

HP-12C CE multi firmware: 12C, 15C (15.2) and 16C, with key filter, battery reading and stopwatch

Firmware file: `HP12c-multi-152-std16-E6E6.bin`

Size: 114,688 bytes

Flash at: `0x4000`, then press **RESET** on the cable

Checksum (g-ENTER-ON → 2, and the flasher's expected value):
E6E6

MD5: `bad38e61569f0a411a95e1b2e6723a56`

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This firmware is for the **HP-12C Collector's Edition**. The calculator can run as one of three calculators, and you choose which one from the hidden menu:

Mode	What it is
12	The HP-12C financial calculator
15.2	The HP-15C scientific calculator, large-memory (15.2) version
16	The HP-16C programmer's calculator, with its standard memory (as in the HP-16C handbook)

In every mode you also get:

- a **key filter** with adjustable press and release times (menu **7** and **8**);
- a **battery reading** (menu key **E**, the 12C **FV** key);
- a **stopwatch** with countdown (menu key **9**); the time can be put into **Last X**.

The keyboard print is the HP-12C's. In 15C and 16C mode each key does what the key in the same position does on an HP-15C or HP-16C. An HP-15C / HP-16C key map or overlay helps. In this guide, where a key's 12C print differs from the name used, the 12C print is given in brackets, for example **E** (12C **FV**).

Position (top row)	1st	2nd	3rd	4th	5th
Name in this guide	A	B	C	D	E
HP-12C key print	n	i	PV	PMT	FV

The 12C key **CLx** is the 15C / 16C backspace key (←).

1. Install

1. Back up the firmware and any programs and data you want to keep.
2. Connect the programming cable and put the calculator in programming mode, as your flasher explains.
3. Flash `HP12c-multi-152-std16-E6E6.bin` at address `0x4000` (full size, 114,688 bytes). Leave everything below `0x4000` alone.
4. Press **RESET** on the cable box. This is required before normal use.
5. Check the build: **g-ENTER-ON**, then **2**. The display shows `ChE--E6E6h` (both halves must match). Press **ON** to leave.

The calculator starts in **12C** mode. If anything looks wrong, flash your backup the same way and press **RESET** again.

2. The hidden menu

1. Turn the calculator **off**.
2. Hold **g** and **ENTER**, then press **ON**.
3. Release the keys. The display shows `1.L2.C3.H`.

Press **ON** to leave the menu at any time. The menu works the same in all three modes and uses the same key positions.

f-ENTER-ON is a different chord: it starts the USB connection mode used by VoyagerSave / VoyagerInterface. It does not open this menu.

Key	What it is
2	Checksum: <code>ChE--E6E6h</code> on this firmware. Press ENTER to see the date.
4	Choose the mode (12 / 15.2 / 16), see section 3
5	CPU speed: 4 → 12 → 48 (MHz)
6	Same-key lockout: 50 → 80 → 100 → 120 (ms)
7	Key press confirmation: 10 → 20 → 30 (ms)
8	Key release confirmation: 10 → 20 → 30 → 50 (ms)
9	Stopwatch, see section 7
E (12C FV)	Battery reading, see section 6

3. Switching mode

1. Turn the calculator **off**.
2. Hold **g** and **ENTER**, press **ON**, release. The display shows **1.L2.C3.H**.
3. Press **4**. The display shows **12 15.2 16**.
4. Press the key under the mode you want:

For	Press (HP-12C key print)	Key position
12	i (or PV)	top row, 2nd (or 3rd) key
15.2	PMT (or FV)	top row, 4th (or 5th) key
16	CHS (or 7)	top row, 6th (or 7th) key

Then the calculator shows **Pr Error**. Press any key. The new mode is ready.

Press **ON** instead of a mode key to leave without switching.

Switching always clears memory. Every switch, even to the mode you are already in, erases all programs, registers and settings of the calculator, exactly like a Continuous Memory reset. Back up anything you want to keep before you switch, and restore a backup only in the mode it was made in (see section 8). The menu settings (speed, key filter, stopwatch speed factor) are not affected.

What you see right after a switch:

Mode	Display after Pr Error and a key	Memory check
12	0.00	
15.2	0.0000	g MEM (12C g 9): 94 99 00-0
16	0 h	f MEM (12C f 0): P-0 r-101

In 15.2 mode, **94 99 00-0** is how the 15.2 version starts after any memory reset. To get the familiar layout with R0 to R.9 as data registers, key **19 f DIM (i)**. **g MEM** then shows **19 174 00-0**.

4. The three modes

12C mode: the HP-12C, as described in its handbook.

15C mode (15.2): the large-memory HP-15C (15.2), as described in the HP-15C Collector's Edition handbook: programs, SOLVE, $\int$, matrices and complex numbers. Holding **SST** shows the program line, and holding **g MEM** keeps the memory display up, as on the HP-15C.

16C mode: the HP-16C, with the memory sizes of the HP-16C handbook (Section 6). After a switch or a Continuous Memory reset the calculator is in hexadecimal, 2's complement, word size 16, with no program.

f MEM with no program	Display	Registers
word size 16	P-0 r-101	R0 to R100
word size 8	P-0 r-203	R0 to R202
word size 64	P-0 r-025	R0 to R24

STO or **RCL** of a register past the end gives **Error 3**, as in the handbook. Programs take storage away seven bytes at a time, as described there.

Built-in self-tests work in all three modes, as described in the HP-12C, HP-15C and HP-16C handbooks:

- Hold **ON**, press **x**, release: full self-test. The display shows **running**, then all segments (**-8,8,8,8,8,8,8,8,**) when the test passes. Press any key to clear it.
- Hold **ON**, press **÷**, release: keyboard test. Press every key once, left to right and row by row (press **ENTER** in both the third and the fourth row, and include **ON**, **f**, **g**, **STO** and **RCL** in the fourth row). At the end the display shows **12**, **15** or **16** for the current mode.

5. Speed and key settings (menu keys 5 to 8)

For each setting you change:

1. Open the menu (**g-ENTER-ON**).
2. Press the key once to see the current value; each further press of the same key moves to the next value.
3. Press **ON** to leave the menu and keep that value.

Change one setting per visit to the menu. The settings are kept while the batteries are in and are the same in all three modes. After the batteries are removed they return to the defaults:

Setting	Default
Speed (5)	4 MHz
Same-key lockout (6)	120 ms
Press confirmation (7)	10 ms
Release confirmation (8)	30 ms

Speed (5): **4** always runs at 4 MHz. **12** limits the fast paths to 12 MHz (idle stays at 4). **48** is the original CE behaviour (4 / 12 / 48 MHz as needed). Higher speeds use the battery faster.

How the keyboard is read: the keys are checked every 10 ms. A key counts as pressed only after it has stayed closed for the press confirmation time (menu **7**), and as released only after it has stayed open for the release confirmation time (menu **8**). A short bounce or dropout while a key is held is therefore ignored. In addition, the same key pressed again within the lockout time (menu **6**) is ignored. Longer times reject more bounce, but a key must then be held a little longer, or released a little more clearly, before it is pressed again. The times are the same at every speed.

6. Battery reading (menu key E)

In the menu, press **E** (12C **FV**). The calculator takes one reading and shows it, for example **bAtt 3.02** (volts). Press **E** again for a new reading. If a reading fails, the display shows **bAtt - - -**. The value is measured under load and may differ by about 0.1 V from a multimeter. Press **E** from the menu itself or from the screens of items 7 and 8; on the item 5 (speed) and item 6 (lockout) screens, press **ON** or another menu number first.

The low-battery ***** turns on after five low readings in a row (below 2.5 V, one reading per keypress) and off again after 80 good readings in a row.

7. Stopwatch (menu key 9)

Open the menu and press **9**. The display shows the time as hours, minutes, seconds and hundredths.

Key (12C key print)	Action
A (n)	Start / stop. In a countdown that has reached zero, A restarts the same length
B (i)	Freeze the display (the time keeps running); B again shows the live time
C (PV)	Countdown: type minutes, then C (example: 5 then C). Press A to start it
D (PMT)	Clear the time, the frozen display and any countdown
0 to 9	Type a number (shown on the display), up to four digits
CLx (backspace)	Delete the last digit typed

Key (12C key print)	Action
+ / –	Speed factor, see below
ON	Leave the stopwatch

Speed factor (+ / –): if your calculator's clock runs a little fast or slow, you can correct it. With no digits typed, + or – changes the factor by 0.010. With digits typed (hundredths of a percent), + sets 1 + digits/10000 and – sets 1 – digits/10000, to three decimals; for example 120 then + sets 1.012. The factor is shown briefly, for example SCF1.012. The range is 0.500 to 2.000 and the default is 1.000. The factor is kept while the batteries are in.

Any other key shows its key code briefly and does nothing.

The time goes to Last X. When you leave the stopwatch with **ON**, the time on the stopwatch (the remaining time in a countdown) is put into **Last X** as hours.minutes-seconds-hundredths, in the same H.MMSS form the calculators use for time (for example 1 min 23.45 s becomes 0.012345). Get it with:

Mode	Key to recall Last X	Notes
12C	g LSTx (12C g ENTER)	The stack is not otherwise changed
15.2	g LSTx	In 15C mode, g →H converts the value to decimal hours
16C	g LSTx	Only in FLOAT mode. In integer modes (HEX, DEC, OCT, BIN) Last X is not changed

Storing the time directly into a numbered register with **STO** is not available in this firmware; recall Last X and store it yourself.

Automatic off. If no key is pressed in the stopwatch for 5 minutes while it is stopped (12 hours while it is running), the stopwatch stops and leaves as if **ON** were pressed. The calculator's own automatic power-off then follows. Leaving with **ON** always stops the stopwatch; it does not run in the background.

8. Backups (VoyagerSave / USB)

1. Connect the USB cable and turn the calculator **off**.
2. Hold **f** and **ENTER**, press **ON**, release all keys. The calculator is now in USB connection mode for VoyagerSave / VoyagerInterface.

The backup is the calculator's 2 KB Continuous Memory image.

- Restore a backup only in the **same mode** of **this firmware** it was made in. A file made in another mode, or on another firmware, may not match this calculator's memory layout and can give wrong programs or registers.
- Switching mode clears memory, so back up first.

Display contrast: hold **ON** and press **+** or **–**, as on the standard calculator.

9. Quick checks after flashing

1. **g-ENTER-ON**, 2: **ChE - - E6E6h**. **ON**.
2. **g-ENTER-ON**, **E** (12C **FV**): **bAtt x.xx**. **ON**.
3. Switch to **16** (section 3), press a key after Pr Error, then **f MEM**: **P-0 r-101**.
4. Switch to **15.2**, press a key after Pr Error, then **g MEM**: **94 99 00-0**.
5. Switch back to **12**: **0.00**.
6. **g-ENTER-ON**, **9**, **A** (12C **n**): the stopwatch runs. **A** again to stop, **ON** to leave, then **g LSTx** shows the time.