

# HP Voyager Calculator Variants

Voyager is the code name for a series of HP calculators originally introduced in 1981, one of which, the HP-12C, is still being manufactured in 2023. There have been many revisions to the Voyager electronics over the years.

The original Voyager design, first used in the HP-11C and HP-12C introduced in 1981, had two integrated circuits: a 1LF5 "Nut" CPU, and a 1LE2 "R2D2" 6K\*10 ROM/43\*56 RAM/display driver. The electronics and LCD display were part of a module which attached to a separate keyboard PCB via a flex circuit. The electronics module was wrapped in special ESD shielding tape, and there was also an ESD shielding plastic sheet wrapped around the keyboard PCB.

The article "A look inside Hewlett-Packard's HP-11C" by Howard W. Markstein was published in Electronic Packaging and Production Magazine, March 1982. This gives an overview of the original Voyager mechanical design. A copy of the article may be seen on Rick Furr's [The Calculator Reference](#) web site.

In 1982, HP introduced the HP-10C, HP-15C, and HP-15C. The HP-10C and HP-16C used the same electronics as the HP-11C and HP-12C, though with different masked ROM code. The HP-15C, on the other hand, required more ROM and more RAM than the other Voyager models. HP redesigned the ROM/RAM/display driver as the 1LH1. This was first used in the HP-15C for memory expansion in conjunction with the 1LE2. The 1LH1 used for memory expansion in the HP-15C did not have the display driver bonded out, so it would fit in a smaller (square) package.

The Voyagers were redesigned to use a single PCB, eliminating the flex circuit. At the same time, the ESD shielding tape and plastic sheet were eliminated. These were probably determined to be unnecessary by extensive ESD testing. It is possible that other, less obvious ESD protection measures were put into place.

The 1LF5 CPU was redesigned as the 1LM2, which was functionally identical. All Voyagers started using the 1LH1 (with the display driver bonded out) in place of the 1LE2. At this point the HP-15C had two 1LH1 chips, one with the display driver bonded out and one without.

Later HP designed the 1LQ9 "SST" (Single Chip Ten-series) integrated CPU/ROM/RAM/display driver, reducing the chip count by one, so that all models but the HP-15C had only a single chip. The redesign changed the LCD display from the original 2:1 multiplexing, which required 52 pins on the R2D2 chip (50 segments and 2 backplanes) to 4:1 multiplexing which only requires 29 pins (25 segments and 4 backplanes). By virtue of the reduced number of necessary electrical contacts on the LCD, those contacts were made larger and placed on a coarser pitch, which may have improved manufacturability somewhat. However, the 4:1 multiplex results in a slightly worse contrast ratio, and segment "ghosting" is slightly more visible.

The 1LQ9 was replaced by the 1RR2. It is unclear whether there was an LCD change.

Most recently, the HP-12C was redesigned to run from a single coin cell rather than three button cells. (All other Voyager calculators had since been discontinued.) The chip was redesigned again as the 2AF1-0001 in order to operate at the lower voltage. The LCD was probably also changed; it might still have the same organization and contacts, but likely contains a different liquid crystal material optimized for the lower voltage.

The HP 12C Platinum is a complete redesign with little or no commonality with earlier Voyager models. It uses a Sunplus microcontroller with a 6502-compatible processor core.

In 2005 the HP 12C Platinum has been redesigned yet again using a different Sunplus chip (still 6502-based), and now uses ROM code that is derived from that of the HP 17BII+. These newer units are sold with the same product number, but can be visually distinguished from the earlier units by the presence of new parenthesis and backspace functions on the keyboard.

In 2006, the HP 12C Prestige was introduced in Brazil. It is equivalent to the new 12C Platinum with a bronze color scheme.

In 2009, HP did a "soft roll" of the 12C, introducing new hardware based on the Atmel AT91SAM7L128 microcontroller, using an ARM7DTMI core and flash memory. The new 12C runs a software simulation of the Nut processor at 50 to 150 times the speed of the earlier 12C models. This model is distinguishable from the earlier models by its larger battery compartment containing two coin cells. This is the first Voyager that is firmware upgradeable, via a proprietary serial connector in the battery compartment. HP has not make the necessary cable and firmware generally available.

In 2011, HP sold an HP 15c Limited Edition, based on the AT91SAM7L128.

The AT91SAM7L128 was obsoleted, and HP redesigned the 12C to use the Microchip ATSAM4LC2CA microcontroller.

In the process of dumping the ROMs of various Voyager calculators, I have taken some [internal photographs](#).

serial number range	model	CPU	ROM/RAM/Display Driver (R2D2)		PCB part number		LCD mux	battery
			main	aux (15C only)	keyboard	display		
	HP-10C	1LF5-0301	?				2:1	3 button
	HP-11C		?					
	HP-12C		1LE2-0308					
	HP-15C		1LE2-0321	1LH1-0302	00011-80002	1130-0566		
	HP-16C		1LE2-0322					
	HP-11C	1LF5-0301	1LE2-0307		00011-80012		2:1	3 button
	HP-12C		1LE2-0308		00011-80012			
	HP-15C		1LE2-0321	1LH1-0302				
	HP-16C		1LE2-0322		00011-80012			
	HP-11C		1LH1-0305					

	HP-12C	1LM2-0001	1LH1-0304			2:1	3 button
	HP-15C		1LH1-0306	1LH1-0302	00015-80001		
	HP-16C		?				
	HP-11C		1LH1-0305		00012-80006		
	HP-12C	1LM2-0001	1LH1-0304			2:1	3 button
	HP-15C		1LH1-0306	1LH1-0302	00012-80006		
	HP-16C		?				
28xx and later	HP-11C	1LQ9-0321 (SST)			5180-1516		
	HP-12C	1LQ9-0322 (SST)			5180-1516	4:1	3 button
	HP-15C	1LQ9-0325 (SST)	1LH1-0302		5180-1516		
	HP-16C	? (SST)					
- 3550 -	HP-12C	1RR2-0001			00012-80020	4:1	3 button
CN11500001 and up	HP-12C	2AF1-0001 (HP, Agilent)			0012C-80001 or 0012C-80440		1 coin
	HP-12C	2AF1-0002 (Marvell)					1 coin
	HP 12c Platinum	Sunplus SPLB20D2 (6502-compatible core)					1 coin
	HP 12c Platinum (v2)	GeneralPlus GPLB31A (unconfirmed) (6502-compatible core)					1 coin
	HP 12c Prestige	GeneralPlus GPLB31A (unconfirmed) (6502-compatible core)					1 coin
from 2008	HP 12C	Atmel AT91SAM7L128 (ARM7)					2 coin
2008	HP 15c+ (prototype)	Atmel AT91SAM7L128 (ARM7)					2 coin
2011	HP 15c Limited Edition	Atmel AT91SAM7L128 (ARM7)					2 coin
from May 2015	HP 12C	Microchip ATSAM4LC2CA (ARM Cortex-M4)					2 coin
		Microchip					2 coin, battery

from 2022	HP 12C	ATSAM4LC2CA (ARM Cortex-M4)		door with captive screw
2023	HP 15C CE	Microchip		2 coin, battery door with captive screw
		ATSAM4LC2CA (ARM Cortex-M4)		

## Notes:

From 1981 to 1991, Voyager calculators used three button cells, either alkaline (type A76, PX76A, LR44, or 675A) or silver oxide (type SR44, PX76, S76, or 357).

All HP 12c Plainum and Prestige calculators, and the HP 12C from 1991 to 2008, use a single lithium coin cell of type CR2032.

The ARM-based HP 12C calculators since 2008, and the HP 15c Limited Edition and Collector's Edition, use two CR2032 lithium coin cells.

It is possible that some Voyagers were manufactured using the 1LF5 CPU paired with a single 1LH1 ROM/RAM/display, or using the 1LM2 CPU paired with a 1LE2 ROM/display. Even if not manufactured this way, it is possible that a repaired calculator might have had the CPU replaced with an older or newer chip. However, I have not seen these combinations.

---

## Acknowledgements

Thanks to the following people for helping collect this information:

- Gerson Barbosa
- Luiz Cláudio
- Tony Duell
- David Huag
- Bruce Horrocks
- Geoff Quickfall
- Nelson Sicuro
- Randy Sloyer
- Ken Sumrall
- Katie Wasserman
- Bill Wiese

---

Last updated 2023-11-21

Copyright 2004-2023 Eric Smith

[eric@brouhaha.com](mailto:eric@brouhaha.com)



[check now](#)

[check now](#)