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
Copyright © 1986 by Commodore Electronics Limited
All rights reserved

This manual contains copyrighted and proprietary information. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior written permission of Commodore Electronics Limited.

Commodore 1351 Mouse is a trademark of Commodore Electronics Limited.

Commodore 64C is a trademark of Commodore Electronics Limited.

Commodore 128 is a trademark of Commodore Electronics Limited.

Commodore and Commodore 64 are registered trademarks of Commodore Electronics Limited.

GEOS is a trademark of Berkeley Softworks.

Copyright © 1986 by Commodore Electronics Limited

All rights reserved

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.

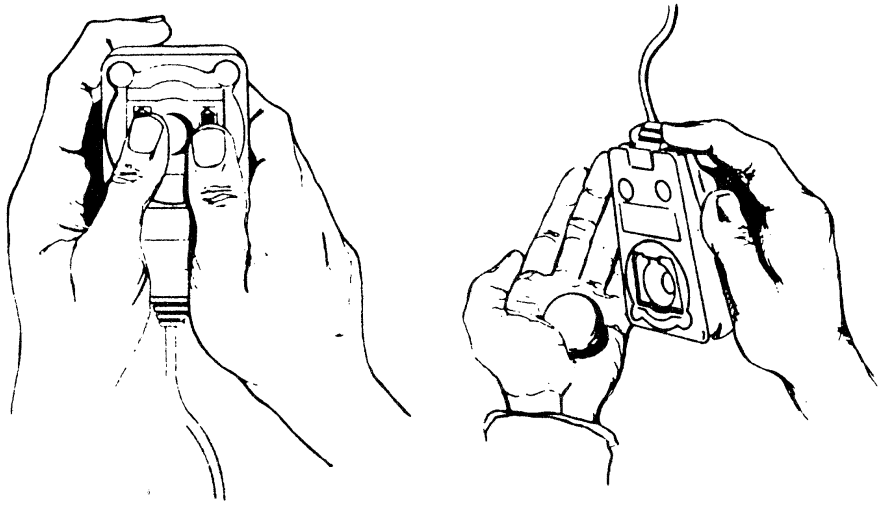
In proportional mode, the mouse uses a new technique to communicate mouse movement to the controlling application software. That requires the software to know the mouse is there and how to read it. For example, the GEOS™ operating system can use many different input drivers. One of them is the Commodore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

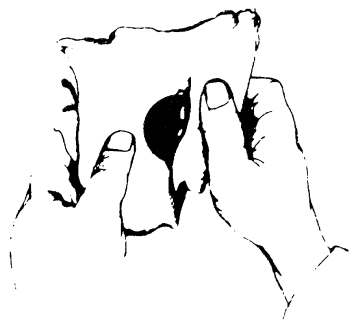
The mouse automatically powers up in proportional mode. To choose joystick mode, plug the mouse into either joystick port on the side of the computer and hold down the right button as the computer is powered up.

MOUSE CLEANING

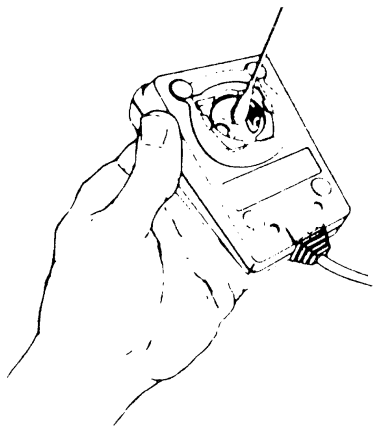
Since the ball of your mouse must roll freely to accurately manipulate the cursor (or whatever) on the screen, it's important that the ball remain free of dirt or debris. This is easily accomplished by sliding out the plastic piece holding the ball in place.



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
```

```
                                 ; movchk
                                 ;       entry   y = old value of pot register
                                 ;               a = currrent value of pot register
                                 ;       exit    y = value to use for old value
                                 ;               x,a = delta value for position

C158    8C C005                  movchk  sty oldvalue    save old &  new values
C15B    8D C004                          sta newvalue
C15E    A2 00                            ldx #0          preload x w/ 0

C160    38                               sec             a <=  mod64( new-old )
C161    ED C005                          sbc oldvalue
C164    29 7F                            and #%01111111
C166    C9 40                            cmp #%01000000  if      > 0
C168    B0 07                            bcs 50$
C16A    4A                               lsr a                   a <= a/2
C16B    F0 12                            beq 80$                 if      <> 0
C16D    AC C004                          ldy newvalue                    y <= newvalue
C170    60                               rts                             return

C171    09 C0                    50$     ora #%11000000  else    or in high order bits
C173    C9 FF                            cmp #$ff                if      <> -1
C175    F0 08                            beq 80$
C177    38                               sec                             a <= a/2
C178    6A                               ror a
C179    A2 FF                            ldx #$ff                        x <= -1
C17B    AC C004                          ldy newvalue                    y <= newvalue
C17E    60                               rts                             return

C17F    A9 00                    80$     lda #0          a <= 0
C181    60                               rts             return w/ y = old value
```

* * 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
```

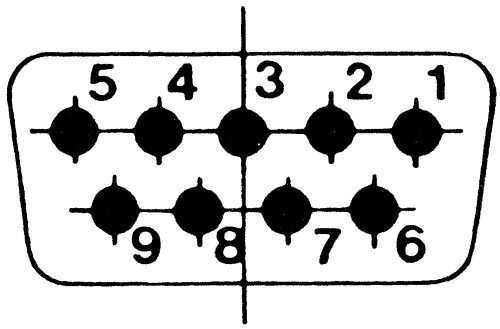
```
                        ; movchk
                        ;       entry   y = old value of pot register
                        ;               a = currrent value of pot register
                        ;       exit    y = value to use for old value
                        ;               x,a = delta value for position

185D   8C 18F5          movchk  sty oldvalue    save old &  new values
1860   8D 18F4                  sta newvalue
1863   A2 00                    ldx #0          preload x w/ 0

1865   38                       sec             a <=  mod64( new-old )
1866   ED 18F5                  sbc oldvalue
1869   29 7F                    and #%01111111
186B   C9 40                    cmp #%01000000  if      > 0
186D   B0 07                    bcs 50$
186F   4A                       lsr a                   a <= a/2
1870   F0 12                    beq 80$                 if      <> 0
1872   AC 18F4                  ldy newvalue                    y <= newvalue
1875   60                       rts                             return

1876   09 C0            50$     ora #%11000000  else    or in high order bits
1878   C9 FF                    cmp #$ff                if      <> -1
187A   F0 08                    beq 80$
187C   38                       sec                             a <= a/2
187D   6A                       ror a
187E   A2 FF                    ldx #$ff                        x <= -1
1880   AC 18F4                  ldy newvalue                    y <= newvalue
1883   60                       rts                             return

1884   A9 00            80$     lda #0          a <= 0
1886   60                       rts             return w/ y = old value
```

* * 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

COMMODORE®

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

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

312066-01

PRINTED IN USA