

**Apple IIc Computer  
Firmware ERS Changes**  
●  
**RS-232 Printer and Mouse Port I/O**

**AUTHOR**

Apple Computer Inc.

**DOCUMENT DATES OF RECORD**

September 1983

( This page is not part of the original document )

# INTRODUCTION

## What is this document?

The Apple IIc Computer Firmware ERS Changes: RS-232 Printer and Mouse Port I/O document describes the programming commands for controlling these ports. This document was written by Apple's internal Apple IIc computer engineering team.

This information eventually was publicly documented by Apple Computer, Inc. in the Apple IIc Reference Manual.

Firmware is the read-only (ROM) memory stored in the Apple IIc.

ERS = Engineering Reference Specification.

Chels is one of many internal Apple Computer, Inc. code names for the Apple IIc computer. Other code names were: Lolly, ET (extra terrestrial), I Ib (b=book), I Ip (p=portable), Pippin, VLC (very low cost), Elf, Yoda, Teddy, Jason, Sherry, Zelda.

## Facts about this document

Author:

Apple Computer Inc

Document dates of record:

September 1983

Owner:

Organization:	DigiBarn Computer Museum	( <a href="http://www.digibarn.com">www.digibarn.com</a> )
Curator:	Bruce Damer	( <a href="http://www.damer.com/">http://www.damer.com/</a> )

This digital rendition of this document is available for non-commercial, educational and research purposes with the requirement to provide attribution and share-alike under the Creative Commons license provided on page 4.

All other uses require the agreement of the DigiBarn Computer Museum (contact through [www.digibarn.com](http://www.digibarn.com)).

( This page is not part of the original document )

## **PROPERTY STATEMENT**

This document is the property of the DigiBarn Computer Museum which is offering it under the following Creative Commons License found on page 4.

Under the terms of this license you must credit the DigiBarn Computer Museum and Apple Computer, Inc. if whole or part of this document is used for non-commercial, educational or research purposes. All other uses require the agreement of the DigiBarn Computer Museum (contact through [www.digibarn.com](http://www.digibarn.com)).

**( This page is not part of the original document )**



**Attribution - Non Commercial - No Derivative Works 2.5**

You are free:

- \* to copy, distribute, display, and perform the work

Under the following conditions:



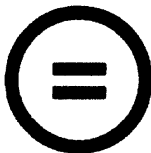
**Attribution.**

You must attribute the work in the manner specified by the author or licensor.



**Noncommercial.**

You may not use this work for commercial purposes.



**No Derivative Works.**

You may not alter, transform, or build upon this work.

- \* For any reuse or distribution, you must make clear to others the license terms of this work.
- \* Any of these conditions can be waived if you get permission from the copyright holder.

Your fair use and other rights are in no way affected by the above.

This is a human-readable summary of the Legal Code.

( This page is not part of the original document )

## **Disclaimer**

The Commons Deed is not a license. It is simply a handy reference for understanding the Legal Code (the full license) — it is a human-readable expression of some of its key terms. Think of it as the user-friendly interface to the Legal Code beneath. This Deed itself has no legal value, and its contents do not appear in the actual license.

Creative Commons is not a law firm and does not provide legal services. Distributing of, displaying of, or linking to this Commons Deed does not create an attorney-client relationship.

**( This page is not part of the original document )**

RECEIVED

Date: September 1, 1983  
 To: Distribution  
 From: Rich Williams  
 Subject: Chels firmware ERS changes

SEP 6 1983

Ken Victor

The RS232 printer and the Mouse specifications have been changed from revision #2 of the firmware of the ERS. Since the changes to the serial printer port are large, they are being sent out in a memo. A revision #3 of the ERS will be done and will be available in fine mail slots everywhere. The changes add new functions and capabilities to the firmware.

RS232 printer

The commands to the printer driver have been changed to make them closer to the Super serial card. The old functions were:

```

nnn    ;Where nnn is the (decimal) line width.
I      ;Enable video echo
J      ;Disable LF, Enable video echo
K      ;Disable LF
L      ;Set LF
M      ;Set LF, Enable video echo
N      ;Disable video echo
`x     ;Set command character to `x. ` = control. x = character.
    
```

The new commands are:

```

nnnB   ;Set the baud rate to nnn. nnn same as Super Serial card.
        1 = 50 baud
        2 = 75 baud
        3 = 109.92 baud
        4 = 134.58 baud
        5 = 150 baud
        6 = 300 baud
        7 = 600 baud
        8 = 1200 baud
        9 = 1800 baud
        10 = 2400 baud
        11 = 3600 baud
        12 = 4800 baud
        13 = 7200 baud
        14 = 9600 baud
        15 = 19200 baud
nnD    ;Set the data format. nnn same as SS card.
        0 = 8 data, 1 stop
        1 = 7 data, 1 stop
        2 = 6 data, 1 stop
        3 = 5 data, 1 stop
        4 = 8 data, 2 stop
        5 = 7 data, 2 stop
        6 = 6 data, 2 stop
        7 = 5 data, 2 stop
I      ;Enable video echo.
K      ;Disable LF.
L      ;Enable LF.
nnnN   ;Set line width to nnn. Disable video echo.
nnnP   ;Set parity bits to nnn. nnn same as SS card.
        0,2,4,6 = none
        1 = odd
        3 = even
    
```

```

5 = mark
7 = space
Z      ;Disable future commands.
nnn    ;Set line width to nnn.
'x     ;Set command char to 'x.

```

Special note for programs using the hardware directly

The 6502 processor does a false read before write when doing indexed write operations. When writing to the transmit register, the false read would read from the receive register causing the loss of data. This can be avoided by using a base address that is in a different page than the final address. For example, the usual way for a program to store to the transmit register is:

```

LDX    #$20    ;X = Slot 2 * 16
STA    $C088,X ;Causes false read

```

The way to avoid it is:

```

LDX    #$80    ;X = Slot 2 * 16 + $90
STA    $BFF8,X ;On a different page

```

#### Mouse

The mouse now has the added feature of allowing the user to specify the bounds for the mouse. The pointer for the routine, called CLAMP\_MOUSE, is at \$C417.

```

CLAMP_MOUSE - Sets the mouse window
Input: A = $00 for X axis, $80 for Y axis
       X = $C4
       Y = $40
       $478 = Low byte of minimum bound
       $4F8 = High byte of minimum bound
       $578 = Low byte of maximum bound
       $5F8 = High byte of maximum bound
Output: A,X,Y undefined

```

CLEAR\_MOUSE will set the mouse position to the upper left corner of the window instead of 0,0.