

HP49G Reserved Names

In the HP49G there are two kinds of reserved names: the "algebraic" ones – which are used by the calculator (CAS) with special meanings in expressions – and the *special purpose variables*. The latter can be created and modified by the CAS or by the OS, by setting parameters in various input forms and, sometimes, only by direct typing. All of them can be manually modified, but you have to know exactly what you are doing in order to obtain meaningful results without errors; e.g. modifying variables in the Hidden directory can easily give a TTRM error (Try To Recover Memory) with data loss.

Be careful, because if you try to create a variable using one of the names below the calculator does not warn you, and no error is reported as if you try using commands for the same purpose: there is no format checking!

Obviously you can use all of them safely as local names in programs, as you can do with functions/commands, unit names (including units' prefixes) and constants already defined in the Constant Library accessible via **APPS** (although the HP49G considers them constants, with respective values, only if you apply the CONST command to them). Anyway I discourage such usages which can bring conflicts and confusion.

The following conventions have been used compiling the list below:

- Algebraic reserved names are written in **dark green**; they are treated – and EVALuated – as any other symbolic object.
- No longer used variables are written in **blue**; they can belong to 48 series calculators, to previous ROM versions or to functionalities never/partially implemented.
- Location (where the calculator "looks" when performing operations involving the specified reserved variable) for the variables is specified using one of the letter below:
D: current DIRECTORY;
P: entire PATH (current directory and its parents);
H: HOME directory;
C: CASDIR directory; if not found search in Home; if it fails, create a new variable in the Casdir directory;
I: HIDDEN directory;
N: NONE (not applicable).
- An hash sign (#) indicates an arbitrary integer value.
- A name between angular brackets < > indicates an arbitrary name which is "described" by the word between the '< >'.
 •List type variables structure: meaningful name and user type – specified by enclosing in square brackets [] – are provided for each item of the list. Appropriate indentation is used for items' descriptions and when items themselves are lists. For those which can assume only specific values, all of these are listed; if applicable, the default value is written in **bold**.
- ****PAR variables ONLY: if a list's item itself is a list, it can be used either in the list form, either by specifying only the first element with the correspondent type.

Note: Names are case sensitive.

Name	Loc.	Type	Description
←<NAME>	(N)	7.	Compiled Local Name. The variable is treated as a local name whether or not any local variable with that name actually exists. This simplifies passing a local variable to a procedure that's compiled separately and called by name.
αENTER	(P)	8., 25.	Vectored ENTER Pre-processor: active only if flags -62 and -63 are set. When the ENTER routine is called, the command line is placed on the stack as a string and the program/code executed, allowing to parse the command line (E.G.: you

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could modify the string or save a copy in a log; use Obj→ to continue processing as usual). After the program/code is finished the key which started the ENTER process is processed using any key assignment if there is one.

Alarms (ALRMDAT) 5. Data for current alarms (list of list): each list represents an alarm.

Structure:

```
{
[5.] Single alarm data
{
[10.] Ticks
Alarm's date and time in ticks of clock (1 tick = 1/8192 secs).
[Any] Any object (since it is in a list)
This is the object evaluated when the alarm will be
acknowledged. Default: "" <Empty String>.
}
...
}
```

βENTER 8., 25. Vectored ENTER Post-processor: active only if flags -62 and -63 are set. After the ENTER routine is executed, a string representing the keycode which started the ENTER process – if existent/applicable – or an empty string is put on level 1 of the stack and this program is executed.

CASDIR 15. Special variables used and created by CAS are stored in this directory.

CASINFO (ERABLEMSG) 11. (2.) Information that CAS gives regarding symbolic manipulation for unsolved problems (integrations).

C# 8. Equation to plot stored by the plotting environment ($\frac{y}{x}$) if Plot Type is CONIC.

cC# 9. Constant arbitrary terms used by DESOLVE and LDEC in solved differential equations.

const<CONST> Any New value for the built-in <CONST> constant. CONST command applied to the <CONST> constant return the value stored in this variable. Note that the Constant Library does not respect the new values. Also you can't define new constants using this method.

CST 5. Contents of a custom soft menu. You can have a different custom menu in each directory.

Structure:

```
{
[5.] Menu Entry
You can have as many menu entries as you wish in the same
custom menu (that is, in the same CST variable).
{
[2.] Label
The string that will show as the menu item identifying the
corresponding object.
[Any] Object
May be of many type. To prevent it being evaluated, you should
enclose it in tick marks ''.
}
...
}
```

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d#	\textcircled{P}	9.	Ordinary/partial derivative of a function with respect to the specified number variable. Repeat and combine these symbols to obtain high-order derivatives.
ENVSTACK	\textcircled{C}	5.	Saved flags and directory path (list of list; organized like a stack). PUSH command adds current flags and directory path to this list, while POP restores the last ones by extracting – and deleting – them from the list.

Structure:

{
[5.] Last saved flags and path
{
[10.] System flags -1÷-64
[10.] User flags +1÷+64
[10.] System flags -65÷-128
[10.] User flags +65÷+128
System and user flags state as obtained by the RCLF command, which returns them in a list.
[5.] Path
The path where the PUSH command was executed.
}
[5.] Next to last saved flags and path
...
}

EPS	\textcircled{C}	3.	The smallest real value below which the calculator rounds to zero for some operations (e.g. the command EPSX0).
EQ	\textcircled{D}	9., 8.	Current equation, plotting and numeric solving. To "use" multiple equations at the same time, store in this variable a list of valid objects.
EXITED	\textcircled{P}	8., 25.	The content of this variable is evaluated whenever the command line editor session is ended.
EXPR	\textcircled{H}	9.	Current expression for symbolic operations.
F#	\textcircled{D}	8.	Equation to plot stored by the plotting environment ($\frac{y}{x}$) if Plot Type is DIFFEQ.
IERR	\textcircled{D}	0.	Uncertainty in current numeric integration.
IOPAR	\textcircled{H}	5.	Current parameters for I/O operations.

Structure:

{
[0.] Baud Rate
The value of this parameter represent the effective baud rate used during transmission. Could be: 15360., 9600. , 7680., 4800., 3840., 2400., 1920. or 1200.. Non standard rates - odd ones in the previous list - could be used only between two HP49G, not with a standard COM port.
[0.] Parity
0.: None – 1.: Odd – 2.: Even – 3.: Mark – 4.: Space
A negative value generates the parity bit when transmitting and ignores it when receiving, and only the 7 low-order bits are treated as data: this means that with any parity settings but 0, you can transfer only the 7-bit pure ASCII characters 0-127 when using XMIT or SRECV commands, or printing "via wire".
Use parity if some other system requires it, since it is not a very effective error detection system for communications and it adds overhead (slower transfer). Also, Kermit and Xmodem protocols use their own (much better) error correction systems.
In Xmodem Server Mode parity is always set to None.

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<p><i>[0.] Receive Pacing Flag (Not implemented)</i> 0.: Do not send XON/XOFF signals. 1.: Send XON/XOFF signals.</p>			
<p><i>[0.] Transmit Pacing Flag (Not implemented: if set disable any printer delay specified in the 1st parameter of PRTPAR)</i> 0.: Do not receive XON/XOFF signals. 1.: Receive XON/XOFF signals.</p>			
<p><i>[0.] Checksum Type</i> 1.: One-digit arithmetic. 2.: Two-digit arithmetic. 3.: Three-digit CRC.</p>			
<p><i>[0.] Characters Translation (only for ASCII Kermit transfers)</i> Specify how to transfer special characters unavailable on the PC. Calc -> PC: appropriate escape sequences will be produced. PC -> calc: tells to the calc how to interpret escape sequences. Each value includes the translations applied by the lower ones. Valid values are: 0.: None. Only ASCII 0 (NULL), 34 (") and 92 (\) are translated in \00, \" and \\, respectively. 1.: Newline – Chr 10. Calc newline symbols (ASCII 10 - Unix style) are translated into PC newline symbols (ASCII 10 & 13 pairs) and viceversa. 2.: Chr 128-159. Characters from ASCII 128 to ASCII 159 are translated to their backslash equivalent and viceversa. 3.: Chr 128-255. Characters from ASCII 128 to ASCII 255 are translated to their backslash equivalent on the PC.</p>			
}			

MATRIX	\textcircled{C}	29.	Last symbolic matrix used in computations (rref command).
MODULO	\textcircled{C}	28.	The value of the current modulo setting.
Mpar	\textcircled{P}	26.	Contains current equations and variables to be used in the Multiple Equations Solver. It can be directly created from the current EQ with the command MINIT.
n#	\textcircled{P}	9.	Integer coefficients used by ISOL and SOLVE in solved equations.
ODETYPE	\textcircled{D}	2.	The differential equation type used in the DESOLVE command.
PERIOD	\textcircled{C}	9.	Period of the trigonometric functions.
PICT	\textcircled{N}	11.	Current Graphic Object. To view its content put 'PICT' in the stack and execute the RCL command (press \underline{RCL} on the keyboard).
PPAR	\textcircled{D}	5.	Current parameters for plotting.

Structure:

{			
<p><i>[1.] (X_{left}, Y_{low})</i> Lower left corner of PICT. Default: (-6.5, -3.1). • If Plot Type is SLOPEFIELD, WIREFRAME, FAST3D, PARSURFACE, YSLICE, PCONTOUR or GRIDMAP this parameter is not used.</p>			
<p><i>[1.] (X_{right}, Y_{high})</i> Upper right corner of PICT. Default: (6.5, 3.2). • If Plot Type is SLOPEFIELD, WIREFRAME, FAST3D, PARSURFACE, YSLICE, PCONTOUR or GRIDMAP this parameter is not used.</p>			
<p><i>[5.] Independent Variable</i> { <i>[6.] X</i> Name of the independent variable and/or the label for the horizontal axis. Default: X. <i>[0.] X_{min}, [0.] X_{max}</i> Their meaning depends on the Plot Type. If they are not specified, X_{left} and X_{right} are used.</p>			

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- FUNCTION, POLAR, PARAMETRIC, CONIC or TRUTH: the minimum and maximum values of the independent variable.
- DIFFEQ: the initial and final values of the independent variable. These elements are needed. Default: **0.**
- BAR: the smaller of the numbers specify the horizontal location of the first bar.
- HISTOGRAM: the minimum and maximum values of the data to be plotted.
- SCATTER, SLOPEFIELD, WIREFRAME, FAST3D, PARSURFACE, YSLICE, PCONTOUR or GRIDMAP: these elements are ignored.

}

[0.]/[10.] Resolution

The value of this parameter is expressed in user-unit coordinates (real) or in pixels (user binary integer). Default: **0.**

The meaning depends on the Plot Type:

- FUNCTION, POLAR, PARAMETRIC, CONIC, TRUTH or GRIDMAP: interval between plotted values of the independent variable. Default means 1 pixel (Function, Conic, Truth, Gridmap) or $2 \text{ _degrees-2 _grad-}\pi/90 \text{ _rad}$ (Polar) or $1/130 \cdot (X_{\max} - X_{\min})$ (Parametric).
- DIFFEQ: maximum interval between values of the independent variable. Can be expressed in user-unit coordinates only. Default means unlimited.
- HISTOGRAM: bin size. Default means bin size is 1/13 of the difference between the specified minimum and maximum values of the data.
- BAR: bar width. Default means width of 1 in user-unit coordinates.
- SCATTER, SLOPEFIELD, WIREFRAME, FAST3D, PARSURFACE, YSLICE or PCONTOUR: this parameter is not used.

[5.] Axes

- If Plot Type is SLOPEFIELD, WIREFRAME, FAST3D, PARSURFACE, YSLICE, PCONTOUR or GRIDMAP this parameter is not used.

{

[1.] Plot Origin

Indicated in user-unit coordinates. Default: **(0., 0.)**.

[5.] Tick-mark Annotation

{

[1.]/[10.] Horizontal Tick Spacing

[1.]/[10.] Vertical Tick Spacing

Values of these are expressed in user-unit coordinates (reals) or in pixels (user binary integers).

}

[2.] Horizontal Axis Label, [2.] Vertical Axis Label

- If Plot Type is DIFFEQ and the solution is real-valued these strings can specify the dep. or indep. variable; if the solution is vector-valued the strings can specify a solution component: 0 stands for X, 1 for Y, n for Yn: other strings are ignored and the calculator will use default string 0 and 1.

}

[19.] Plot Type

[6.] Dependent Variable

Name of the dependent variable and/or the label for the vertical axis. Default: **Y.**

- If Plot Type is DIFFEQ, this parameter must be a list:

{

[6.] Y

Name of the solution.

[0.] Y_0

Initial value for the solution Y. Default: **0.**

[0.] $X_{\text{Err.Tol.}}$

Global absolute error tolerance on the solution. Default: **.0001.**










}

}

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PRIMIT	\textcircled{C}	9.	The last computed antiderivative.
PRTPAR	\textcircled{H}	5.	Current parameters for printing.
<u>Structure:</u>			
{			
[0.] <i>Printer Delay</i> Number of seconds (0.+6.9) the calculator waits between sending lines of information, as long as transmit pacing (4 th parameter in IOPAR) is not set. Appropriate value for an 82240A/B printer is 1.8. Default: 0.			
[2.] <i>Remap String</i> A string defining the current remapping of the extended character set for printing. The string can contain as many characters as you want to remap, with the first character being the new character 128, the second being the new character 129, etc.. Any character number that exceeds the string length will not be remapped. Default: "" <Empty String> . Built-in command OLDPRN stores the character-remapping string for the HP82240A Infrared Printer.			
[0.] <i>Printer Line Length</i> Default is 80.			
[2.] <i>End-of-line sequence</i> Default is carriage-return/line-feed (ASCII10+ASCII13) .			
}			
R#	\textcircled{D}	8.	Equation to plot stored by the plotting environment ($\frac{y}{x}$) if Plot Type is POLAR.
REALASSUME	\textcircled{C}	5.	A list of variables that the CAS assumes are real values.
s#	\textcircled{P}	9.	Sign coefficients used by ISOL and QUAD. These commands are identical to SOLVE; they are preserved only for compatibility with the 48 series.
Σ DAT	\textcircled{D}	3.	Current matrix of data used for statistics.
Σ PAR	\textcircled{D}	5.	Parameters for statistics calculations.
<u>Structure:</u>			
{			
[0.] <i>Independent Variable Column</i> Independent-variable column number of the current statistics matrix (stored in Σ DAT). Used when drawing a Statistical Plot. Default: 1.			
[0.] <i>Dependent Variable Column</i> Dependent-variable column number of the current statistics matrix (stored in Σ DAT). Used when drawing a Statistical Plot. Default: 2. • If Plot Type is HISTOGRAM or BAR: this parameter is not used.			
[0.] <i>Linear Regression Intercept</i> Coefficient computed in data fitting. Default: 0. , which means data was not yet computed.			
[0.] <i>Linear Regression Slope</i> Coefficient computed in data fitting. Default: 0. which means data was not yet computed.			
[19.] <i>Statistical Model</i> Command specifying the curve fitting method used in statistics. Default: LINFIT which stands for Linear Fitting.			
}			
STARTED	\textcircled{P}	8., 25.	The content of this variable is evaluated whenever the command line editor session is started.
STARTEQW	\textcircled{P}	8., 25.	The content of this variable is evaluated by pressing <u>CUSTOM</u> into the Equation Writer whenever an element is selected.

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STARTERR		8., 25.	Used to customize error message displays.
STARTOFF		8., 25.	The content of this variable is evaluated whenever the calculator turns off automatically.
STARTUP		8., 25.	The content of this variable is evaluated after a warm-start ( + ). Commands modifying the stack have no effect.
T#		8.	Equation to plot stored by the plotting environment () if Plot Type is TRUTH.
TOFF		10.	Sets the number of ticks - 1/8192 seconds - before the calculator automatically turns off. Minimum 5 seconds, Maximum 71 hours (HP49G clock is 32 bits).
TPAR		5.	Current parameters for viewing tables.

Structure:

{
[0.] <i>Starting Value</i> First independent variable value displayed in table. Default: 0.
[0.] <i>Increment Value</i> Step between independent variable values. Default: .1 .
[0.] <i>Table Format Flag</i> 0.: Standard Formatting. The calculator will use the default formatting method, beginning with Starting Value and using Increment Value for successive steps. 1.: Custom formatting. You can directly specify the independent variable values to use when tabling the function, value by value, with user-defined steps. The format is stored in the variable specified in the parameter Table Format Filename.
[0.] <i>Zoom Factor</i> Default: 4.
[0.] <i>Small Font Flag</i> Determines the font used when displaying the table: 0.: Small font is used. 1.: Current system font is used.
[6.] <i>Table Format Filename</i> Specifies the variable to use for the custom formatting [<i>Table Format Flag</i> = 1.]. This variable should be a numeric vector [3.] containing the list of the independent variable values to use when tabling the function(s) stored in EQ. Default: TAB .
}

UserKeys		5.	User Keys Assignments (list of list). User keys are active only when USER mode is on (flag -62 set).
----------	---	----	---

Structure:



Default (no user key assigned): { } <Empty List>.

{
[5.] <i>Key Assignment</i> There MUST be one list for each key of the HP49G (total: 51), even for the unassigned ones. The keys' assignments are listed in keyboard order, from left to right, from top to bottom (like system keycodes). Each plane (shift) is separately configurable. At user level – in UserRPL – keys are identified by a real number <i>rc.p</i> (<i>r</i> is the row number, <i>c</i> the column and <i>p</i> the plane), while in SystemRPL they are represented by a pair of system binary integers (BINTs): the first identifies the key (the keycode), the second the plane. Both plane conventions are reported (the SystemRPL one in decimal form). Default (nothing assigned to the key on the user keyboard): { } <Empty List>.
{
[Any] <i>Unshifted plane</i> (user: .1 - system: 1)
[Any] <i>Left-shifted plane</i> (user: .2 - system: 2)
[Any] <i>Right-shifted plane</i> (user: .3 - system: 3)

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[Any] Alpha plane (user: .4 - system: 4)
 [Any] Alpha+Left-shifted (user: .5 - system: 5)
 [Any] Alpha+Right-shifted (user: .6 - system: 6)
 [Any] Unused (user: .11 - system: 7)
 [Any] Hold Left-shifted (user: .21 - system: 8)
 [Any] Hold Right-shifted (user: .31 - system: 9)
 [Any] Hold Alpha-shifted (user: .41 - system: 10)
 [Any] Hold Alpha+Left-shifted (user: .51 - system: 11)
 [Any] Hold Alpha+Right-shifted (user: .61 - system: 12)

...

UserKeys.CRC		10.	Cyclic Redundancy Check for the variable UserKeys.
VPAR		5.	Current parameters for viewing 3-D plots. 3-D plots use also PPAR.

Structure:

{
[0.] X_{left} , [0.] X_{right} Real numbers specifying the width of the view space. Default: -1., 1..
[0.] Y_{near} , [0.] Y_{far} Real numbers specifying the depth of the view space. Default: -1., 1..
[0.] Z_{low} , [0.] Z_{high} Real numbers specifying the height of the view space. Default: -1., 1.. • If Plot Type is SLOPEFIELD, PCONTOUR or GRIDMAP: this parameter is not used.
[0.] X_{min} , [0.] X_{max} • If Plot Type is SLOPEFIELD, WIREFRAME, FAST3D, PARSURFACE, YSLICE or PCONTOUR: this parameter is not used. • If Plot Type is GRIDMAP: real numbers specifying the input region's width. Default: -1., 1..
[0.] Y_{min} , [0.] Y_{max} • If Plot Type is SLOPEFIELD, WIREFRAME, FAST3D, PARSURFACE, YSLICE or PCONTOUR: this parameter is not used. • If Plot Type is GRIDMAP: real numbers specifying the input region's width. Default: -1., 1..
[0.] X_{eye} , [0.] Y_{eye} , [0.] Z_{eye} Real numbers specifying the point in space from which the graph is viewed. Default: 0., -3., 0.. • If Plot Type is SLOPEFIELD, FAST3D, YSLICE, PCONTOUR or GRIDMAP: this parameter is not used.
[0.] X_{step} , [0.] Y_{step} Real numbers that set the number of x-coordinates versus the number of y-coordinates plotted. Default: 10., 8.. • If Plot Type is YSLICE: X_{step} determines the interval between plotted x-values within each slice. Y_{step} determines the number of slices to draw.
}

VX		6.	The default variable used in symbolic operations (*VX commands).
X#		8.	Equation to plot stored by the plotting environment ($\underline{Y=}$) if Plot Type is PSURFACE.
XY#		8.	Equation to plot stored by the plotting environment ($\underline{Y=}$) if Plot Type is PARAMETRIC or GRIDMAP.
Y#		8.	Equation to plot stored by the plotting environment ($\underline{Y=}$) if Plot Type is FUNCTION or SLOPEFIELD.

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Z#	Ⓣ	8.	Equation to plot stored by the plotting environment ($\underline{Y=}$) if Plot Type is FAST3D, WIREFRAME, PCONTOUR, YSLICE.
ZPAR	Ⓣ	5.	Zoom parameters in plotting.

Structure:

{
[0.] Horizontal Zoom Factor Default is 4..
[0.] Vertical Zoom Factor Default is 4..
[0.] Recenter on cursor flag 0.: Do not recenter plot on cursor. 1.: Recenter plot on cursor.
[5.] Previous PPAR Variable When zooming, some of the PPAR's parameters are changed. The previous PPAR variable is stored here for restoring via the ZLAST menu command.
}

HP49G Escape Sequences

Below you find the ASCII Character Translations (Character Codes: decimal 128÷255) used when transferring files with Kermit in ASCII mode.

When you use ASCII Kermit protocol to transfer a non compiled object, it will be saved as a string with an header [%%HP:T(n)A(R)F(.);]: escape sequences allow a translation in this string of special calculator characters not available on the PC.

What characters will be translated is defined in the *IOPAR* reserved variable, specifically at the *Characters Translation* parameter (see for further details). What kind of translation was used can be determined reading in the header the number 'n' in paranthesis after the letter 'T'.

Code	HP 4x Char	Transl.	Code	HP 4x Char	Transl.
128	⌵	\<)	149	⊖	\Gh
129	⊗	\x-	150	⌵	\G
130	∇	\.V	151	ℙ	\Gr
131	√	\w/	152	σ	\Gs
132	∫	\.S	153	τ	\Gt
133	Σ	\GS	154	ω	\Gw
134	⤵	\ >	155	△	\GD
135	π	\pi	156	Π	\PI
136	∂	\.d	157	Ω	\GW
137	≤	\<=	158	■	\[]
138	≥	\>=	159	⊗	\oo
139	≠	\=/	171	⊗	\<<
140	α	\Ga	176	■	\o
141	→	\->	181	μ	\Gm
142	←	\<-	187	⊗	\>>
143	↓	\ v	215	×	\.x
144	↑	\ ^	216	∅	\O/
145	γ	\Gg	223	β	\Gb
146	δ	\Gd	247	÷	\.-
147	ε	\Ge	nnn	<i>Other</i>	\nnn
148	η	\Gn			