

# *Apple IIc ROM Versions*

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The Apple IIc was in production between April 1984 until August 1988, and during this time accrued some minor changes. These modifications included three new ROM updates, a bug-fix correction to the original motherboard, a newly revised motherboard, and a slight cosmetic change to the external appearance of the machine.

## **Original IIc (ROM version 255)**

The initial ROM, installed in machines produced during the first year and a half of production, was 16 KB in size. The only device which could be connected to the disk port was (one) external 5¼-inch floppy drive; software could be booted from this external drive by typing the command: **PR#7**. The serial port did not mask incoming linefeed characters or support the XON/XOFF protocol, unlike all later firmware revisions to come. There was no self-test diagnostic present in this ROM, holding down the solid-Apple key during cold boot merely cycled unusual patterns on screen which served no useful purpose or indication of the machine's health.

## **Serial Port Timing Fix**

The original Apple IIc motherboard (manufactured between April and November 1984) derived the timing for its two serial ports through a 74LS161 TTL logic chip. It was later found that this method's timing was 3% slower than the minimum requirement specified and caused some third party (i.e. non-Apple) modems and printers, which operated at 1200 bits per second (baud) or faster, to function improperly. Slower serial devices operating at 300 baud or less were unaffected, as well as some faster devices which could tolerate the deviation. The solution to ensure all devices were compatible was to replace the TTL chip with an oscillator during manufacture. Apple would swap affected motherboards for users who could prove they had an incompatible serial device (e.g. a third party 1200-baud modem which presented problems; not all did). It is important to note the problem did not affect all owners; it was more or less a hit-or-miss issue depending on the specific device connected.

## **UniDisk 3.5 support (ROM version 0)**

This update, introduced November 1985, came in the form of an upgrade to the ROM firmware which doubled in size from 16 KB to 32 KB. The new ROM supported intelligent devices such as the Apple UniDisk 3.5-inch (800 KB) floppy drive, in addition to an external 5¼-inch floppy drive. A new selftest diagnostic was provided for testing built-in RAM and other signs of logic faults. The Mini-Assembler, absent since the days of the Apple II Plus, made a return, and new Monitor STEP and TRACE commands were added as well. The upgraded ROM added rudimentary support for an external AppleTalk networking device which was yet to be developed. When attempting to boot virtual slot 7, users would encounter the message APPLE TALK OFFLINE. The IIc however had no built-in networking capabilities, and no external device was ever released. The upgrade consisted of a single chip swap (and a trivial motherboard modification), which Apple provided free only to persons who purchased a UniDisk 3.5 drive. A small sticker with an icon of a 3½-inch floppy diskette was placed next to the existing 5¼-inch diskette icon above the floppy drive port indicating the machine had been upgraded.

## **Memory Expansion IIc (ROM version 3)**

Introduced in September 1986 simultaneously with the Apple IIGS, this model introduced a new motherboard, new keyboard and new color scheme ala the Apple IIc (Platinum); the mouse moved from Slot 4 to Slot 7. The original Apple IIc had no expansion options and required third-party cards to perform various hardware tricks. This could be done by removing the CPU and MMU chips and squeezing a special board into these sockets, which then used bank switching to expand memory (RAM). This was similar to the function of the auxiliary slot in the original Apple IIe. The new motherboard added a 34-pin socket for plugging in memory cards directly, which allowed for

the addressing of up to 1 megabyte of memory using Slinky-type memory cards. The onboard chip count was reduced from sixteen memory chips (64K—1) to four (64K—4). The new firmware removed the code for the cancelled AppleTalk networking device and replaced it with support for memory cards. Bumping out the non-supported AppleTalk functionality, memory now lived in virtual slot 4, and mouse support moved to slot 7. The new keyboard no longer had the rubber anti-spill mat and offered generally more tactile and responsive keys that felt more clicky. At the same time the color of the keyboard, floppy drive latch, and power supply cords changed from beige to light grey, which matched the new Platinum color scheme of the Apple IIGS. The case style, however, remained Snow White. Owners of the previous IIC model were entitled to a free motherboard upgrade if they purchased one of Apple's IIC memory expansion boards (they did not receive the new keyboard or the cosmetic changes).

#### **Memory Expansion fix (ROM version 4)**

In January 1988 a new ROM firmware update was issued to address bugs in the new memory expandable IIC. Changes included better detection of installed RAM chips, correction of a problem when using the serial modem port in terminal mode, and a bug fix for keyboard buffering. The ROM upgrade was available free of charge only to owners of the memory expansion IIC. This was the final change to the Apple IIC until superseded by the Apple IIC Plus (identified as ROM version 5).