulation of the famous HP-67 calculator contains every function of the original calculator. Of course there is no card reader on a computers desktop. But you can save and load your programs to/from file.

The top model programmable HP pocket calculator with integrated card reader.
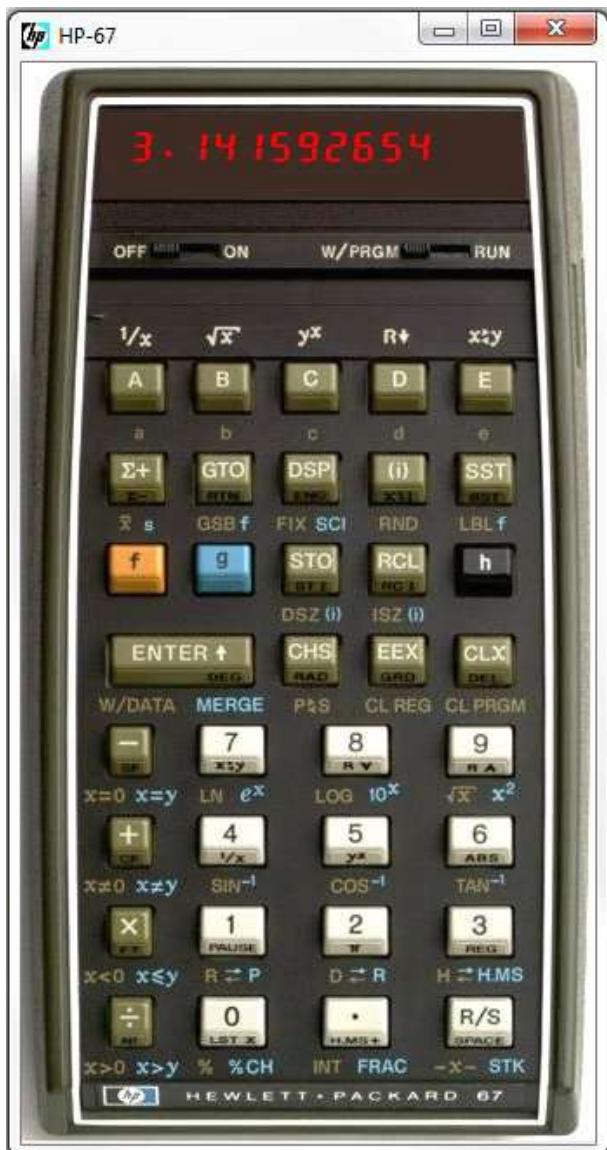
You can edit your program text files.

You can choose an image of your own.

You can use fast keyboard entry instead of mouse clicks.

Nothing else! No additional features, No 10000 program steps, No hundreds of registers. No high speed calculation. No extras.

Just the HP-67.

Keyboard assignment

For easy use with a PC keyboard all buttons have counterparts on the keyboard. The keys are not case sensitive. Therefore there is no need for the shift key with only a few exceptions. Most of the keys are the first letter of the button like S for STO and R for RCL. In case where the letters are already used, the second or third letter is used like O for GTO and T for SST. N is for CHS to enter Negative values.

```
'A', 'B', 'C', 'D', 'E',
'#', 'O', 'P', 'i', 'T',
'f', 'g', 'S', 'R', 'h',
'RETURN', 'N', 'X','BACKSPACE',
'-', '7', '8', '9',
'+', '4', '5', '6',
'*', '1', '2', '3',
'/', '0', '.', ' ',
```

For switching between RUN and PRGM mode use the `'M'` key. The ON/OFF switch does not have a key assignment. There is not much more to say. Just click to the buttons or use the keys and make your calculations.

Loading and Saving Programs/Registers

For Saving or loading a program expand the right side of the window and press „Save Program" or „Load Program". Alternatively click to the card reader area below the slider

switches. In RUN mode the dialog for loading a program is opened, in PRGM mode the

dialog for saving appears and you can save your program to disk or any other storage media.

PROGRAM section

You can enter programs in PRGM mode with the calculators buttons as usual and save them to hard disk or you can edit them with a text editor on the PC side, and then load them into your calculator.

An example of a small program is shown here:

HP67
PROGRAM

LBL 1
1
+
PAUSE
GTO 1

END

The Program is enclosed by the keywords PROGRAM and END. A maximum of 224 program steps are allowed. There will be an error message if the syntax is not correct or the number of steps exceeds 224.

DATA section

Your program file can contains an optional section, which is enclosed by DATA and END keywords. If that section is found the values will be read into the data registers of the HP-67.

DATA

1.00
-1.234e3
3.141592654
-50.7
1.0000e-45

END

In the above example five registers are loaded from file into R0-R4. The DATA section can contain up to 26 numbers, which were loaded into the 26 HP-67 registers. The original card reader could store 16 registers on each side of a magnetic card. Side one would store

registers 0-9 A-E and I, side two stored the values into the 10 swap registers. As the HP-67 has 26 registers in total, the second side of a magnetic card contained only the 10 swap registers 0-9. This order was always fixed.

When reading the DATA section it stores the values in the same order, beginning with R0-9 then A-E, I and then the swap registers 0-9. If you specify 26 consecutive lines with numbers all registers are loaded.

When writing your program to disk always the complete 26 registers will be saved in a DATA section, following the PROGRAM section, regardless of their contents. If you don't want all registers being overwritten when loading the file again, you have to edit the DATA section and remove the unused registers.

Unlike when reading a real magnetic card, you can read less than 16 registers, if you specify less numbers in your file.

MODE section

When writing the second side of a a magnetic card, the original HP-67 did also save the trigonometric mode, the actual display format and the four user flags to the card. Therefore the HP-67 emulator adds a MODE section to the file, when saving to disk, which contains this information. The section is just one line without an END statement and contains the keywords for the trigonometric mode, display format and status of the flags.

DEG RAD GRD   ; keywords for trigonometric mode
FIX SCI ENG   ; keywords for display format

Example:

MODE DEG FIX 2   1 1 0 0 ; Degree mode, Fixed display 2 decimals, flag 0 and 1 set

If you create a program file with an editor you can add an optional MODE section by using the above keywords.

Configuration File

To give you more flexibility you can provide an optional configuration file. The name of the configuration file depends on the emulator and has the extension .kml (keyboard mapping layout). For the HP-67 it is "hp67.kml". In the configuration file you can specify your own background image. The file tells the application, where the buttons and the display are located in the image. If no configuration file is found, the build in image of the application is used. Furthermore, the configuration file allows you to choose the foreground and background color of the display area, thus you can achieve an exact match with the color in your image. And last not least you can choose a font of your own.

Nearly every image of an HP calculator with or without its border or with or without front label can be used.

Change your calculators Image

If you want to use your own image of the calculator, you just have to provide an image file. The name of the image file must be specified in the configuration file (since V1.04), and should be located in the same folder of the emulator executable. It is not necessarily a Windows Bitmap file, it can also be a .jpg image or even a .png transparent image. If you specify a transparent image, the application starts in borderless window mode and dragging can be done by clicking the image somewhere outside the keyboard area. In borderless mode, switching the ON/OFF slider to the OFF position exits the application.

The size of the Emulator window will become the size of your image and the location of the display and the font size will be adjusted according to the configuration. With the release 1.04 there are provided six HP-67 image files of three different sizes, which allows you to select your preferred image and windows size, depending on the resolution of your screen, this could make the readability better for you.
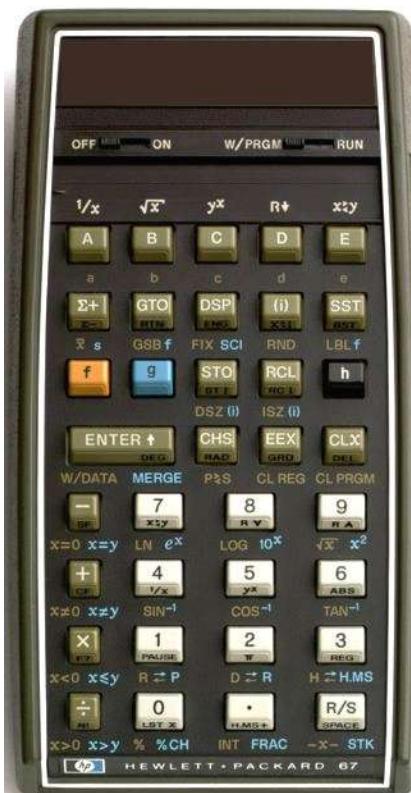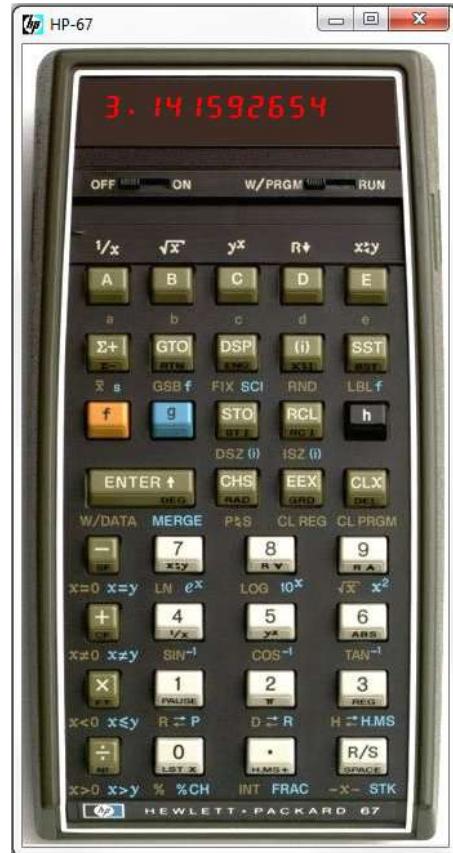
Your image   Your HP67 emulator

If you provide an image of your own you need to tell the program where the buttons are located by specifying its coordinates in the configuration file as described later. If you do not specify a configuration file, the application always starts with its default image and size.

Choose a display font

7-Segment Font

To get a more realistic appearance the emulators use a 7-segment font for showing the numbers or program steps in the LED display. This font is part of the .zip file, which you downloaded. You have to install this font first, to get the original display. The file name is "LEDcharset_class.TTF" and the font name is "HP Classic LED Set". The decimal point of this font is higher than in normal fonts and its width is the full digit.

Just double click to the font file and the window for installing the font on your computer will appear. If the 7-segment Font is not installed on your PC, there will be used "Lucida Console" instead.

This font was created especially for the LED HP-calculators by Luiz C. Vieira. Many thanks and credits to him.

Select the keyboard area

Because the calculator buttons can be located anywhere in your image, you can specify the position of the upper left button and the lower right button with the BUTTONS keyword. The relative position of each individual button is calculated from these two positions. Always use the pixel position of the center of the outlining buttons.

Select the display area

The LED display area must be specifier by its pixel coordinates, upper left and lower right, thus also define the width of the display. However the lower coordinate is not really used, it will be calculated automatically by the display font size.

Example

Here is an example of a configuration file:

```
; HP-67 Emulator keyboard mapping layout file for image hp67_330.jpg


; specify transparent Image file
IMAGE hp67_330.png  TRANSPARENT


; Pixel coordinates for center of upper left and lower right button
BUTTONS 28,114 192,418,


; Display foreground and background color RGB
COLOR 255,0,0   20,0,0


; Pixel coordinates for upper left and lower right display
DISPLAY 5,15 215,40


; Font name and point size
FONT "HP Classic LED Set" 13
```

The IMAGE keyword must be followed a file name. It can be any common image format like .bmp, .jpg or .png. The .png file format offers the possibility to define a transparent

color. If you want to create your own transparent image, the transparency color must be chosen as Lime Green RGB(50,205,50).

In the BUTTONS section you specify the pixel location of the center of the upper left and the lower right button. All other buttons are calculated from these values.

The COLOR values are typical RGB (red green blue) values ranging from 0=dark to 255=maximum brightness. The first RGB value is the foreground color, the second three values build the background color, which is normally near black or very dark red. You need to check the RGB background color of your image with a paint program or just try values until they fit.

The DISPLAY value is the upper left and lower right corner of the display. However the height of the display will be finally determined only by the font size, the lower coordinate of the lower right coordinate is not used.

The FONT name must be enclosed in apostrophes. The font size follows you to enter a floating point number, you can try values like FONT "Lucida Console" 15.75. Always use the dot, not the comma, as decimal separator.

In the HP-67 release version 1.04 there are six image files and six corresponding .kml files. If you want to choose one of these images, rename the corresponding configuration file to "hp67.kml". Then start your program from within the same folder.

HP-65 Emulator

The very first programmable pocket calculator with a magnetic card reader!
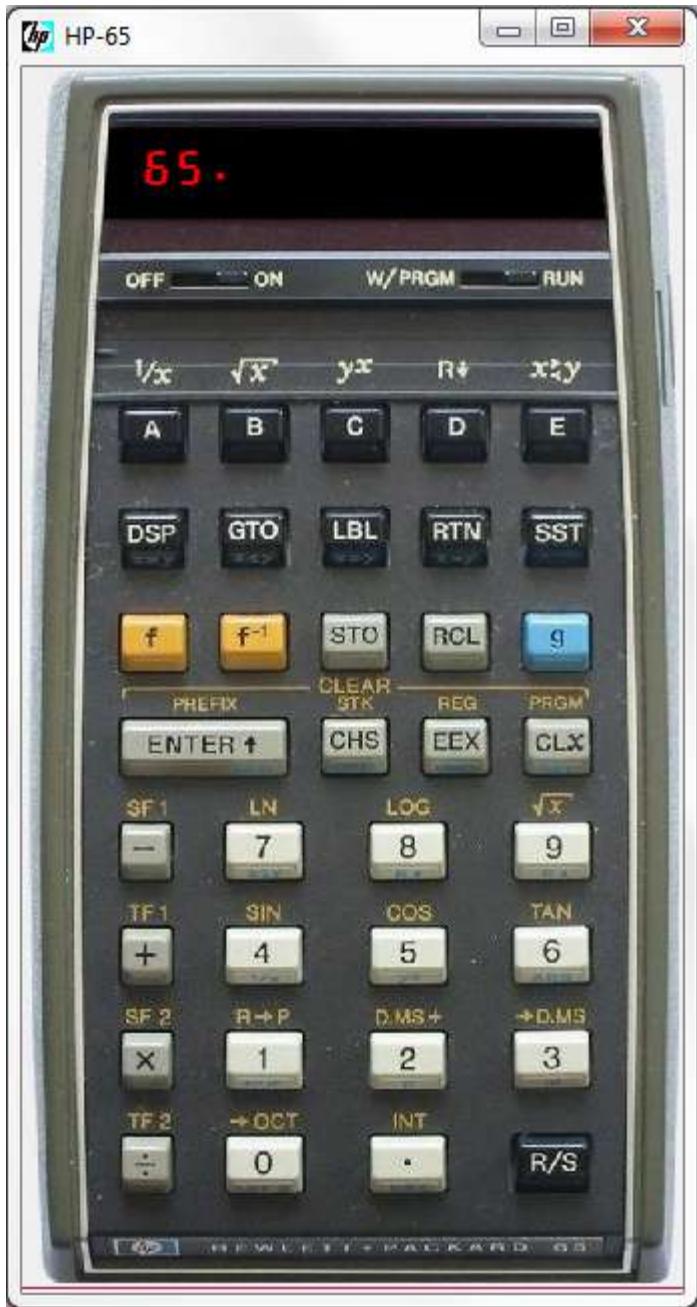
This classic pocket calculator was the first calculator, ever, which didn't lose its memory, because it had the possibility to save its program to magnetic cards.

It has 100 Program steps and 9 Data register.

Emulating the original Microcode.

Choose your own background image.

You can save and load files to/from disk.

HP-25 Emulator

Only one year before the HP-67 the HP-25 was the famous affordable programmable calculator for everybody. It had no magnetic card reader and the early models even didn't keep the program when switched off. Now the emulation of this calculator give you the possibility to store and load as many programs as you want, as if it had a card reader.

The famous programmable pocket calculator for everybody!
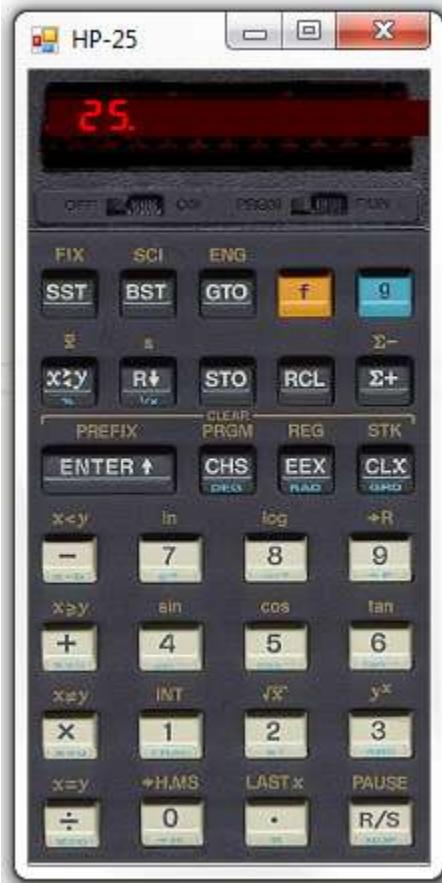
The key assignments for the HP-25 are as follows:

```
'T', 'B', 'O', 'f', 'g',
'Y', 'D', 'S', 'R', '#',
'RETURN', 'N', 'X','BACKSPACE',
'-', '7', '8', '9',
'+', '4', '5', '6',
'*', '1', '2', '3',
'/', '0', '.', ' ',
```

Program load and store are the same as described before in a previous chapter. The number of program steps are limited to 49 and up to 8 registers can be loaded.

HP-21/HP-22/HP-27 Emulator

The non programmable pocket calculators!

These are the non programmable woodstock calculators. They behave like the originals. Of course they cannot load or save a program, there the "Load program" and "Save program" buttons are missing. They have all functions you need for manual calculations. The HP-21 is a pure basic scientific RPN calculator. The HP-22 is the business model and the HP-27 combines scientific and financial functions. If you like these RPN calculators, this is your choice.

Of course you can choose your own image and determine the size of the calculators and optionally specifying a configuration file. The name of the image file is "woodstock.bmp", the configuration file is "woodstock.kml"

HP-29C Emulator

The high end programmable pocket calculator!
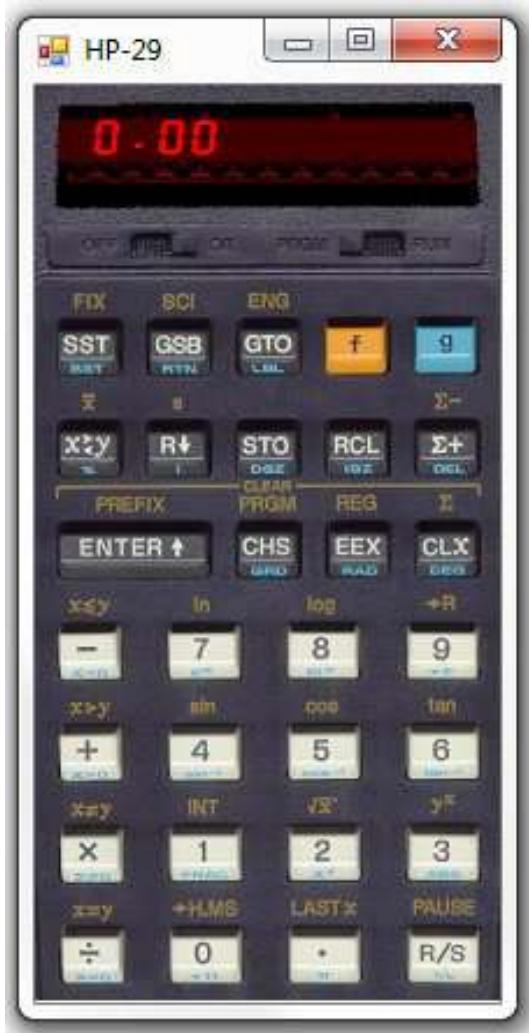
This is the top scientific calculator of the woodstock models? It is programmable and has double the program space and registers of the HP-25.

You can save and load your programs and data registers.

You can edit your programs with a text editor.

You can configure the image and the calculator size.

HP-19C Emulator

The high end printing programmable pocket calculator!

This is the only available HP-19C emulator, which runs the original microcode, including the exact emulation of printer output. Its printing capabilities include printing the X-register, space, data registers, stack, statistics and your program like the original calculator.

You can save and load programs and data registers.

You can edit your programs with a text editor.

You can configure the image and size of the application.

And there is a keyboard mapping.

```
'Y', 'D', 'B', 'O', 'T'  , 'f',
'RETURN', 'N', 'X','BKSP', 'g',
'-', '7', '8', '9', 'E',
'+', '4', '5', '6', 'S',
'*', '1', '2', '3', 'R',
'/', '0', '.', ' ', 'P',
```

Two additional keys move the slider positions `'M'` PRGM/RUN `'#'` MAN/TRACE/NORM

Configuring the HP-19C emulator

Configuring the HP-19C emulator has more options that the other calculators because of the printer area. But generally you can choose an image of your own and define its active keyboard and display area and display font like in the non printing models, see chapter *Configuration File*.

The configuration file is named HP19C.kml. There is a ready to use configuration file and an image file available, which shows a bigger 407x790 pixel HP-19C image. If you don't use a configuration file in your start folder, then the standard HP-19C with a small 207x395 calculator will appear.

Four new keywords define the printer font, the printer area and the position of the two sliders.

SLIDER

Because the HP-19C sliders have three positions, whose states are not clearly indicated by the actual display contents, it was necessary to show their knob position on the screen. You have to define the upper left and lower right position of the left slider area, and the horizontal pixel position of the right slider. It will be assumed, that it has the same size and vertical position than the left slider.

; Pixel coordinates for slider left (upper left, lower right), slider right (left)
SLIDER 96,329, 144, 341, 268

It is assumed, that the vertical position of the right slider is the same as for the left. The two slider areas in your image will be painted over by a black rectangle at program start and a dark gray smaller rectangle, which shows the actual knob position.

PRINTAREA

The white paper area for printing may be located anywhere in your image, but normally it is placed above the display on the left side. It will be defined by the upper left and lower right coordinates. You have to choose an appropriate printer font size, that matches the horizontal paper size, otherwise some characters of the print line are outside of the area.

; Pixel coordinates for upper left and lower right printer area
PRINTAREA 50,15, 270,190

PRINTFONT

This keyword allows you to choose a suitable printer font. Normally it should be a non proportional font, but also proportional will work, however they don't align consecutively lines properly. There is a special matrix printer font, which is also created by Louis Vieira and is part of the emulator package, that imitates the matrix font of the HP82240B printer. Its file name is "char82240_R.TTF" and font name is "HP 82240 ROMAN8 CharSet". But unfortunately it doesn't fit perfectly the needs, because it doesn't contain the up and down

arrows and the x mean symbol. But it is a good approximation.

PRINTFONT "HP 82240 ROMAN8 CharSet" 12

If you don't select a printer font, "Courier New" will be selected, but its size can only be estimated and must correspond with the printer area of your image. It is always recommended to select a printer font explicitly.

PRINTLINES

The maximum number of print lines, which are visible, depends on the size of the printer area and the font size. You can choose any number from 1 to lets say 15, if there is enough space for it. If more lines are printed during your calculations, the oldest lines are lost at the top of the printer area.

The image above shows a configuration of the HP-19C using a transparent image, HP82240 printer font and 14 print lines

In transparent mode, clicking to any point outside the keyboard area will drag the window around the screen. Because in transparent mode, the "Load Program" and "Save Program" buttons are not available, you can click to the "Continuous Memory" area below the buttons to open the Load or Save dialog, dependent on whether you have selected RUN mode or PRGM mode.

HP-01 Emulator

The famous wristwatch calculator!

You can show the actual time and date

You can start the stopwatch and take lap times.

You can calculate with four basic arithmetic operators.

You can set an alarm time.

This HP-01 emulator is an accurate copy of the famous HP-01 wristwatch calculator from 1977 (the free stainless steel version however runs the prototype microcode, which differs from the original and does not offer the percent function). When started it shows the actual PC time and date.

Start

At program start the actual PC time will be read and displayed. Also the date will be taken from the PC real time clock. As the program doesn't use preferences it will start up always in 12 hour mode and MMDDYY mode. The modes can be switched by the   button sequence .

Info

The window can be maximized by dragging the right border. Then some information will become visible.

Display

The display uses the font „Lucida Console" 13pt. It should be available on any normal windows PC.

With mouse clock to the display, you can switch between permanent and time limited display. When time limited display is chosen, the watch does show the time only for a few seconds like the original to save battery power. However there won't be saved any power with the emulator version..

Alarm

The alarm will be triggered when the actual time matches the alarm time. Or when the countdown has reached zero. In this case the sound file „HP01Alarm.wav" will be played. It can be replaced by your own file. The actual file is identical with Windows „notify.wav".

The HP-01 emulator is not configurable nor programmable. There is a separate user manual available for this emulator. Because of implementing an accurate stopwatch, the emulation uses the runtime environment .NET 4.5. Earlier .NET versions don't offer an accurate timer for this purpose. If not already installed you have to make this .NET version available on your computer.

Bernhard Emese
PANAMATIK June-September 2016

Appendix A

HP-67 Program Steps Mnemonics

The Mnemonics, which are used for reading and writing a program contain only ASCII characters. There is no need for entering special characters like Σ or x² etc.

Here is the list of all possible mnemonics for HP-67 programs.

```
"R/S", "RTN", "1/x", "x^2", "SQRT", "E+", "E-", "Y^X", "LN", "e^x", "LOG","10^x",

"SIN", "COS", "TAN", "SIN-1", "COS-1", "TAN-1",

"0", "1", "2", "3", "4", "5", "6", "7", "8", "9", ".", "+", "-", "*", "/",

"ENTER", "CHS",  "EEX", "CLX",

"N!", "xmean", "s", "%", "%CH", "ABS", "INT",  "FRAC", "RND",

"X<>Y", "X<>I", "RDOWN", "RUP", "ENG", "FIX", "SCI",

"R->P", "P->R", "D->R", "R->D", "H->H.MS", "H.MS->H", "H.MS+",

"SPACE", "PAUSE", "-x-", "STK", "LastX", "W/DATA", "MERGE",

"PI", "DEG", "RAD", "GRD", "P<>S", "CLREG", "REG",

"x!=y?", "x=y?", "x>y?", "x!=0?", "x=0?", "x>0?",  "x<0?", "x<=y?",

"ISZ", "ISZ(i)", "DSZ", "DSZ(i)",

"DSP n", "DSP(i)",

"CF n", "SF n" , "F? n", "Fn?"

„RCL n", "RCL A","RCL B","RCL C","RCL D","RCL E","RCL I","RCL(i)",

"STO n", "STO A","STO B","STO C","STO D","STO E","STO I","STO(i)",
"STO+n", "STO+(i)", "STO-n", "STO-(i)","STO*n", "STO*(i)","STO/n", "STO/(i)",

"GSB n","GSB A","GSB B","GSB C","GSB D","GSB E","GSB(i)",
"GSB a","GSB b","GSB c","GSB d","GSB e"

"GTO n","GTO A","GTO B","GTO C","GTO D","GTO E","GTO(i)",
"GTO a","GTO b","GTO c","GTO d","GTO e",

"LBL n", "LBL A","LBL B","LBL C","LBL D","LBL E","LBL(i)",
"LBL a","LBL b","LBL c","LBL d","LBL e",
```

HP-25 Program Steps Mnemonics

Here is the list of all possible mnemonics for HP-25 programs.

```
"GTO nn", "FIX n", "SCI n", "ENG n",

"STO n", "RCL n", "STO+n", "STO-n", "STO*n", "STO/n",

"->H.MS", "INT", "SQRT", "Y^X", "SIN", "COS", "TAN", "LN", "LOG", "->R",

"->H", "FRAC", "x^2", "ABS", "SIN-1", "COS-1", "TAN-1", "e^x", "10^x", "->P",

"0", "1", "2", "3", "4", "5", "6", "7", "8", "9",

"x<y?", "x>=y?", "x!=y?", "x=y?", "x<0?", "x>=0?", "x!=0?", "x=0?",

"LASTX", "PAUSE", "", "CL", "CLREG", "CLSTK", "xmean", "s", "E-",

"PI", "NOP", "", "DEG", "RAD", "GRD", "%", "1/x",

"-", "+", "*", "/", ".", "R/S","ENTER","CHS","EEX","CLX", "x<>y","ROLL","E+",
```

HP-19C/29C Program Steps Mnemonics

```
"R/S", "RTN", "ENTER",  "CHS",  "EEX", "CLX", "CLREG", "CLE",

"0", "1", "2", "3", "4", "5", "6", "7", "8", "9", ".", "-", "+", "*", "/",

"INT", "FRAC", "ABS", "SQRT","x^2", "Y^X", "%", "1/x", "PI", "LastX",

"SIN", "COS", "TAN", SIN-1", "COS-1", "TAN-1",

"e^x", "LN", "10^x", "LOG",

"x<=y?", "x>y?", "x!=y?", "x=y?","x>0?", "x!=0?", "x=0?","x<0?",

"->H", "->H.MS", "->P", "->R",

"FIX", "SCI", "ENG",  "DEG", "RAD", "GRD",

"X<>Y", "ROLL", "E+", "E-", "xmean", "s", "PAUSE",

"DSZ", "ISZ",

"GSB n", "GTO n" "LBL n" "GSB(i)", "GTO(i)", "LBL(i)",

"RCL n", "STO n", "STO-n", "STO+n", "STO*n", "STO/n", "STO-.n", "STO+.n", "STO*.n", "STO/.n"

"RCL(i)", "STO(i)", "STO-(i)", "STO+(i)", "STO*(i)", "STO/(i)",

 "PRX",  "PRSPC",  "PRSTK",  "PRE",  "PRREG", (HP-19C only)
```