Power48

HP 48SX/48GX/49G Series
Calculator Emulator

Manual version: 1.5
November 8, 2004

Note: This version of the manual applies to version 1.5 of Power48.

Introduction

Power48 is a PalmOS based emulator for the Hewlett-Packard 48SX, 48GX and 49G series of calculators. It provides a fairly complete emulation of the Saturn CPU upon which these calculators are based and is able to run a majority of the programs available for them. It emulates one instance each of the 48SX, 48GX and 49G, and maintains complete and separate state information for each allowing the user to quickly switch between either one.
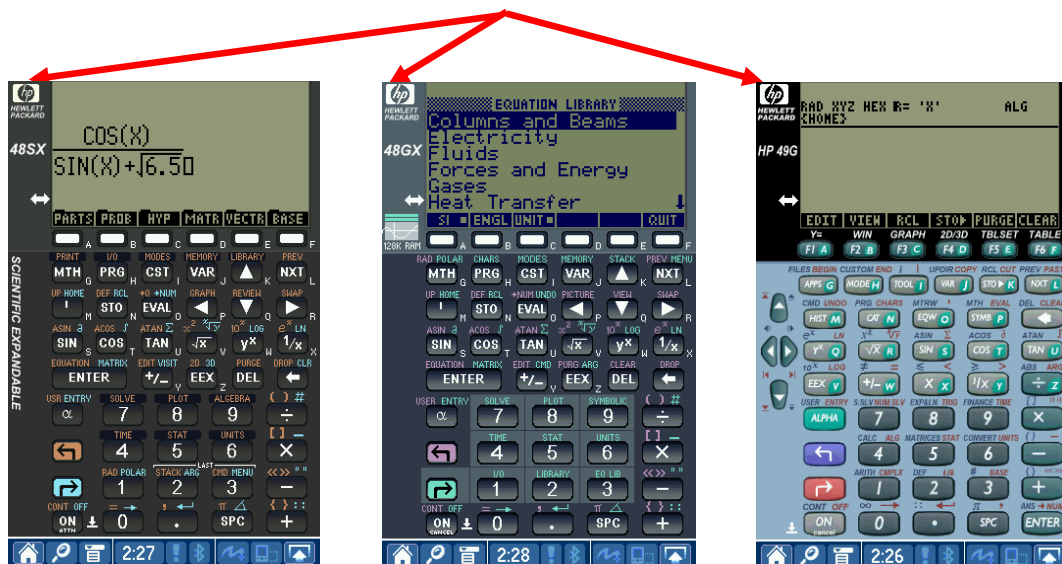
Power48 is based primarily on Emu48 originally written by Sebastien Carlier and now maintained and updated by Christoph Gießelink. It is important to note however that Power48 is not 100% equivalent to Emu48, as state and port files generated by Emu48 are not compatible with Power48 and vice-versa. Additionally, the core emulation code has been almost completely rewritten and optimized for the Palm platform in an attempt to squeeze in every ounce of performance possible.

Power48 requires the presence of a ROM image for each target (48SX, 48GX, and 49G) that the user wishes to emulate. These ROM images are the property of and copyrighted by Hewlett-Packard and are *not* distributed with this emulator. Please see the installation for directions on obtaining ROM images and how to install them.

Features

❖ Robust Saturn CPU emulation
❖ Supports 48SX, 48GX, and 49G ROM images
❖ ROM/RAM images can be loaded internally or from VFS expansion
❖ Ability to load/save objects to/from stack level 1
❖ Supports MetaKernel shell replacement
❖ Support for merge-able 128K expansion card in port 1
❖ Support for 320x320 and 320x480 displays
❖ Supports screen zooming in 320x320 mode
❖ Virtual LCD display support including contrast adjustment and alternate colors
❖ Virtual keyboard support
❖ Full state and memory saving for quick resume
❖ Support for mapping PalmOS internal real time clock to HP48 clock
❖ Beep support through Makebeep patch
❖ ARM native emulation core faster than real calculator!
❖ Small memory footprint on OS5 devices with large heap space
❖ Support for background images on calculator display
❖ Support for pixel color cycling effect

Easily switch between
emulation targets by
pressing the HP logo

Table of Contents:

System Requirements

Power48 has the following minimum hardware requirements for correct operation:

- ❖ PalmOS 5 based device
- ❖ High resolution screen of at least 320x320 resolution. (320x480 and 480x320 (Sony UX-40/50) also supported)
- ❖ 16-bit display color depth
- ❖ ARM CPU
- ❖ 16MB internal memory

Memory Usage

Power48 is an emulator that requires the presence of ROM and RAM images to function correctly. These images are loaded from internal memory or from VFS storage at startup, and then saved back out to to either medium at shutdown. The following table lists the sizes of all stored elements:

Image storage requirements per target:

HP48SX		HP48GX		HP49G	
ROM image:	256 KB	ROM image:	512 KB	ROM image:	1024 KB
RAM image:	32 KB	RAM image:	128 KB	IRAM image:	256 KB
PORT1 image:	128 KB (optional)	PORT1 image:	128 KB (optional)	ERAM image:	256 KB

Internal program store requirements per target:

- ▪ ~592KB for Power48 executable
- ▪ 0.6 KB for HP48SX state file
- ▪ 0.6 KB for HP48GX state file
- ▪ 0.6 KB for HP49G state file

Runtime memory requirements per target:

HP48SX		*HP48GX*		*HP49G*	
ROM image:	512 KB	ROM image:	1024 KB	ROM image:	2048 KB
RAM image:	64 KB	RAM image:	256 KB	IRAM image:	512 KB
PORT1 image:	256 KB	PORT1 image:	256 KB	ERAM image:	512 KB
	(optional)		(optional)		
Total:	832 KB	Total:	1536 KB	Total:	3072 KB

Note that the runtime requirements only apply when running in that particular mode. Also, the PORT1 usage is optional depending on whether or not a 128K expansion card is desired for PORT1. The user is not required to have ROM/RAM files for all of the targets – the user can limit the operation of the emulator to specific target(s) and save the storage space used by the other target(s).

Note regarding runtime memory allocation:

In most cases Power48 allocates the large chunks of memory it needs to hold the ROM/RAM images from the dynamic heap, which is an area of memory set aside for the temporary use by running programs and is separate from the main program storage area. There are some cases however where the dynamic heap is not large enough for this purpose (Tungsten T, Tungsten T2 for instance). In these cases Power48 will attempt to allocate the memory directly from the program storage area. This is the same area whose current Free Space is shown by the Palm launcher. The user may run into problems where there is no enough contiguous free memory in the program storage area to run Power48 successfully. If this occurs, the user can try to delete some existing programs from the PDA, or perform a soft-reset of the device by pushing the reset switch, which will cause the program storage area to be compacted and create the largest possible contiguous area of free space.

Installation

After downloading and uncompressing the .zip file containing the Power48 release, the user should be presented with the following files:

```
Power48.prc                 - Main executable
Power48 Manual v1.5.pdf     - This document!
P48rc.exe                   - Win32 utility for converting ROM images to Power48
                              format
P48obj.exe                  - Win32 utility for converting object files to
                              Power48 format
GPL.txt                     - Copy of the GNU General Public License
```

The process for installing Power48 is as follows:

Step 1: Hotsync the file Power48.prc

The file Power48.prc is the main executable for Power48 and should be hotsynced to the device via the normal program installation method. It can be stored in main memory or run from external storage via any launcher program that supports execution from external devices. Power48 requires ROM images to run properly, so it will start up in "Dry Run Mode" until you install at least one.

When Power48 is hotsynced to the device it will register the following file extensions and default directories with the hotsync file installation tool so files of this type they can be stored directly to an expansion card without using an external card reader:

```
.p48rom (ROM images)   ->  /PALM/PROGRAMS/Power48/
.p48ram (RAM images)   ->  /PALM/PROGRAMS/Power48/
.p48obj (Object files) ->  /PALM/PROGRAMS/Power48/Objects/
```

Step 2: Obtain ROM images for each target the user wishes to emulate

Since Power48 is not packaged with any ROM images, it is up to the user to obtain them. They can be obtained through several methods, but the user should keep in mind that these images are the copyrighted property of Hewlett-Packard. There is no licensing agreement in place with Hewlett-Packard for users of Power48, so the user is explicitly not granted a usage license for any of these ROMs by the simple download and installation of Power48, nor by donating to its continued development. The only legal way in which a user has a license to use one of Hewlett-Packard's calculator ROMs in Power48 is if they already own the physical calculator being emulated, or they have a prior licensing agreement with Hewlett-Packard in place. The developer of Power48 and its parent company, mobilevoodoo.com, deny any liability in copyright infringement or other wrongdoing should the user choose to ignore Hewlett-Packard's copyright.

Having said all that, Hewlett-Packard has been gracious in allowing access to their calculator ROMs for non-profit uses, for which the HP calculator emulation community owes them gratitude. As Power48 is a non-profit emulation vehicle supported entirely by donations, it should fall under these guidelines.

The calculator ROM images can be obtained in several ways, the most labor intensive being to actually dump the ROM from an existing calculator and convert it for use with Power48. The website http://www.hpcalc.org/ has many programs in its archives for dumping ROM images from the various HP calculator types.

Fortunately, since HP is allowing the ROM images to be downloaded from the web, it's far easier just to go out and get them. The website http://www.hpcalc.org/ has the latest revision ROM images for the HP 48SX, 48GX, and 49G series of calculators. At the time of this writing the following links were valid:

48SX: http://www.hpcalc.org/hp48/pc/emulators/sxrom-j.zip

48GX: http://www.hpcalc.org/hp48/pc/emulators/gxrom-r.zip

49G: http://www.hpcalc.org/hp49/pc/rom/beta1196.zip
(This particular archive contains several files. The actual rom image is contained in the file rom.49g.)

Step 3: Convert ROM images to Power48 format

Once the ROM images are obtained they must be converted for use by Power48. Supplied with Power48 is a windows-based command line utility for converting the ROM images called "p48rc.exe". This utility will convert raw ROM images such as those obtained from www.hpcalc.org or from dumping a physical device ROM into a format suitable for Power48.

Power48 expects to find its ROM images in either of two places: stored internally as .pdb file, or stored externally on an expansion card such as a memory stick or SD card. The p48rc.exe utility will convert raw ROM images for use in either place. To use the converter, copy the executable file p48rc.exe to the directory where the raw ROM images reside, then bring up a command prompt and cd to that directory. Run p48rc without any arguments to bring up the p48rc help screen:

```
C:\romimages>p48rc

Power48 ROM Converter ver. 1.0
------------------------------

Usage:
        p48rc ROM_name destination
```

```
where ROM_name    = the name of the ROM file to convert
      destination = CARD or INTERNAL. CARD specifies that the file be
                    converted to format suitable for storing on a VFS
                    compatible storage medium such as SD card or memory
                    stick. INTERNAL specifies that the file be converted
                    to the PalmOS .pdb format for storing internally
```

The following shows the output for converting a 48GX rom file named "gxrom" downloaded from hpcalc.org into an internal Power48 ROM:

```
C:\romimages>p48rc gxrom INTERNAL

Converting file gxrom to .pdb format...
Opening file gxrom for conversion...
ROM file size: 524288 bytes
ROM series: 48
Compression Necessary? NO
Nybble swap Necessary? NO
ROM Version: HP48-R
ROM checksum: 225065f5
Dumping .pdb format Power48 ROM file...
...Finished!
```

When finished the converter will have produced the file "HP48GXROM.pdb", which can be hotsynced directly to internal storage. The next example shows the same file being converted for use with an expansion card:

```
C:\romimages>p48rc gxrom CARD

Converting file gxrom to VFS compatible format...
Note: Power48 must be installed and run once
      to register the default VFS location
      for .p48rom files, which will then enable a
      user to hotsync .p48rom files directly to
      the expansion card.
Opening file gxrom for conversion...
ROM file size: 524288 bytes
ROM series: 48
Compression Necessary? NO
Nybble swap Necessary? NO
ROM Version: HP48-R
ROM checksum: 225065f5
Dumping VFS compatible Power48 ROM file...
...Finished!
```

When finished the converter will have produced the file "HP48GX.p48rom", which can be hotsynced directly to external storage and will placed in the directory /PALM/Programs/Power48/. Note that the hostync install tool does not automatically

know about the .p48rom extension so the user can't just double-click the file to install it. The user will have to bring up the install tool manually and browse to the location of the ROM file and select it before it will be installed by hotsync.

The above process is repeated for each ROM file…

Power48 will first try to find all the ROM images for each target in internal storage, and then look at external storage for those images it couldn't find internally. The internal image will be used in cases where there is both an internal and an external image for the same target. Having images in both places is generally not recommended and could result in the emulator using an unintended ROM image. Power48 will store the RAM images for each target where it finds the ROM image.
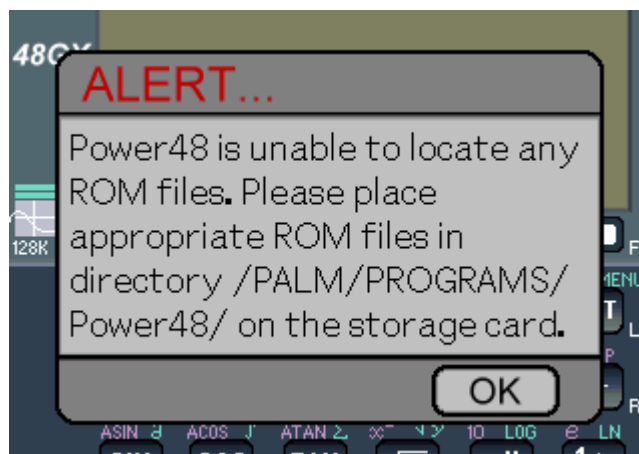
Starting Up…

At this point the emulator is now installed correctly and is ready to run for the first time.
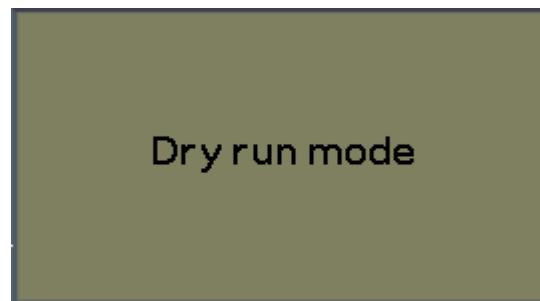
Tap on the Power48 icon to start the emulator.

If for some reason the ROM images weren't installed, or they were installed in the wrong place, the user will be presented with the following display:
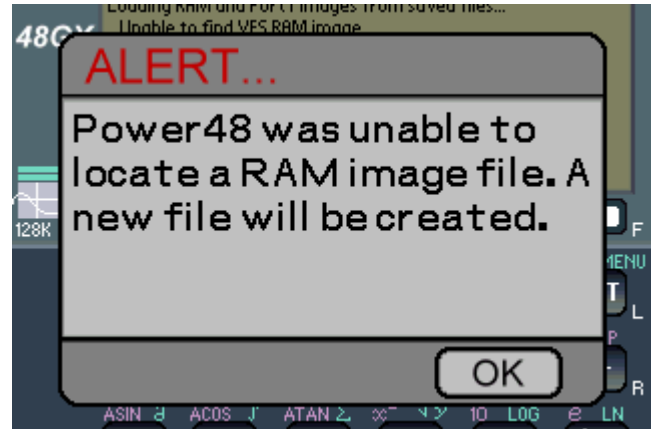
After tapping OK, the screen will revert to the following:

Dry run mode indicates that the emulator is running without having loaded a ROM image. In this state the user may access and modify the preferences screen, as well as display the "about" screen and even switch targets, but that is all. The user must quit the emulator, rectify the problem with the ROM images, and then restart the emulator.
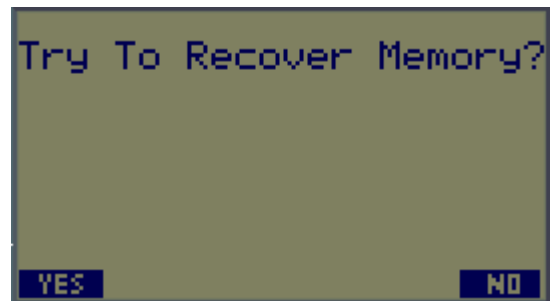
Once the ROM images have been installed correctly, the emulator will then proceed with loading the ROM, RAM and PORT1 images. Since this will be the first time the emulator is run, there will be no RAM or PORT1 image. The emulator will then display the following message:

This screen simply indicates that no RAM image was found, which is to be expected wince this is the first time the emulator has been run. Tap OK to acknowledge this screen.
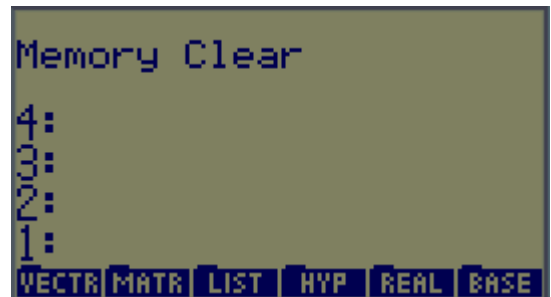
After several messages indicating startup status scroll by, the user should be rewarded with the following screen:

Tap the soft key "F" to indicate that no memory recovery should be attempted.

And now the emulator is fully up and running…

Note that in the preceding steps the 48GX target was shown. The examples all apply equally to the 48SX and the 49G. The first time the emulator has been run it will attempt to load the 48GX target. If it can't find the 48GX Rom file, it will automatically attempt to load the 48SX target instead, and so on for the 49G. If it can't find the 49G ROM file either, it will start in dry run mode. Each subsequent time the emulator is run it will attempt to start in whichever mode was last active.

Hi-Res+ GUI Mode:

These are the virtual screens representing the 48SX, 48GX and 49G calculators in Hi-Res+ (320x480) GUI mode. The virtual key layout is identical to the real machines. This emulator will start up in this mode by default on machines that are capable of it, and will be unavailable for those that aren't.
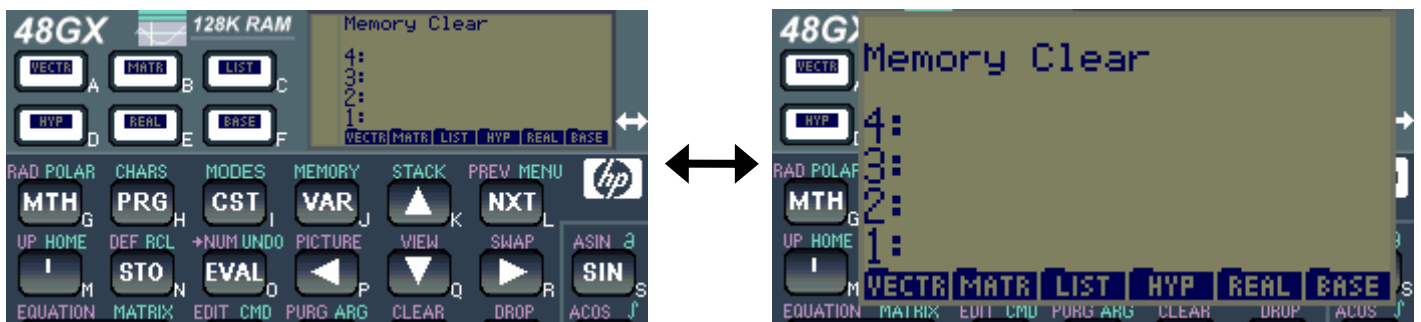
Hi-Res GUI mode:

These are the virtual screens representing the 48SX, 48GX and 49G calculators in Hi-Res (320x320) mode. The virtual key layout differs slightly from the real thing. Unfortunately, this was necessary in order to accommodate the "squareness" of the palm display. This mode differs from the Hi-Res+ mode in two key areas:

One, because the soft keys are not directly under the screen labels, the labels are reproduced on top of the soft keys:

Two, the screen can be zoomed to twice its size for increased readability. Tapping the screen or pressing the jog dial back button will toggle between the two modes, and most of the keys are still usable in the zoomed mode:

Special Button Layout (Hi-Res+ mode):

There are several additional buttons present on the virtual screen that perform functions external to the emulated calculator. These buttons are in the same location on all targets. In Hi-Res+ mode (320 x 480) they are laid out as follows:

HP Logo: Tapping on this button will switch from 48GX to 48SX and vice-versa.

48GX/SX: Tapping on this button will bring up the Power48 "about" screen.

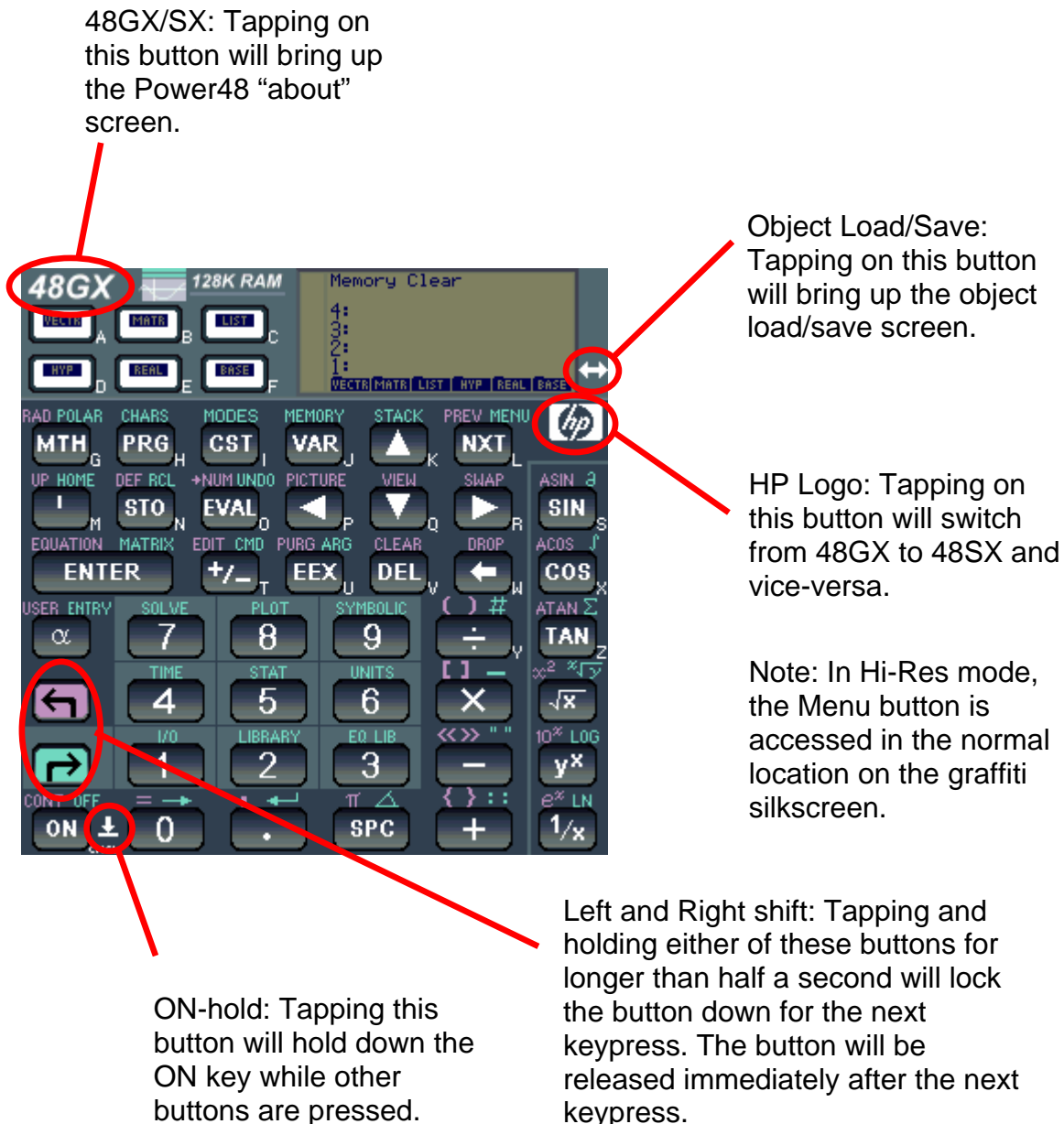Object Load/Save: Tapping on this button will bring up the object load/save screen.

Left and Right shift: Tapping and holding either of these buttons for longer than half a second will lock the button down for the next keypress. The button will be released immediately after the next keypress.

ON-hold: Tapping this button will hold down the ON key while other buttons are pressed.
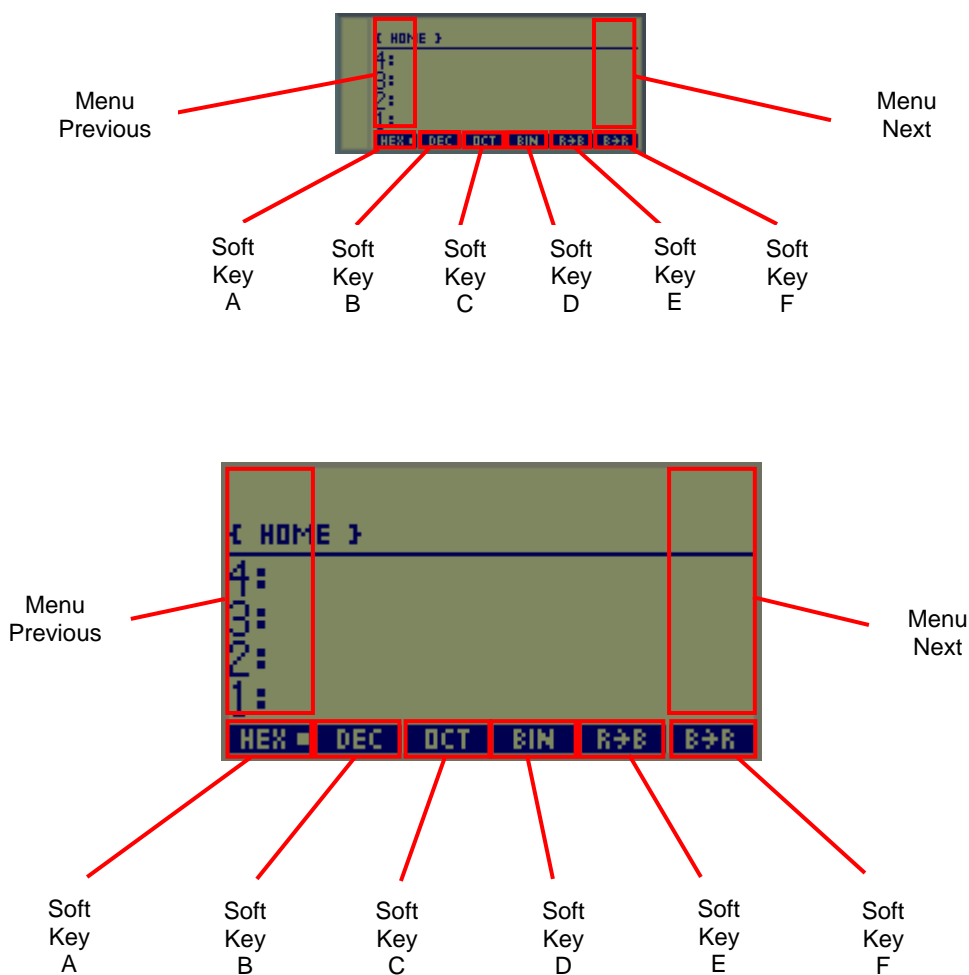
Special Button Layout (Hi-Res Mode):

In Hi-Res mode (320 x 320) the special buttons are laid out as follows:

48GX/SX: Tapping on this button will bring up the Power48 "about" screen.

Object Load/Save: Tapping on this button will bring up the object load/save screen.

HP Logo: Tapping on this button will switch from 48GX to 48SX and vice-versa.

Note: In Hi-Res mode, the Menu button is accessed in the normal location on the graffiti silkscreen.

ON-hold: Tapping this button will hold down the ON key while other buttons are pressed.

Left and Right shift: Tapping and holding either of these buttons for longer than half a second will lock the button down for the next keypress. The button will be released immediately after the next keypress.

Display area function key support:

Power48 emulates the soft function keys (the A-F keys) like all of the rest of the keys found on a 48 or 49 series calculator by using a visual representation of the calculator's soft key buttons. Additionally, it provides support for pressing the LCD labels representing the keys as a substitute for pressing the soft key button. This is most helpful when in the reduced 320x320 mode, and the LCD is in large or zoomed mode and is covering up the soft key buttons. The layout is as shown:

Preferences

Several aspects of the emulator's operation can be modified through the preferences screen. The screen is tabbed with three separate pages: the "General" page which contains options applicable to the emulator as a whole, and the "48GX" and "48SX" pages which contain options specific to each target.

Preferences, General:

Pressing the menu button brings up the preferences screen, "General" page. The other pages "48GX", "48SX" and "49G" can be accessed simply by tapping on the appropriate tab.
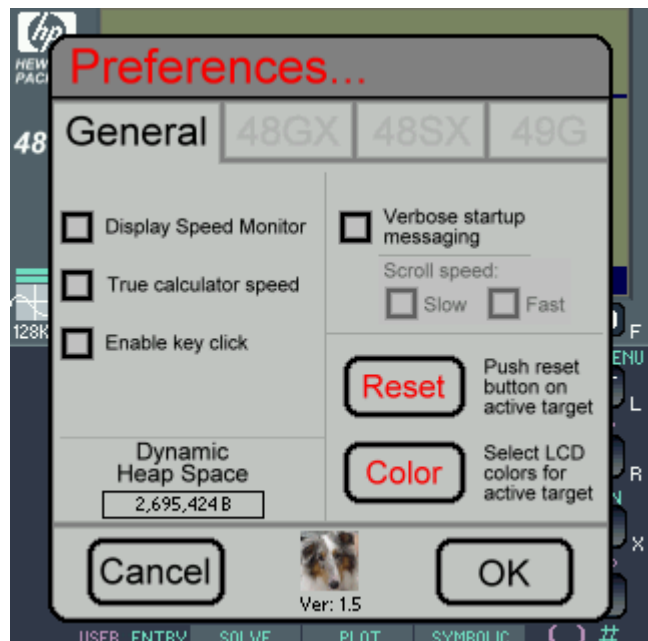
Dynamic heap space: This is not user adjustable. It simply displays the remaining dynamic heap space in the PalmOS.

Display Speed Monitor: Checking this option will cause a small pull-out tab to appear on the right-hand side of the display. Tapping on the tab and dragging left will expose a Saturn CPU emulation speed display that is updated every second. Tap the display to switch between Saturn MIPs and Mhz, and slide the tab to the right to hide the display.

True calculator speed: Checking this option causes the emulator to emulate each target at close to the original speed of the actual calculator. This will also cause the emulator to use less battery power as it does not have to run the emulation full speed and can return control back to the OS more often.

Enable key click: Checking this option will enable a light key click sound every time a calculator key is pressed.

Verbose startup messaging: Checking this option causes the emulator to display certain status messages on the virtual LCD during bootup. Select a **scroll speed** of Slow or Fast to control how fast the messages scroll on the screen. Turning verbose messaging off makes the emulator startup as fast as possible.

Color: Pressing this button will exit the preferences screen and bring up a color selection dialog that will allow the user to pick custom colors for the pixels and background of the virtual LCD display for the currently active target. See the section titled "Virtual LCD Color Selection" for more information.

Reset: Pressing this button will bring up a dialog box asking the user if they would like to simulate pushing the reset pin of the currently active target. This is generally only necessary if the calculator locks up for some reason. It is usually a memory-safe process, but not always.

Cancel: Pressing this button exits the preferences screen without accepting any of the changes.

OK: Pressing this button exits the preferences screen and activates all changes.
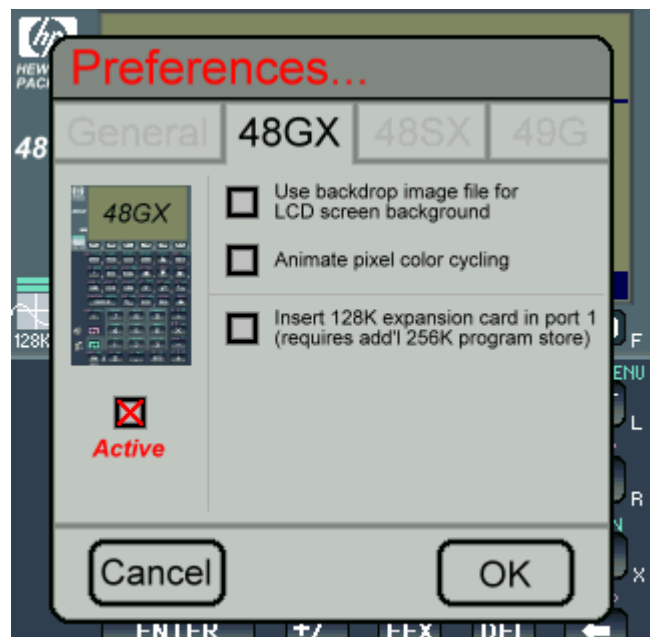
Preferences, 48GX:

These options apply only to the 48GX target.

Use background image file for LCD screen background: Selecting this option will enable the user to display a custom background image for the virtual LCD display instead of a single color backdrop. See the section titled "Virtual LCD Background Image" for more information.

Animate pixel color cycling: Checking this option will cause the color of the pixels in the virtual LCD display to slowly change colors in a cyclic pattern. The background will stay the same color.

Insert 128K expansion card in port 1: Checking or unchecking this option controls the insertion or removal of a virtual 128K expansion card in port 1 of the emulator. If the 48GX is not the active target, the emulator will simply remember the setting and load or not load the PORT1 file when the 48GX is made active again. If the 48GX is currently the active target, this operation will be denied unless the calculator is in a powered-off state.

Once the calculator is off, the card can be inserted or removed at will. Inserting the card by checking the option will cause the emulator to allocate an additional 256KB of

internal memory for the PORT1 image and look for a PORT1 file to load it with. If it doesn't find one an alert box will be presented and the calculator will create a blank file.

Removing the card causes the emulator to deallocate the PORT1 internal memory, but DOES NOT delete the PORT1 file, so the user can go back to it if desired simply by reinserting the card.

Note: This card is not shared with the card for the 48SX. The emulator maintains to separate PORT1 cards.

Active: If the 48GX is not the active target, checking this option will make it active once the user presses OK.

Cancel: Pressing this button exits the preferences screen without accepting any of the changes.

OK: Pressing this button exits the preferences screen and activates all changes.
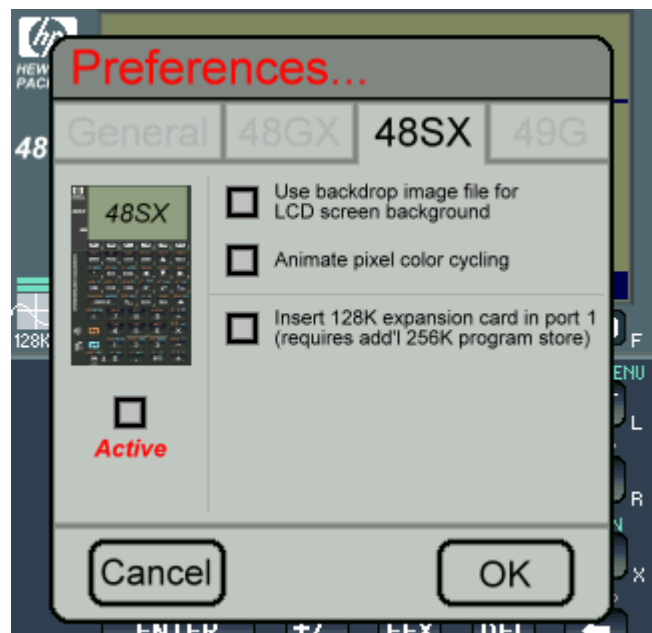
Preferences, 48SX:

These options apply only to the 48SX target.

Use background image file for LCD screen background: Selecting this option will enable the user to display a custom background image for the virtual LCD display instead of a single color backdrop. See the section titled "Virtual LCD Background Image" for more information.

Animate pixel color cycling: Checking this option will cause the color of the pixels in the virtual LCD display to slowly change colors in a cyclic pattern. The background will stay the same color.

Insert 128K expansion card in port 1: Checking or unchecking this option controls the insertion or removal of a virtual 128K expansion card in port 1 of the emulator. If the 48SX is not the active target, the emulator will simply remember the setting and load or not load the PORT1 file when the 48SX is made active again. If the 48SX is currently

the active target, this operation will be denied unless the calculator is in a powered-off state.

Once the calculator is off, the card can be inserted or removed at will. Inserting the card by checking the option will cause the emulator to allocate an additional 256KB of internal memory for the PORT1 image and look for a PORT1 file to load it with. If it doesn't find one an alert box will be presented and the calculator will create a blank file.

Removing the card causes the emulator to deallocate the PORT1 internal memory, but DOES NOT delete the PORT1 file, so the user can go back to it if desired simply by reinserting the card.

Note: This card is not shared with the card for the 48GX. The emulator maintains to separate PORT1 cards.

Active: If the 48SX is not the active target, checking this option will make it active once the user presses OK.

Cancel: Pressing this button exits the preferences screen without accepting any of the changes.
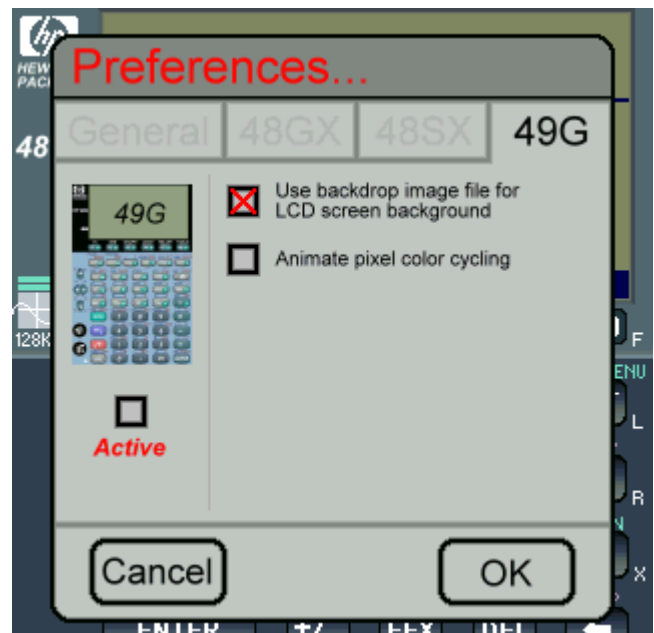
OK: Pressing this button exits the preferences screen and activates all changes.

Preferences, 49G:

These options apply only to the 48SX target.

Use background image file for LCD screen background: Selecting this option will enable the user to display a custom background image for the virtual LCD display instead of a single color backdrop. See the section titled "Virtual LCD Background Image" for more information.

Animate pixel color cycling: Checking this option will cause the color of the pixels in the virtual LCD display to slowly change colors in a cyclic pattern. The background will stay the same color.

Active: If the 49G is not the active target, checking this option will make it active once the user presses OK.

Cancel: Pressing this button exits the preferences screen without accepting any of the changes.

OK: Pressing this button exits the preferences screen and activates all changes.

Object Loading and Saving

Power48 has the ability to load HP48 object files directly onto the stack at level 1, and conversely to save objects at stack level 1 into binary object files. Object files are loaded from or stored to either the object file directory on the external storage card or internal memory. The object file directory on the expansion card is:
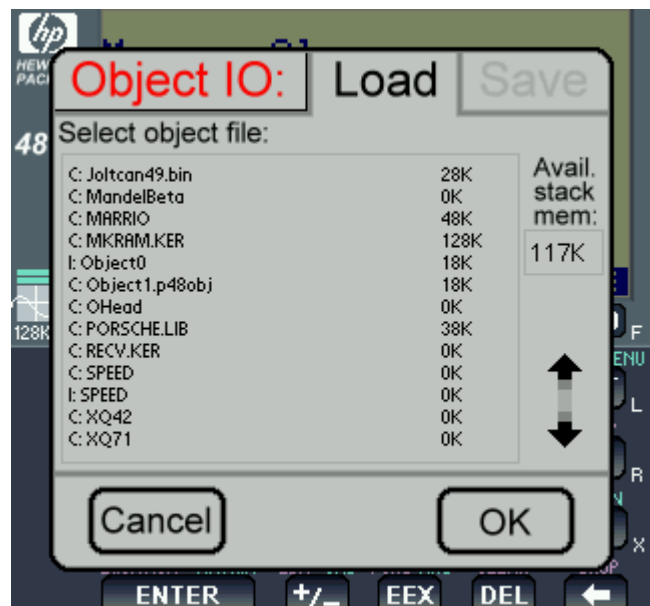
```
/PALM/PROGRAMS/Power48/Objects/
```

The object loading and saving screen is accessed by pressing the object load/save button (the white two-headed arrow.)

Object Loading:

Pressing the object load / save button brings up the object loading screen. The object saving screen can be accessed simply by pressing the "save" tab. It takes a moment for the object loading screen to come up fully as it is enumerating the object files and getting size information. The "C:" and "I:" prefixes before each file indicate whether they are stored internally or on the expansion card.

To load an object file simply tap on the file name and press OK. Use the arrow buttons to scroll up and down the list. The **Avail stack mem** window shows the amount of HP48 stack space available for loading the object. The object file size cannot exceed this amount. If the emulator is able to detect that the object file contains a binary object, the object will be loaded as such. Otherwise the object file is loaded as a string.
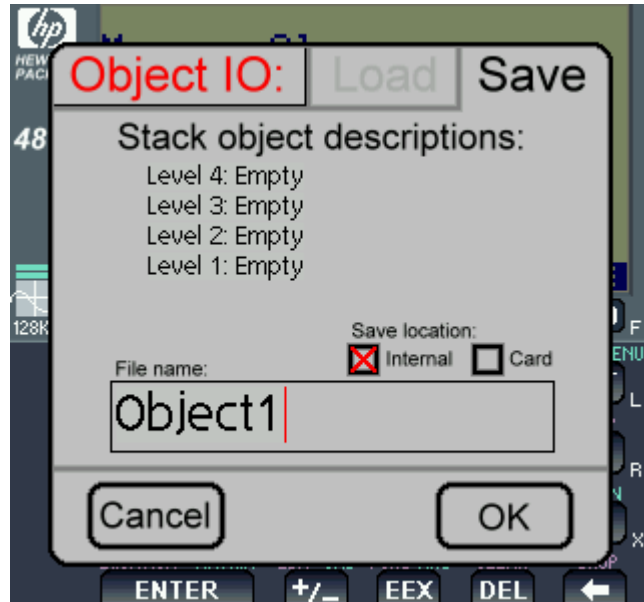
Warning: loading an object file while the calculator is busy is a good way to corrupt the calculator image. Only load objects when the calculator is in an idle state.

Object Saving:

Pressing the "Save" tab brings up the object saving screen.

The object at stack level 1 can be saved via this screen. Simply input the file name and press "OK" and the level 1 object will be encoded and saved in the object file directory.

The **Stack object descriptions** give a brief indication of the type of object currently at the first four stack levels of the current target.

The **Save location** field allows a user to specify where they would like the object file to be stored.

Note that to save time the emulator will provide the basic names Object0 through Object99 automatically in the entry box as a shortcut. It will always suggest the next available from 0 (i.e. if Object0 exists already, it will suggest Object1, and so on up to 99.) These names are just suggestions; the name can be anything and doesn't have to follow any specific convention. If the file is saved to the expansion card Power48 will automatically append the extension ".p48obj" to the filename.
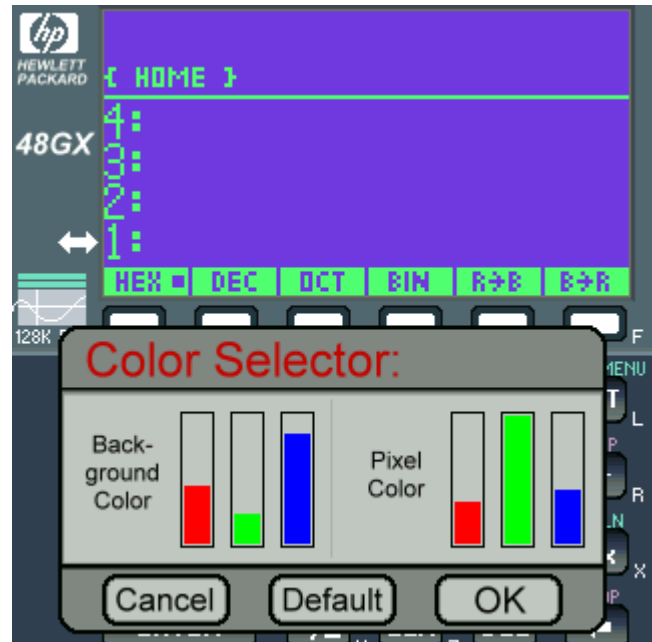
Loading program files from other sources:

Power48 comes bundled with a small windows-based utility for converting external program files (or object files) to a format compatible with Power48. The utility is called "p48obj.exe", and it works in much the same way as the ROM converter. P48obj can convert object files into .pdb format so that they can be hotsynced to internal memory, or it can rename them to have a ".p48obj" extension such that hotsync stores them directly to the location "/Palm/Programs/Power48/Objects/" on the expansion card. Note: the user can also copy external program files directly to the above directory using an external card reader as before.

Virtual LCD Color Selection

Pressing the "Color" button in the general tab of the preferences screen will exit the preferences screen and bring up the following color selection screen that will allow the user to pick custom colors for the pixels and background of the virtual LCD display for the currently active target.

Users change the color of the background and/or the pixels by tapping with the stylus in the red, green and blue color bar areas to adjust the relative amount of each respective color. The color bars will adjust themselves to the position of the stylus, and the user will receive immediate feedback as the virtual LCD display is updated to match the color specified by the color bars. The colors can be changed for each individual target.

Note: If the "animate pixel color cycling" is checked for the active target, changing the pixel color will have no effect. Also, if the user is displaying a custom background image on the virtual LCD screen, changing the background color will have no effect.

Cancel: Pressing this button exits the color selection screen without accepting any of the changes.

Default: Pressing this button causes the colors for the active target to be set back to their default settings.

OK: Pressing this button exits the color selection screen and activates the color changes.

Virtual LCD Background Image

The user may desire to have a custom background image for each individual target rather than the static single color background. Power48 has the ability to load and display a 24-bit Windows formatted bitmap as the background in place of the background color. Individual backgrounds can be displayed for each target, as well as for each of the two screen zoom levels.

The image files must be stored on the VFS device (memory stick, SD card, etc…) at the following location:
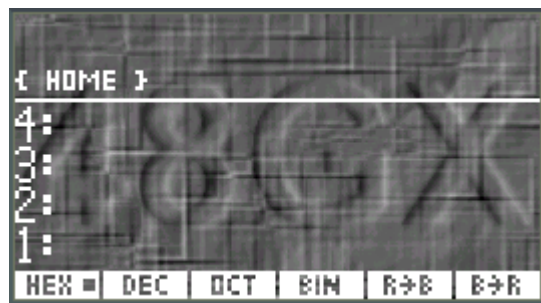
`/PALM/PROGRAMS/Power48`

The files must be uncompressed 24-bit Windows formatted bitmaps, with resolutions of 262 x 142 for the large LCD display size, and 148 x 64 for the small LCD display size. The files must have the following names for each respective target and display size:

```
HP48SXBackImage2x2.bmp
HP48SXBackImage1x1.bmp
HP48GXBackImage2x2.bmp
HP48GXBackImage1x1.bmp
HP49GBackImage2x2.bmp
HP49GBackImage1x1.bmp
```

Any deviation from the above requirements will cause the background image not to be displayed. In those instances, a simple, default tiled background image will be displayed.

Large LCD display background image example:

Small LCD display background example:

Miscellaneous

Key Chording:

The ON-hold key, located immediately to the right of the ON button, acts as a chording start and stop key. Pressing it the first time automatically holds down the ON key. The user can then press up to four subsequent keys which will all be held down together. Pressing the ON-hold button the second time releases all the held keys. This is the method whereby the user can generate ON-C and ON-A-F key strokes.

Keyboard and Graffiti support:

Power48 includes supports for alphanumeric entry via the PalmOS Graffiti area and via an external keyboard. Additionally, those keyboard keys that are logically equivalent to certain calculator buttons, like the '+' and '-' keys, are mapped to the equivalent calculator button.

There is no need to press the 'alpha' key to enter alphabetic characters via keyboard or graffiti. The emulator takes care of this automatically.

Jog Dial mapping:

Power48 supports limited use of the Sony Jog Dial. Jog Dial actions are mapped as follows:

◆ Jog Dial Up = HP48 UP Arrow
◆ Jog Dial Down = HP48 Down Arrow
◆ Jog Dial Push = HP48 ENTER
◆ Jog Dial Back = Toggle LCD in Hi-Res mode

User Guides and Supplementary Info

The documentation included with Power48 is concerned solely with the operation of the emulator itself. For information on the use of HP calculators and the RPM entry method, please consult the HP calculator guides available at http://www.hpcalc.org/.

HP calculator software and other information:

The following websites contain large amounts of information and software for HP calculators:

http://www.hpcalc.org/
http://www.hpmuseum.org/

Support Information

For all Power48 support issues...

email: support@power48.mobilevoodoo.com

website: http://power48.mobilevoodoo.com/

License Information

This program is free software; you can redistribute it and/or modify it under the terms of the GNU General Public License as published by the Free Software Foundation; either version 2 of the License, or (at your option) any later version.

This program is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU General Public License for more details.

You should have received a copy of the GNU General Public License along with this program; if not, write to the Free Software Foundation, Inc., 59 Temple Place, Suite 330, Boston, MA 02111-1307 USA

Credits

In the credit where credit is due department…

❖ All original Power48 code and graphic layout by: Robert Hildinger

❖ Emu48 code originally programmed by: Sebastien Carlier

❖ Emu48 code maintained and updated by: Christoph Gießelink

❖ 48SX graphic representation based on work of: Jeff Breadner

❖ 48GX graphic representation based on work of: Jeffery L. McMahan

❖ 49G graphic representation based on work of: Eric Rechlin

HP48/49 ROM images are the property of and copyrighted by Hewlett-Packard.