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Commodore Business Machines, Inc.
1200 Wilson Drive • West Chester, PA 19380

Commodore Business Machines, Limited
3470 Pharmacy Avenue • Agincourt, Ontario, M1W 3G3

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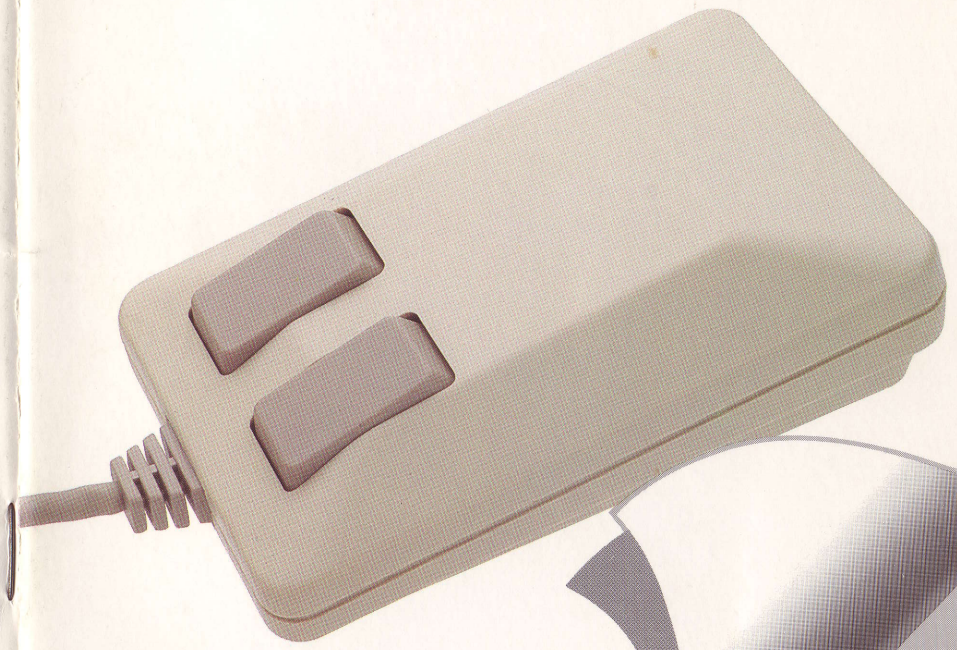
COMMODORE® 1351 MOUSE

user's guide



For Use With Commodore C64,® 64C,™ C128™ Computers

1351 MOUSE
USER'S GUIDE

USER'S MANUAL STATEMENT

WARNING:
This equipment has been certified to comply with the limits for a Class B computing device, pursuant to subpart J of Part 15 of the Federal Communications Commission's rules, which are designed to provide reasonable protection against radio and television interference in a residential installation. If not installed properly, in strict accordance with the manufacturer's instructions, it may cause such interference. If you suspect interference, you can test this equipment by turning it off and on. If this equipment does cause interference, correct it by doing any of the following:

- Reorient the receiving antenna or AC plug.
- Change the relative positions of the computer and the receiver.
- Plug the computer into a different outlet so the computer and receiver are on different circuits.

CAUTION: Only peripherals with shield-grounded cables (computer input-output devices, terminals, printers, etc.), certified to comply with Class B limits, can be attached to this computer. Operation with non-certified peripherals is likely to result in communications interference.

Your house AC wall receptacle must be a three-pronged type (AC ground). If not, contact an electrician to install the proper receptacle. If a multi-connector box is used to connect the computer and peripherals to AC, the ground must be common to all units.

If necessary, consult your Commodore dealer or an experienced radio-television technician for additional suggestions. You may find the following FCC booklet helpful: "How to Identify and Resolve Radio-TV Interference Problems." The booklet is available from the U.S. Government Printing Office, Washington, D.C. 20402, stock no. 004-000-00345-4.

First Printing, September 1986

ABOUT THIS MANUAL

Basically, this manual is divided into two parts. The first part includes the introduction, mouse cleaning, and tips for general care of the mouse. That part is for the user with mouse-compatible software, who wants simply to plug in the mouse and begin using it. The second part of the manual contains information needed by those who wish to develop software for the mouse.

INTRODUCTION

The Commodore 1351 Mouse™ is a controller designed for use with the Commodore 64® or Commodore 128™ computers. It features two buttons on the top, and a ball on the underside that is rolled upon a flat surface to manipulate onscreen activity.

The mouse has two modes of operation—joystick mode and proportional mode.

In joystick mode, the mouse emulates a joystick and can be used with all joystick-compatible software. In this mode, the left button is the fire button and the right button is usually ignored.

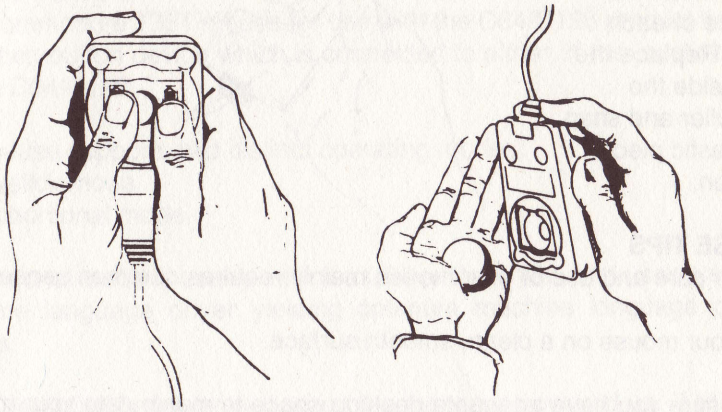
In proportional mode, the mouse uses a new technique to communicate mouse movement to the controlling application software. That requires the software to know the mouse is there and how to read it. For example, the GEOS™ operating system can use many different input drivers. One of them is the Commodore Mouse driver, which can be used with the 1351 in proportional mode.

The 1351 provides proportional mode so that applications can have a fast, responsive pointer that moves easily on the screen. Joystick mode acts as a fallback for those applications that don't have installable device drivers. Therefore, you can use the mouse as a joystick for older software, and take advantage of the benefits provided by proportional mode with newer applications.

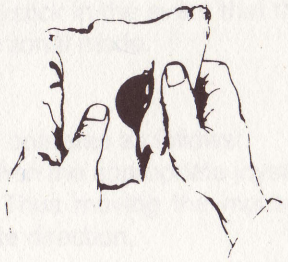
The mouse automatically powers up in proportional mode. To choose joystick mode, plug the mouse into either joystick port on the side of the computer and hold down the right button as the computer is powered up.

MOUSE CLEANING

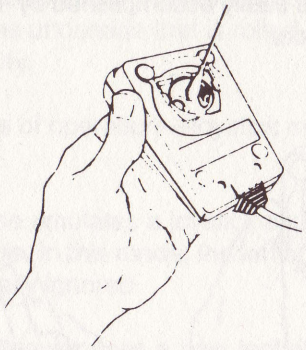
Since the ball of your mouse must roll freely to accurately manipulate the cursor (or whatever) on the screen, it's important that the ball remain free of dirt or debris. This is easily accomplished by sliding out the plastic piece holding the ball in place.



Remove the ball and wipe it off with a soft cloth, such as a handkerchief.



To remove any dirt or dust from the ball area, just blow gently into the opening. Around the top of the opening, there are three metal rollers. To clean these, take a cotton-tipped swab, moistened with head cleaning fluid or alcohol, and gently clean the surface of each roller. Replace the ball inside the controller and snap the plastic piece back on.



MOUSE TIPS

Proper care and use of your mouse mainly requires common sense.

Use your mouse on a clean, smooth surface.

Make sure you have adequate desktop space to manipulate your mouse, so you don't have to constantly pick up and reposition it.

Don't hold the mouse by its cord, or let the body of the mouse hang off the table.

PROPORTIONAL MOUSE DEVELOPER'S GUIDE

This section explains the theory of operation of the Commodore 1351 mouse and suggests software strategies for interfacing to it.

INTRODUCTION

The Commodore 1351 mouse for use with the C64/C128 product line is a small two-button device which is connected to either of the joystick ports on the C64/C128.

The mouse supports two distinct operating modes:

1) Joystick mode.
2) Proportional mode.

Proportional mode is usable with the C64 or the C128, and uses a special machine language driver yielding optimum machine language performance.

Mode selection is determined when the mouse is powered up. If the user depresses the right mouse button when the device is powered up, then the mouse will be in joystick mode.

If the user does not depress the right mouse button when the device is powered up, then the mouse will default to proportional mode.

It is the intent of joystick mode to provide a mode of operation where the mouse can be used as a joystick in the event that the software being run does not support the proportional mode.

JOYSTICK MODE

In joystick mode the mouse operates as follows:

1) If the mouse is moved, then the appropriate joystick lines are activated for a period of 20 ms. Thus moving the mouse is like pushing the joystick in the appropriate direction.
2) The left mouse button is mapped to what would be the fire button on a joystick.
3) The right mouse button is mapped into the SID POTX register. If the button is depressed then the SID POTX register will contain a number <$80. If the button is not depressed then SID POTX will contain a number >=$80.
4) See the section on SID REGISTER CAUTIONS.

Software interface:
For most applications, the interface for joystick mode of operation shall be just as any joystick driver, and the right button shall be ignored.

PROPORTIONAL MODE
In proportional mode the mouse operates as follows:

1) Mouse movement is tracked internally to the mouse. The position of the mouse MOD 64 is transmitted to the SID POTX and POTY registers every 512 us., requiring no software intervention.

   The POTX register is used to read the X position of the mouse and the POTY register is used to read the Y position of the mouse.

   The register contents are as follows:

Bit Position	7	6	5	4	3	2	1	0
POT Register	X	P5	P4	P3	P2	P1	P0	N

   where:

   X . . . . . is a don't care bit.
   P5-P0 . . . . . is the mouse position MOD 64.
   N . . . . . is a special (noise) bit (keep reading . . .).

2) The left mouse button is mapped to what would be the fire button on a joystick.
3) The right mouse button is mapped to what would be the UP direction on a joystick.

Software interface:

1) Because the left and right buttons appear as joystick lines, reading them from software is a trivial exercise in polling.

   Note that as with a joystick, the buttons will interfere with the keyboard map, and software should make some effort to distinguish between a point short in the keyboard matrix (i.e., a key being depressed), and a whole row or column being grounded (i.e., a joystick type of signal).

2) The position information is not difficult to handle. It fits ideally in the 60 hz interrupt routine (preferably at the beginning—see the section on SID REGISTER CAUTIONS).

   The strategy is as follows:

   1) Read the mouse position MOD 64.
   2) Determine if the mouse has moved by comparing the current position with a saved copy of the previous position.
   3) If the mouse has moved, then modify your pointer position appropriately.

   The mouse makes an effort to transmit a position to the SID register. Unfortunately, there is a single bit of noise in the transmission.

   For example, even if the mouse is still, it is possible for the POT register to vacillate between $80 and $7F. This would result in the mouse position as jittering between two points.

It is therefore necessary to consider the low order bit of the POT register before making any decision as to whether the mouse has moved.

All of this can be seen in the supplied mouse driver code.

SID REGISTER CAUTIONS:
In the C64 & C128, the SID pot lines are connected to both joystick ports. A 4066 analog switch is used to switch the POT lines between the two ports based on one of the keyboard scan lines. The means that the normal keyscan interrupt temporarily affects the values returned in the POT registers. Therefore, in order to perform reliable conversions, the POT lines must be connected to the mouse for a period of >1.6 ms before the value returned in the POT register is valid.

The best way to insure this is to wedge the mouse driver software into the IRQ handler prior to the polled keyscan. This more-or-less assures that the keyscan lines have been sufficiently stable before the POT register is read by the mouse drivers.

BASIC AND MACHINE LANGUAGE PROGRAMS FOR 1351 MOUSE AND C64

```
100 GOSUB140:GOSUB330
110 V=13*4096:POKEV+21,1:POKEV+39,1:POKEV+
    0,100:POKEV+1,100:POKEV+16,0
120 POKE2040,56:SYS12*4096+256
130 END
140 FORX=0TO129:READA$:GOSUB430:POKE49408+X,Y:NEXTX:
    RETURN
150 DATAAD,15,03,C9,C1,F0,19,08
160 DATA78,AD,14,03,8D,00,C0,AD
170 DATA15,03,8D,01,C0,A9,21,8D
180 DATA14,03,A9,C1,8D,15,03,28
190 DATA60,D8,AD,19,D4,AC,02,C0
200 DATA20,58,C1,8C,02,C0,18,6D
210 DATA00,D0,8D,00,D0,8A,69,00
220 DATA29,01,4D,10,D0,8D,10,D0
230 DATAAD,1A,D4,AC,03,C0,20,58
240 DATAC1,8C,03,C0,38,49,FF,6D
250 DATA01,D0,8D,01,D0,6C,00,C0
260 DATA8C,05,C0,8D,04,C0,A2,00
270 DATA38,ED,05,C0,29,7F,C9,40
```



```
280 DATAB0,07,4A,F0,12,AC,04,C0
290 DATA60,09,C0,C9,FF,F0,08,38
300 DATA6A,A2,FF,AC,04,C0,60,A9
310 DATA00,60
320 REM----------
330 FORX=0TO63:READA$:GOSUB430:POKE3584+X,Y:NEXTX:
    RETURN
340 DATAF8,00,00,90,00,00,B8,00
350 DATA00,DC,00,00,8E,00,00,07
360 DATA00,00,02,00,00,00,00,00
370 DATA00,00,00,00,00,00,00,00
380 DATA00,00,00,00,00,00,00,00
390 DATA00,00,00,00,00,00,00,00
400 DATA00,00,00,00,00,00,00,00
410 DATA00,00,00,00,00,00,00,00
420 REM----------
430 Y=1:Y1=0
440 IFLEFT$(A$,1)<>MID$("0123456789ABCDEF",Y,1)
    THENY=Y+1:GOTO440
450 Y1=(Y-1)*16:Y=1
460 IFRIGHT$(A$,1)<>MID$("0123456789ABCDEF",Y,1)
    THENY=Y+1:GOTO460
470 Y=Y1+Y-1:RETURN

READY.
```

```
                                1   ;
                                2   ;       C/64 mouse driver for BASIC 2.0 applications
                                3   ;
                                4
                =0314           5   iirq     = $0314
                =D000           6   vic      = $d000
                =D400           7   sid      = $d400
                =D419           8   potx     = sid+$19
                =D41A           9   poty     = sid+$1a
                               10
                =D000          11   vicdata = $d000          ; vic registers
                =D000          12   xpos     = vicdata+$00   ; low order x position
                =D001          13   ypos     = vicdata+$01   ; y position
                =D010          14   xposmsb = vicdata+$10   ; bit 0 is high order x position
                               15
                =C000          16                   *=$c000
                               17
C000            =C002          18   iirq2            *=*+2
C002            =C003          19   opotx            *=*+1
C003            =C004          20   opoty            *=*+1
C004            =C005          21   newvalue         *=*+1
C005            =C006          22   oldvalue         *=*+1
                               23
                =C100          24            * = $c100
                               25
C100    AD 0315                26   install lda iirq+1
C103    C9 C1                  27           cmp #>mirq
C105    F0 19                  28           beq 90$
C107    08                     29           php
C108    78                     30           sei
C109    AD 0314                31           lda iirq
C10C    8D C000                32           sta iirq2
C10F    AD 0315                33           lda iirq+1
C112    8D C001                34           sta iirq2+1
                               35
C115    A9 21                  36           lda #<mirq
C117    8D 0314                37           sta iirq
C11A    A9 C1                  38           lda #>mirq
C11C    8D 0315                39           sta iirq+1
                               40
C11F    28                     41           plp
C120    60                     42   90$     rts
```



```
                               43
C121    D8                     44   mirq    cld             ; just in case.....
C122    AD D419                45           lda potx        ; get delta values for x
C125    AC C002                46           ldy opotx
C128    20 C158                47           jsr movchk
C12B    8C C002                48           sty opotx
                               49
C12E    18                     50           clc             ; modify low order x position
C12F    6D D000                51           adc xpos
C132    8D D000                52           sta xpos
C135    8A                     53           txa
C136    69 00                  54           adc #$00
C138    29 01                  55           and #%00000001
C13A    4D D010                56           eor xposmsb
C13D    8D D010                57           sta xposmsb
                               58
C140    AD D41A                59           lda poty        ; get delta value for y
C143    AC C003                60           ldy opoty
C146    20 C158                61           jsr movchk
C149    8C C003                62           sty opoty
                               63
C14C    38                     64           sec             ; modify y position ( decrease y for increase in pot )
C14D    49 FF                  65           eor #$ff
C14F    6D D001                66           adc ypos
C152    8D D001                67           sta ypos
                               68
C155    6C C000                69   90$     jmp (iirq2)     ; continue w/ irq operation
```

```
C158   8C C005          70
C15B   8D C004          71    ; movchk
C15E   A2 00            72    ;       entry   y = old value of pot register
                        73    ;               a = currrent value of pot register
                        74    ;       exit    y = value to use for old value
                        75    ;               x,a = delta value for position
                        76
C158   8C C005          77    movchk  sty oldvalue    save old &  new values
C15B   8D C004          78            sta newvalue
C15E   A2 00            79            ldx #0          preload x w/ 0
                        80
C160   38               81            sec             a <=  mod64( new-old )
C161   ED C005          82            sbc oldvalue
C164   29 7F            83            and #%01111111
C166   C9 40            84            cmp #%01000000  if      > 0
C168   B0 07            85            bcs 50$
C16A   4A               86            lsr a                   a <= a/2
C16B   F0 12            87            beq 80$                 if      <> 0
C16D   AC C004          88            ldy newvalue                    y <= newvalue
C170   60               89            rts                             return
                        90
C171   09 C0            91    50$     ora #%11000000  else    or in high order bits
C173   C9 FF            92            cmp #$ff                if      <> -1
C175   F0 08            93            beq 80$
C177   38               94            sec                             a <= a/2
C178   6A               95            ror a
C179   A2 FF            96            ldx #$ff                        x <= -1
C17B   AC C004          97            ldy newvalue                    y <= newvalue
C17E   60               98            rts                             return
                        99
C17F   A9 00           100    80$     lda #0          a <= 0
C181   60              101            rts             return w/ y = old value
                       102
```



```
                    * * Cross Reference * *

Reference flags  (# = Definition, $ = Write, <BLANK> = Read)

Symbol     Value          References

IIRQ      =0314           5#      26      31      33      37$     39$
IIRQ2      C000           18#     32$     34$     69
INSTALL    C100           26#
MIRQ       C121           27      36      38      44#
MOVCHK     C158           47      61      77#
NEWVALUE   C004           21#     78$     88      97
OLDVALUE   C005           22#     77$     82
OPOTX      C002           19#     46      48$
OPOTY      C003           20#     60      62$
POTX      =D419           8#      45
POTY      =D41A           9#      59
SID       =D400           7#      8       9
VIC       =D000           6#
VICDATA   =D000           11#     12      13      14
XPOS      =D000           12#     51      52$
XPOSMSB   =D010           14#     56      57$
YPOS      =D001           13#     66      67$
```

BASIC AND MACHINE LANGUAGE PROGRAMS FOR 1351 MOUSE AND C128

```
100 GOSUB230:GOSUB420:SYS6144
120 BA=DEC("0A04"):POKE BA,1ORPEEK(BA)
130 SPRITE 1,1,2:MOVSPR 1,100,100
140 GRAPHIC1,1:CHAR 1,8,1,"1351 MOUSE PAINT"
150 DO:IF (JOY(1) AND 128) THEN GOSUB 180
160 IF (JOY(1) AND 1) THEN GRAPHIC 1,1:CHAR 1,8,1, "1351 MOUSE PAINT"
170 LOOP
180 X=RSPPOS(1,0)-25:Y=RSPPOS(1,1)-51:X=-X*(X>0):Y=-Y*(Y>0)
190 LOCATE X,Y: C=1-RDOT(2):DRAW C,X,Y
200 DO:X=RSPPOS(1,0)-25:Y=RSPPOS(1,1)-51:
    X=-X*(X>0):Y=-Y(Y>0)
210 DRAW C TO X,Y:LOOP WHILE JOY(1) AND 128 : RETURN
220 REM----------------------
230 FORX=0TO135:READA$:POKE6144+X,DEC(A$):NEXTX:
    RETURN
240 DATAAD,15,03,C9,18,F0,19,08
250 DATA78,AD,14,03,8D,F0,18,AD
260 DATA15,03,8D,F1,18,A9,21,8D
270 DATA14,03,A9,18,8D,15,03,28
```



```
280 DATA60,D8,AD,7E,11,D0,33,AD
290 DATA19,D4,AC,F2,18,20,5D,18
300 DATA8C,F2,18,18,6D,D6,11,8D
310 DATAD6,11,8A,69,00,29,01,4D
320 DATAE6,11,8D,E6,11,AD,1A,D4
330 DATAAC,F3,18,20,5D,18,8C,F3
340 DATA18,38,49,FF,6D,D7,11,8D
350 DATAD7,11,6C,F0,18,8C,F5,18
360 DATA8D,F4,18,A2,00,38,ED,F5
370 DATA18,29,7F,C9,40,B0,07,4A
380 DATAF0,12,AC,F4,18,60,09,C0
390 DATAC9,FF,F0,08,38,6A,A2,FF
400 DATAAC,F4,18,60,A9,00,60,00
410 REM----------------------
420 FORX=0TO63:READA$:POKEDEC("0E00")+X,DEC(A$):NEXTX:
    RETURN
430 DATAF8,00,00,90,00,00,B8,00
440 DATA00,DC,00,00,8E,00,00,07
450 DATA00,00,02,00,00,00,00,00
460 DATA00,00,00,00,00,00,00,00
470 DATA00,00,00,00,00,00,00,00
480 DATA00,00,00,00,00,00,00,00
490 DATA00,00,00,00,00,00,00,00
500 DATA00,00,00,00,00,00,00,00
```

```
                                1   ;
                                2   ;       C/128 mouse driver for BASIC 7.0 applications
                                3   ;
                                4
          =0314                 5   iirq     = $0314
          =D000                 6   vic      = $d000
          =D400                 7   sid      = $d400
          =D419                 8   potx     = sid+$19
          =D41A                 9   poty     = sid+$1a
                               10
          =117E                11   active   = $117e          ; if zero, then move sprite
                               12
          =11D6                13   vicdata = $11d6          ; basic's copy of vic register image
          =11D6                14   xpos     = vicdata+$00    ; low order x position
          =11D7                15   ypos     = vicdata+$01    ; y position
          =11E6                16   xposmsb = vicdata+$10    ; bit 0 is high order x position
                               17
          =18F0                18                    *=$18f0
                               19
18F0      =18F2                20   iirq2             *=*+2
18F2      =18F3                21   opotx             *=*+1
18F3      =18F4                22   opoty             *=*+1
18F4      =18F5                23   newvalue          *=*+1
18F5      =18F6                24   oldvalue          *=*+1
                               25
          =1800                26            * = $1800
                               27
1800      AD 0315              28   install lda iirq+1
1803      C9 18                29           cmp #>mirq
1805      F0 19                30           beq 90$
1807      08                   31           php
1808      78                   32           sei
1809      AD 0314              33           lda iirq
180C      8D 18F0              34           sta iirq2
180F      AD 0315              35           lda iirq+1
1812      8D 18F1              36           sta iirq2+1
                               37
1815      A9 21                38           lda #<mirq
1817      8D 0314              39           sta iirq
181A      A9 18                40           lda #>mirq
181C      8D 0315              41           sta iirq+1
                               42
181F      28                   43           plp
1820      60                   44   90$     rts
```



```
                               45
1821      D8                   46   mirq    cld              ; just in case.....
1822      AD 117E              47            lda active       ; if    basic is moving sprite
1825      D0 33                48            bne 90$          ;       let basic have it (why not ?)
1827      AD D419              49            lda potx         ; get delta values for x
182A      AC 18F2              50            ldy opotx
182D      20 185D              51            jsr movchk
1830      8C 18F2              52            sty opotx
                               53
1833      18                   54            clc              ; modify low order x position
1834      6D 11D6              55            adc xpos
1837      8D 11D6              56            sta xpos
183A      8A                   57            txa
183B      69 00                58            adc #$00
183D      29 01                59            and #%00000001
183F      4D 11E6              60            eor xposmsb
1842      8D 11E6              61            sta xposmsb
                               62
1845      AD D41A              63            lda poty         ; get delta value for y
1848      AC 18F3              64            ldy opoty
184B      20 185D              65            jsr movchk
184E      8C 18F3              66            sty opoty
                               67
1851      38                   68            sec              ; modify y position ( decrease y for increase in pot )
1852      49 FF                69            eor #$ff
1854      6D 11D7              70            adc ypos
1857      8D 11D7              71            sta ypos
                               72
185A      6C 18F0              73   90$      jmp (iirq2)      ; continue w/ irq operation
```

```
185D   8C 18F5
1860   8D 18F4
1863   A2 00

1865   38
1866   ED 18F5
1869   29 7F
186B   C9 40
186D   B0 07
186F   4A
1870   F0 12
1872   AC 18F4
1875   60

1876   09 C0
1878   C9 FF
187A   F0 08
187C   38
187D   6A
187E   A2 FF
1880   AC 18F4
1883   60

1884   A9 00
1886   60
```

```
74
75   ; movchk
76   ;       entry   y = old value of pot register
77   ;               a = currrent value of pot register
78   ;       exit    y = value to use for old value
79   ;               x,a = delta value for position
80
81   movchk  sty oldvalue    save old &  new values
82           sta newvalue
83           ldx #0          preload x w/ 0
84
85           sec             a <=  mod64( new-old )
86           sbc oldvalue
87           and #%01111111
88           cmp #%01000000  if      > 0
89           bcs 50$
90           lsr a                   a <= a/2
91           beq 80$                 if      <> 0
92           ldy newvalue                    y <= newvalue
93           rts                             return
94
95   50$     ora #%11000000  else    or in high order bits
96           cmp #$ff                if      <> -1
97           beq 80$
98           sec                             a <= a/2
99           ror a
100          ldx #$ff                        x <= -1
101          ldy newvalue                    y <= newvalue
102          rts                             return
103
104  80$     lda #0          a <= 0
105          rts             return w/ y = old value
106
```



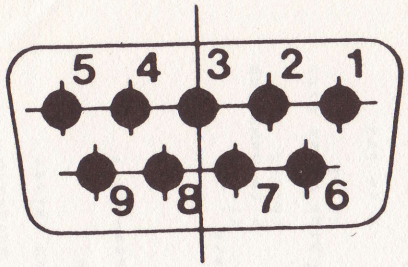
```
                    * * Cross Reference * *

Reference flags  (# = Definition, $ = Write, <BLANK> = Read)

Symbol     Value          References

ACTIVE    =117E           11#     47
IIRQ      =0314           5#      28      33      35      39$     41$
IIRQ2      18F0           20#     34$     36$     73
INSTALL    1800           28#
MIRQ       1821           29      38      40      46#
MOVCHK     185D           51      65      81#
NEWVALUE   18F4           23#     82$     92      101
OLDVALUE   18F5           24#     81$     86
OPOTX      18F2           21#     50      52$
OPOTY      18F3           22#     64      66$
POTX      =D419           8#      49
POTY      =D41A           9#      63
SID       =D400           7#      8       9
VIC       =D000           6#
VICDATA   =11D6           13#     14      15      16
XPOS      =11D6           14#     55      56$
XPOSMSB   =11E6           16#     60      61$
YPOS      =11D7           15#     70      71$
```

1350 MOUSE PIN-OUT



CONNECTION TABLE		
	FUNCTION	
PIN NO.	JOYSTICK MODE	PROPORTIONAL MODE
1	UP	RIGHT BUTTON
2	DOWN	UNUSED
3	LEFT	UNUSED
4	RIGHT	UNUSED
5	UNUSED	Y-POSITION
6	LEFT BUTTON	LEFT BUTTON
7	+5V	+5V
8	GND	GND
9	RIGHT BUTTON	X-POSITION