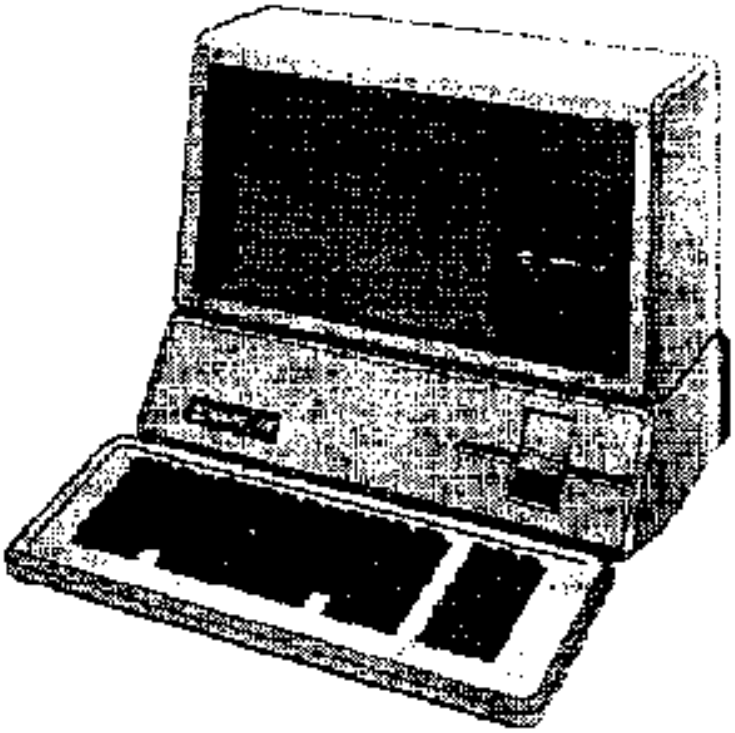
Apple /// Computer Technical Information

Apple /// RS-232 Serial Port Driver 1.30 Source Code Listing



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FORMATTED LISTING

```
; ##############################################################################################################
; #   PROJECT  :  Apple /// SOS RS-232 Driver 1.30 (6502 Assembly Source Code)
; #   FILE NAME:  RS232.text
; ##############################################################################################################

000001                  .TITLE       "SOS RS232 DRIVER"
000002
000003  ;
000004  ;               SOS RS232 DRIVER
000005  ;
000006  ;               (C)  APPLE COMPUTER 1981, 1982, 1983
000007  ;
000008  ;               Jim Trezzo     1/07/83
000009  ;
000010  ;               V 1.01  9/11/81 Clear NO_OUTPUT flag during reset
000011  ;               V 1.02  4/23/82 Don't drop DTR during reset and wait for
000012  ;                       DLYCNT before close.
000013  ;               V 1.30  1/07/83 Add comment field
000014  ;
000015
000016  DEVTYPE         .EQU         63                      ;I/O CHAR DEV
000017  SUBTYPE         .EQU         01                      ;DEV SUBTYPE
000018  MANID           .EQU         01                      ;MANUFACTURER ID-APPLE
000019  RELEASE         .EQU         1300                    ;RELEASE NUMBER-BCD FORMAT
000020
000021  ;
000022  ;  The macro SWITCH performs an N way branch based on a switch index.  The
000023  ;  maximum value of the switch index is 127 with bounds checking provided
000024  ;  as an option.  The macro uses the A and Y registers and alters the C,
000025  ;  Z, and N flags of the status register, but the X register is unchanged.
000026  ;
000027  ;               SWITCH  [index], [bounds], adrs_table, [*]
000028  ;
000029  ;       index   This is the variable that is to be used as the switch index.
000030  ;               If omitted, the value in the accumulator is used.
000031  ;
000032  ;      bounds   This is the maximum allowable value for index.  If index
000033  ;               exceeds this value, the carry bit will be set and execution
000034  ;               will continue following the macro.  If bounds is omitted,
000035  ;               no bounds checking will be performed.
000036  ;
000037  ;  adrs_table   This is a table of addresses (low byte first) used by the
000038  ;               switch.  The first entry corresponds to index zero.
000039  ;
000040  ;            *   If an asterisk is supplied as the fourth parameter, the
000041  ;               macro will push the switch address but will not exit to
000042  ;               it; execution will continue following the macro.  The
000043  ;               program may then load registers or set the status before
000044  ;               exiting to the switch address.
000045  ;
000046
000047                  .MACRO       SWITCH
000048                  .IF          "%1" <> ""              ;If PARM1 is present,
000049                  LDA          %1                      ;  Load A with switch index
000050                  .ENDC
000051                  .IF          "%2" <> ""              ;If PARM2 is present,
000052                  CMP          #%2+1                   ;  Perform bounds checking
000053                  BCS          $010                    ;  on switch index
000054                  .ENDC
000055                  ASL          A
000056                  TAY
000057                  LDA          %3+1,Y                  ;Get switch address from table
000058                  PHA                                  ;  and push onto stack
000059                  LDA          %3,Y
000060                  PHA
000061                  .IF          "%4" <> "*"             ;If PARM4 is omitted,
000062                  RTS                                  ;  Exit to code
000063                  .ENDC                                ;Otherwise, drop through
000064  $010            .ENDM
000065
000066  ;
000067  ;       INCREMENT WORD MACRO
000068  ;
000069
000070                  .MACRO       INW
000071                  INC          %1
000072                  BNE          $210
000073                  INC          %1+1
000074  $210            .ENDM
000075
000076  ;
000077  ;       INCREMENT ADDRESS MACRO
000078  ;
000079  ;               INCREMENTS 3 BYTE ADDRESS
000080  ;
000081
000082                  .MACRO       INCADR
000083                  INC          %1
000084                  BNE          $310
```

```
000085                  INC         %1+1
000086                  BNE         $310                    ;Bank overflow ?
000087                  SEC                                 ;Yes
000088                  ROR         %1+1
000089                  INC         %1+1+1400               ;Increment X byte
000090  $310            .ENDM
000091
000092                  .MACRO      SET_1MHZ
000093
000094                  LDA         E_REG
000095                  ORA         #BITON7                 ;Set 1 MHZ mode
000096                  STA         E_REG
000097                  .ENDM
000098
000099                  .MACRO      SET_2MHZ
000100
000101                  LDA         E_REG
000102                  AND         #07F                    ;Set 2 MHZ mode
000103                  STA         E_REG
000104                  .ENDM
000105
000106                  .PROC       RS232
000107
000108  ;
000109  ;       SOS GLOBAL DATA AND SUBROUTINES
000110  ;
000111  ALLOCSIR        .EQU        1913                    ;SOS interrupt allocation manager
000112  DEALCSIR        .EQU        1916                    ;SOS interrupt deallocation manager
000113  SYSERR          .EQU        1928                    ;SOS error return
000114  ;
000115  ;       SOS Error Codes
000116  ;
000117  XREQCODE        .EQU        20                      ;Invalid request code
000118  XCTLCODE        .EQU        21                      ;Invalid control/status code
000119  XCTLPARM        .EQU        22                      ;Invalid control/status param
000120  XNOTOPEN        .EQU        23                      ;Device not open
000121  XNOTAVIL        .EQU        24                      ;Device not available
000122  XNORESRC        .EQU        25                      ;Resource not available
000123  XBADOP          .EQU        26                      ;Invalid operation for device
000124  ;
000125  ;       HARDWARE I/O ADDRESSES
000126  ;
000127  ACIADATA        .EQU        0C0F0                   ;ACIA DATA REGISTER
000128  ACIASTAT        .EQU        0C0F1                   ;ACIA STATUS REGISTER
000129  ACIACMD         .EQU        0C0F2                   ;ACIA COMMAND REGISTER
000130  ACIACTL         .EQU        0C0F3                   ;ACIA CONTROL REGISTER
000131  E_REG           .EQU        0FFDF                   ;ENVIRONMENT REGISTER
000132  B_REG           .EQU        0FFEF                   ;BANK REGISTER
000133  ;
000134  ;       GENERAL EQUATES
000135  ;
000136  TRUE            .EQU        80
000137  FALSE           .EQU        00
000138  BITON0          .EQU        01
000139  BITON1          .EQU        02
000140  BITON2          .EQU        04
000141  BITON3          .EQU        08
000142  BITON4          .EQU        10
000143  BITON6          .EQU        40
000144  BITON7          .EQU        80
000145  ASC_LF          .EQU        0A
000146  ASC_FF          .EQU        0C
000147  ASC_CR          .EQU        0D
000148  ;
000149                  .PAGE
000150
000151                  .WORD       0FFFF
000152                  .WORD       73.
000153                  .ASCII      "(C) Apple Computer 1981, 1982, 1983.  "
000154                  .ASCII      "Built-in Serial Port RS-232 Driver."
000155
000156  ;---------------
000157  ;
000158  ;       DEVICE INFORMATION BLOCK
000159  ;
000160  ;---------------
000161  ;       DEVICE HEADER BLOCK
000162  ;---------------
000163
000164  IDBLK           .WORD       0000                    ;LINK TO NEXT DEVICE HANDLER
000165                  .WORD       RS_MAIN                 ;ENTRY POINT ADDRESS
000166                  .BYTE       6                       ;LENGTH OF DRIVER NAME
000167                  .ASCII      ".RS232         "       ;DRIVER NAME
000168                  .BYTE       80,00,00                ;DEV NUM, DEV SLOT, DEV UNIT
000169                  .BYTE       DEVTYPE                 ;DEVICE TYPE
000170                  .BYTE       SUBTYPE                 ;DEV SUBTYPE
000171                  .BYTE       00                      ;FUTURE USE
000172                  .WORD       0000                    ;BLOCK COUNT-NOT USED
000173                  .WORD       MANID                   ;MANUFACTURER ID
000174                  .WORD       RELEASE                 ;RELEASE NUMBER-BCD
000175
000176  ;---------------
000177  ;       DEVICE CONFIGURATION BLOCK
```

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000178  ;---------------
000179
000180  CNFGBLK         .WORD       12.                     ;CONFIGURATION BLOCK LENGTH
000181
000182  DCB             .BYTE       06                      ;BAUD RATE - 300
000183                  .BYTE       22                      ;Data format
000184  ;CTL - Hi nybble
000185  ;CMD - Lo nybble
000186                  .BYTE       00                      ;Carriage return delay
000187                  .BYTE       00                      ;Line feed delay
000188                  .BYTE       00                      ;Form feed delay
000189                  .BYTE       00                      ;00 - no protocol
000190  ;80 - XON/XOFF
000191  ;40 - ENQ/ACK
000192                  .BYTE       13                      ;Character to use as XOFF (or ENQ)
000193                  .BYTE       11                      ;Character to use as XON (or ACK)
000194                  .BYTE       223.                    ;Buffer level which triggers XOFF
000195                  .BYTE       132.                    ;Buffer level which triggers XON
000196                  .BYTE       80.                     ;Character count for ENQ/ACK
000197                  .BYTE       00                      ;Hardware handshake support
000198
000199  DCB_LN          .EQU        *-DCB
000200
000201                  .ASCII      "(C) Apple Computer Inc. 1983"
000202
000203                  .PAGE
000204  ;
000205  ;   SOS Device Handler Interface
000206  ;
000207
000208  SOSINT          .EQU        0C0
000209  REQCODE         .EQU        SOSINT+0                ;SOS request code
000210  BUFFER          .EQU        SOSINT+2                ;Buffer pointer
000211  REQCNT          .EQU        SOSINT+4                ;Requested count/Byte count
000212  CTLSTAT         .EQU        SOSINT+2                ;Control/status code
000213  CSLIST          .EQU        SOSINT+3                ;Control/status list pointer
000214  RETPTR          .EQU        SOSINT+8                ;Returned count pointer
000215
000216
000217  ;
000218  ;  Zero Page Storage
000219  ;
000220
000221  ZPGSAVE         .EQU        SOSINT+0A               ;Saved zero page storage
000222
000223  ZPGTEMP         .EQU        ZPGSAVE+00              ;Temporary zero page storage
000224
000225  OPRODPTR        .EQU        0E1                     ;Producer pointer
000226  ICSMRPTR        .EQU        0E2                     ;Consumer pointer
000227  RETCNT          .EQU        0E3                     ;Returned byte count word
000228
000229
000230  ;
000231  ;   Private Variable Storage
000232  ;
000233
000234  SIRADDR         .WORD       SIRTABLE
000235  SIRTABLE        .BYTE       1,0                     ;ACIA resource
000236                  .WORD       ACIAMIH
000237  MIHBANK         .BYTE       0
000238  SIRCOUNT        .EQU        *-SIRTABLE
000239
000240  OPENFLG         .BYTE       FALSE                   ;Device open flag
000241  IS_NEWLINE      .BYTE       FALSE                   ;Bit 7 (1=new line mode)
000242  NEWLINE         .BYTE       00                      ;Newline character
000243  IN_PROG         .BYTE       00                      ;Bit 7 (1=XOFF in progress)
000244  ;Bit 6 (1=XOFF needs to be sent)
000245  SEND_XON        .BYTE       00                      ;Bit 7 (1=XON needs to be sent)
000246  RTS_FALSE       .BYTE       00                      ;Bit 7 (1=RTS false)
000247  NO_OUTPUT       .BYTE       00                      ;Bit 7 (1=suspend output)
000248  DLYCNT          .BYTE       00                      ;Delay count for MIH
000249  BRK_CNT         .BYTE       00                      ;Interval count for Break signal
000250  CHAR_OUT        .BYTE       00                      ;Output character count for ENQ/ACK
000251  IN_PROG1        .BYTE       00                      ;Bit 7 (1=ENQ in progress)
000252
000253  ;
000254  ;       Device control parameters
000255  ;
000256
000257  CNTL_PARAM      .BYTE       15.                     ;List length
000258
000259  BAUD            .BYTE       00                      ;BAUD RATE
000260  DFORMAT         .BYTE       00                      ;Data format
000261  ;CTL - Hi nybble
000262  ;CMD - Lo nybble
000263  CRDELAY         .BYTE       00                      ;Carriage return delay
000264  LFDELAY         .BYTE       00                      ;Line feed delay
000265  FFDELAY         .BYTE       00                      ;Form feed delay
000266  PROTOCOL        .BYTE       00                      ;00 - none
000267  ;80 - XON/XOFF
000268  ;40 - ENQ/ACK
000269  CTLCHR1         .BYTE       00                      ;Character to use as XOFF (or ENQ)
000270  CTLCHR2         .BYTE       00                      ;Character to use as XON (or ACK)
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000271  MAXBUF          .BYTE       00                      ;Buffer level which triggers XOFF
000272  ;       (or RTS false)
000273  MINBUF          .BYTE       00                      ;Buffer level which triggers XON
000274  ;       (or RTS true)
000275  CHARCNT         .BYTE       00                      ;Character count for ENQ/ACK
000276  HDW_HSHAKE      .BYTE       00                      ;Hardware handshake
000277  ;       Bit 7 (1=enabled)
000278  RD_IMMEDIATE    .BYTE       00                      ;Bit 7 (1=read immediate mode)
000279  STAT_REG        .BYTE       00                      ;Status reg - saved from last interrupt
000280  STAT_LATCH      .BYTE       00                      ;Latched status bits - cleared by reset
000281  ;       or status request-1
000282  ;Bit 0 (1=parity error)
000283  ;Bit 1 (1=framing error)
000284  ;Bit 2 (1=overrun)
000285  ;Bit 5 (1=DCD went false)
000286  ;Bit 6 (1=DSR went false)
000287  ;Bit 7 (1=input character lost)
000288
000289  CNTL_LN         .EQU        *-CNTL_PARAM
000290
000291  ;
000292  ;       Data Buffers
000293  ;
000294
000295  OBUFCNT         .BYTE       0                       ;Local output buffer byte count
000296  OSPRODPTR       .BYTE       0                       ;Producer buffer pointer
000297  OCSMRPTR        .BYTE       0                       ;Consumer buffer pointer
000298  OLOCBUF         .BLOCK      0100,0                  ;Local output buffer
000299
000300  IBUFCNT         .BYTE       0                       ;Local input buffer byte count
000301  ISCSMRPTR       .BYTE       0                       ;Input consumer pointer
000302  IPRODPTR        .BYTE       0                       ;Input producer pointer
000303  ILOCBUF         .BLOCK      0100,0                  ;Local input buffer
000304
000305                  .PAGE
000306  ;---------------------------------------------------------------
000307  ;
000308  ;       RS232 DRIVER - MAIN ENTRY POINT
000309  ;
000310  ;---------------------------------------------------------------
000311
000312  RS_MAIN         .EQU        *
000313                  SWITCH      REQCODE,8,RS_REQSW
000314
000315
000316  BADREQ          LDA         #XREQCODE               ;Invalid request code
000317                  JSR         SYSERR
000318
000319
000320  NOTOPEN         LDA         #XNOTOPEN               ;Device not open
000321                  JSR         SYSERR
000322
000323
000324  RS_REQSW        .EQU        *                       ;RS232 driver request switch
000325                  .WORD       RS_READ-1
000326                  .WORD       RS_WRITE-1
000327                  .WORD       RS_STAT-1
000328                  .WORD       RS_CNTL-1
000329                  .WORD       BADREQ-1
000330                  .WORD       BADREQ-1
000331                  .WORD       RS_OPEN-1
000332                  .WORD       RS_CLOSE-1
000333                  .WORD       RS_INIT-1
000334
000335                  .PAGE
000336  ;---------------------------------------------------------------
000337  ;
000338  ;       RS232 Driver -- Initialization Request
000339  ;
000340  ;---------------------------------------------------------------
000341
000342  RS_INIT         .EQU        *
000343
000344                  LDA         #FALSE
000345                  STA         OPENFLG                 ;Set serial port to not open
000346                  CLC                                 ;Insure carry clear for load program
000347                  RTS
000348
000349                  .PAGE
000350  ;---------------------------------------------------------------------
000351  ;
000352  ;       RS232 Driver -- Open Request
000353  ;
000354  ;---------------------------------------------------------------------
000355
000356  RS_OPEN         .EQU        *
000357                  BIT         OPENFLG                 ;Serial Port open?
000358                  BPL         $010                    ;  No
000359                  LDA         #XNOTAVIL
000360                  JSR         SYSERR
000361
000362  $010            LDA         B_REG
000363                  AND         #0F
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000364                  STA         MIHBANK                 ;Set interrupt handler bank
000365                  LDA         #SIRCOUNT
000366                  LDX         SIRADDR
000367                  LDY         SIRADDR+1
000368                  JSR         ALLOCSIR                ;Allocate the ACIA
000369                  BCS         $020
000370
000371                  LDX         #DCB_LN-1               ;Copy Device Configuration Block
000372  ;  into device control parameters
000373
000374  $015            LDA         DCB,X
000375                  STA         CNTL_PARAM+1,X
000376                  DEX
000377                  BPL         $015
000378
000379                  LDA         #0
000380                  STA         IS_NEWLINE              ;Set newline mode to False
000381                  STA         NEWLINE                 ;Clear newline character
000382                  STA         RD_IMMEDIATE            ;Read immediate mode off
000383                  STA         IN_PROG                 ;XOFF in progress flag off
000384                  STA         SEND_XON                ;Send XON flag off
000385
000386                  JSR         CNTL00                  ;Set up ACIA
000387                  LDA         #TRUE                   ;  and clear STAT_REG, STAT_LATCH,
000388  ;  RTS_FALSE, NO_OUTPUT, CHAR_OUT,
000389  ;  IN_PROG1, DLYCNT and BRK_CNT
000390                  STA         OPENFLG                 ;Set serial port open
000391                  RTS
000392
000393  $020            LDA         #XNORESRC
000394                  JSR         SYSERR
000395                  .PAGE
000396  ;---------------------------------------------------------------------
000397  ;
000398  ;       RS232 Driver -- Close Request
000399  ;
000400  ;---------------------------------------------------------------------
000401
000402  RS_CLOSE        .EQU        *
000403                  ASL         OPENFLG                 ;Serial Port open?
000404                  BCS         $05                     ;  Yes
000405                  JMP         NOTOPEN
000406
000407  $05             LDA         OBUFCNT                 ;Wait for write completion
000408                  ORA         DLYCNT                  ; and delay complete
000409                  BNE         $05
000410
000411                  PHP                                 ;Save interrupt status
000412                  SEI                                 ;Disable interrupt system
000413                  SET_1MHZ
000414                  LDA         ACIACMD
000415                  AND         #0F0                    ;Disable Rcv/Xmit Interrupt
000416                  STA         ACIACMD                 ;DTR off, RTS off
000417                  LDA         ACIASTAT                ;Clear any prior interrupt
000418                  PLP                                 ;Restore interrupt status
000419
000420                  LDA         #SIRCOUNT
000421                  LDX         SIRADDR
000422                  LDY         SIRADDR+1
000423                  JSR         DEALCSIR                ;Deallocate the ACIA
000424                  RTS
000425
000426                  .PAGE
000427  ;---------------------------------------------------------------------
000428  ;
000429  ;       RS232 Driver -- Read Request
000430  ;
000431  ;---------------------------------------------------------------------
000432
000433  RS_READ         .EQU        *
000434                  BIT         OPENFLG                 ;Serial Port open?
000435                  BMI         $05
000436                  JMP         NOTOPEN
000437
000438  $05             LDA         ISCSMRPTR               ;Get CSMRPTR from driver storage
000439                  STA         ICSMRPTR                ;Put in temporary zero page
000440                  LDY         #00                     ;Prevent offset
000441                  STY         RETCNT                  ;Zero return count
000442                  STY         RETCNT+1
000443
000444                  LDA         #0FF                    ;One's complement count
000445                  EOR         REQCNT
000446                  STA         REQCNT
000447                  LDA         #0FF
000448                  EOR         REQCNT+1
000449                  STA         REQCNT+1
000450
000451  $010            INC         REQCNT                  ;Increment count
000452                  BNE         $015                    ;Is count zero ?
000453                  INC         REQCNT+1
000454                  BEQ         $099                    ;Yes, terminate
000455
000456  $015            LDA         IBUFCNT                 ;Is input buffer empty ?
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000457                  BNE         $020                    ;No, continue
000458                  BIT         RD_IMMEDIATE            ;Is read immediate mode set ?
000459                  BPL         $015                    ;No, loop until character received
000460                  BMI         $099                    ;Yes, terminate
000461
000462  $020            LDY         #0
000463                  LDX         ICSMRPTR
000464                  LDA         ILOCBUF,X               ;Get char from local input buffer
000465                  STA         (BUFFER),Y              ;Send to user buffer
000466                  PHA                                 ;Save character on stack
000467                  INCADR      BUFFER                  ;Increment addr - user buffer pointer
000468                  INC         ICSMRPTR
000469                  DEC         IBUFCNT
000470                  INW         RETCNT
000471
000472                  LDA         MINBUF                  ;Check if below min buffer level
000473                  CMP         IBUFCNT                 ;       (IBUFCNT < MINBUF ?)
000474                  BCC         $025                    ;No, continue
000475
000476                  BIT         IN_PROG                 ;Yes, XOFF in progress ?
000477                  BMI         $022                    ;Yes, send XON
000478
000479                  BIT         RTS_FALSE               ;Is RTS false ?
000480                  BPL         $025                    ;No, continue
000481
000482                  PHP                                 ;Save interrupt status
000483                  SEI                                 ;Disable interrupt system
000484                  SET_1MHZ                            ;Yes, set 1 MHZ mode
000485                  LDA         ACIACMD                 ;Set RTS true and
000486                  AND         #0F2                    ;  enable xmit interrupt
000487                  ORA         #05
000488                  STA         ACIACMD                 ;Set to [xxxx01x1]
000489                  LDA         #0
000490                  STA         RTS_FALSE               ;Clear RTS_FALSE
000491                  SET_2MHZ                            ;Set 2 MHZ mode
000492                  PLP                                 ;Restore interrupt status
000493                  JMP         $025
000494
000495  $022            LDA         #80                     ;Send XON
000496                  STA         SEND_XON                ;Set flag
000497                  JSR         PRIME_OUT               ;Prime output routine
000498
000499  $025            PLA                                 ;Retrieve character from stack
000500                  BIT         IS_NEWLINE              ;Is newline mode set ?
000501                  BPL         $010                    ;No, get next char
000502                  CMP         NEWLINE                 ;Yes, is char terminator ?
000503                  BEQ         $099                    ;If yes, terminate
000504                  JMP         $010                    ;No, get next char
000505
000506  $099            LDY         #0
000507                  LDA         ICSMRPTR                ;Terminate
000508                  STA         ISCSMRPTR               ;Save pointer
000509
000510                  LDA         RETCNT                  ;Get count of returned bytes
000511                  STA         (RETPTR),Y              ;Send to user
000512                  LDA         RETCNT+1
000513                  INY
000514                  STA         (RETPTR),Y
000515
000516                  RTS                                 ;Return to user
000517
000518                  .PAGE
000519  ;---------------------------------------------------------------------
000520  ;
000521  ;       RS232 Driver -- Write Request
000522  ;
000523  ;---------------------------------------------------------------------
000524
000525  RS_WRITE        .EQU        *
000526                  BIT         OPENFLG                 ;Serial Port open?
000527                  BMI         $05
000528                  JMP         NOTOPEN
000529
000530
000531  $05             LDA         OSPRODPTR               ;Get PRODPTR from driver storage
000532                  STA         OPRODPTR                ;Put in temporary zero page
000533
000534                  LDA         #0FF                    ;One's complement count
000535                  EOR         REQCNT
000536                  STA         REQCNT
000537                  LDA         #0FF
000538                  EOR         REQCNT+1
000539                  STA         REQCNT+1
000540
000541  $010            INC         REQCNT                  ;Increment count
000542                  BNE         $030                    ;Is count zero ?
000543                  INC         REQCNT+1
000544                  BNE         $030                    ;No
000545
000546                  JSR         PRIME_OUT               ;Prime consumer
000547                  LDA         OPRODPTR                ;Save producer pointer in driver
000548                  STA         OSPRODPTR
000549                  RTS                                 ;Return to user
```

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000550
000551  $030            LDX         OBUFCNT                 ;Is local output buffer full ?
000552                  INX
000553                  BNE         $040                    ;No
000554
000555                  JSR         PRIME_OUT               ;Local buffer is full, prime consumer
000556                  JMP         $030
000557
000558  $040            LDY         #00
000559                  LDA         (BUFFER),Y              ;Get character from user buffer
000560                  INCADR      BUFFER                  ;Increment addr - user buffer ptr
000561
000562                  LDX         OPRODPTR                ;Get producer pointer
000563                  STA         OLOCBUF,X               ;Store character in local buffer
000564                  INC         OPRODPTR                ;Advance local buffer
000565                  INC         OBUFCNT                 ;Advance count
000566                  BNE         $010                    ;Branch always taken
000567
000568
000569                  .PAGE
000570  ;---------------------------------------------------------------------
000571  ;
000572  ;       RS232 Driver -- Status Request
000573  ;
000574  ;---------------------------------------------------------------------
000575
000576  RS_STAT         .EQU        *
000577                  BIT         OPENFLG                 ;Serial Port open?
000578                  BMI         $05
000579                  JMP         NOTOPEN
000580  $05             SWITCH      CTLSTAT,3,STATSW
000581
000582
000583  BADCTL          LDA         #XCTLCODE               ;Invalid control code
000584                  JSR         SYSERR
000585
000586
000587  STATSW          .WORD       STAT00-1
000588                  .WORD       STAT01-1
000589                  .WORD       STAT02-1
000590                  .WORD       STAT03-1
000591
000592  STAT00          RTS                                 ;0 -- NOP
000593
000594
000595  STAT01          LDY         #0                      ;1 -- Retrieve device control
000596  ;  parameters (including RD_IMMEDIATE
000597  ;     STAT_REG and STAT_LATCH)
000598                  LDA         (CSLIST),Y
000599                  CMP         CNTL_PARAM              ;Check for room in status list
000600                  BCS         $01                     ;  >= OK
000601
000602                  LDA         #XCTLPARM               ;  < NG
000603                  JSR         SYSERR
000604
000605  $01             LDY         #CNTL_LN-1
000606                  PHP                                 ;Save interrupt status
000607                  SEI                                 ;Disable interrupt system
000608
000609  $05             LDA         CNTL_PARAM,Y
000610                  STA         (CSLIST),Y
000611                  DEY
000612                  BPL         $05
000613
000614                  INY
000615                  STY         STAT_LATCH              ;Clear status latch bits
000616                  PLP                                 ;Restore interrupt status
000617                  RTS
000618
000619
000620  STAT02          LDY         #0                      ;2 -- Get newline character
000621
000622                  LDA         IS_NEWLINE
000623                  STA         (CSLIST),Y
000624                  INY
000625                  LDA         NEWLINE
000626                  STA         (CSLIST),Y
000627
000628                  RTS
000629
000630  STAT03          LDY         #0                      ;3 -- Retrieve driver buffer info
000631
000632                  LDA         #0FF                    ;Output buffer size
000633                  JSR         CNTOUT
000634                  LDA         OBUFCNT                 ;Number of chars in output buffer
000635                  JSR         CNTOUT
000636                  LDA         #0FF                    ;Input buffer size
000637                  JSR         CNTOUT
000638                  LDA         IBUFCNT                 ;Number of chars in input buffer
000639                  JSR         CNTOUT
000640
000641                  RTS
000642
```

```
000643  CNTOUT          STA         (CSLIST),Y
000644                  INY
000645                  LDA         #0                      ; high byte (0)
000646                  STA         (CSLIST),Y
000647                  INY
000648
000649                  RTS
000650
000651                  .PAGE
000652  ;---------------------------------------------------------------------
000653  ;
000654  ;       RS232 Driver -- Control Request
000655  ;
000656  ;---------------------------------------------------------------------
000657
000658  RS_CNTL         .EQU        *
000659                  BIT         OPENFLG                 ;Serial Port open?
000660                  BMI         $05                     ;  Ok
000661                  JMP         NOTOPEN
000662  $05             SWITCH      CTLSTAT,3,CNTLSW
000663                  JMP         BADCTL
000664
000665
000666  CNTLSW          .WORD       CNTL00-1
000667                  .WORD       CNTL01-1
000668                  .WORD       CNTL02-1
000669                  .WORD       CNTL03-1
000670
000671
000672  CNTL00          .EQU        *                       ;0 -- Reset device
000673
000674                  BIT         IN_PROG                 ;XOFF in progress ?
000675                  BPL         $020                    ;No, continue
000676
000677                  LDA         #80                     ;Yes, send XON
000678                  STA         SEND_XON                ;Set flag
000679                  JSR         PRIME_OUT               ;Prime output routine
000680
000681  $015            BIT         SEND_XON                ;Wait until XON gets out
000682                  BMI         $015
000683
000684  $020            PHP                                 ;Save interrupt status
000685                  SEI                                 ;Disable interrupt system
000686                  LDA         BAUD                    ;Validate data rate
000687                  AND         #00F
000688                  STA         BAUD
000689
000690                  SET_1MHZ
000691
000692                  LDA         #0
000693                  STA         IBUFCNT                 ;Zero Input Buffer count
000694                  STA         OBUFCNT                 ;Zero Output Buffer count
000695                  STA         DLYCNT                  ;Zero delay count
000696                  STA         BRK_CNT                 ;Zero interval count
000697
000698                  STA         OSPRODPTR               ;Zero pointers
000699                  STA         OCSMRPTR
000700                  STA         ISCSMRPTR
000701                  STA         IPRODPTR
000702
000703                  STA         RTS_FALSE               ;Clear RTS false flag
000704                  STA         NO_OUTPUT               ;Clear suspend output flag
000705                  STA         CHAR_OUT                ;Zero output character count
000706                  STA         IN_PROG1                ;ENQ in progress flag off
000707                  STA         STAT_LATCH              ;Clear status latch bits
000708                  LDA         ACIASTAT
000709                  STA         STAT_REG                ;Save status reg
000710
000711                  LDA         DFORMAT                 ;Validate data format
000712                  AND         #0E0
000713                  ORA         #BITON4                 ;Set receiver clock source to internal
000714                  ORA         BAUD
000715                  LDX         #03
000716                  CPX         BAUD                    ;If data rate  is 110 baud
000717                  BNE         $025
000718
000719                  ORA         #BITON7                 ;  force two stop bits
000720
000721  $025            STA         ACIACTL                 ;Set up ACIA control register
000722                  LDA         DFORMAT
000723                  ASL         A
000724                  ASL         A
000725                  ASL         A
000726                  ASL         A
000727                  AND         #0E0
000728                  ORA         #09                     ;Xmit disabled, Rcv enabled
000729  ;DTR and RTS on
000730                  STA         ACIACMD                 ;Set up ACIA command register
000731
000732                  PLP                                 ;Restore interrupt status
000733                  RTS
000734
000735
```

```
000736  CNTL01          LDY         #0                      ;1 -- Load device control parameters
000737  ;  except STAT_REG and STAT_LATCH
000738                  LDA         (CSLIST),Y
000739                  CMP         CNTL_PARAM              ;Check length of control list
000740                  BEQ         $01                     ;  = OK
000741
000742                  LDA         #XCTLPARM               ;   NG
000743                  JSR         SYSERR
000744
000745  $01             LDY         #CNTL_LN-3
000746
000747  $05             LDA         (CSLIST),Y
000748                  STA         CNTL_PARAM,Y
000749                  DEY
000750                  BPL         $05
000751
000752                  JSR         CNTL00                  ;Set up ACIA
000753
000754                  RTS
000755
000756  CNTL02          .EQU        *                       ;2 -- Set New Line Character
000757
000758                  LDY         #0
000759                  LDA         (CSLIST),Y
000760                  STA         IS_NEWLINE
000761                  INY
000762                  LDA         (CSLIST),Y
000763                  STA         NEWLINE
000764
000765                  RTS
000766
000767  CNTL03          .EQU        *                       ;3 -- Transmit Break
000768
000769  $05             LDA         OBUFCNT                 ;Wait for write completion
000770                  BNE         $05
000771
000772                  TAY
000773                  LDA         (CSLIST),Y              ;Get number of break intervals
000774                  BMI         $050                    ;Too large, return
000775                  BEQ         $050                    ;Zero, return
000776                  CMP         #101.                   ;Check if > 100 (23.3 sec)
000777                  BCS         $050                    ;Too large, return
000778
000779                  STA         BRK_CNT                 ;Save interval count
000780                  PHP                                 ;Save interrupt status
000781                  SEI                                 ;Disable interrupt system
000782                  SET_1MHZ                            ;Set 1 MHz mode
000783                  LDA         ACIACMD                 ;Transmit Break
000784                  ORA         #0C
000785                  STA         ACIACMD                 ;Set to [xxxx11xx]
000786                  LDA         #0
000787                  STA         RTS_FALSE               ;Clear RTS false
000788                  PLP                                 ;Restore interrupt status
000789
000790  $010            LDY         #181.                   ;This double loop takes 233 ms
000791                  LDX         #0                      ;  in 1 MHz mode
000792  $015            DEX
000793                  BNE         $015
000794                  DEY
000795                  BNE         $015
000796
000797                  DEC         BRK_CNT                 ;Loop for interval count
000798                  BNE         $010
000799
000800                  JSR         PRIME_OUT               ;Prime output routine
000801
000802  $050            RTS
000803
000804                  .PAGE
000805  ;---------------------------------------------------------------------
000806  ;
000807  ;       ACIA MASTER INTERRUPT HANDLER
000808  ;
000809  ;---------------------------------------------------------------------
000810
000811  ACIAMIH         .EQU        *
000812
000813                  STY         STAT_REG                ;Save current status reg
000814
000815                  TYA
000816                  AND         #BITON3                 ;Check receiver data reg full
000817                  BEQ         $010                    ;No, continue
000818
000819                  TYA                                 ;Input interrupt
000820                  AND         #67
000821                  ORA         STAT_LATCH
000822                  STA         STAT_LATCH              ;Latch status bits
000823                  JMP         RS_IN
000824
000825  $010            TYA                                 ;Treat as output interrupt
000826                  AND         #60
000827                  ORA         STAT_LATCH
000828                  STA         STAT_LATCH              ;Latch status bits
```

```
000829                  JMP         RS_OUT
000830
000831  RS_IN           .EQU        *                   ;Receive next character
000832
000833                  SET_1MHZ
000834                  LDX         ACIADATA            ;Read character
000835                  SET_2MHZ
000836                  TXA
000837
000838                  BIT         PROTOCOL            ;Is XON/XOFF protocol mode set?
000839                  BPL         $016                ;No, continue
000840
000841                  CMP         CTLCHR1             ;Yes, check for XOFF
000842                  BNE         $010                ;No
000843
000844                  LDA         #TRUE               ;Yes, suspend output
000845                  STA         NO_OUTPUT
000846                  JMP         RS_OUT
000847
000848  $010            CMP         CTLCHR2             ;Check for XON
000849                  BNE         $015                ;No
000850
000851                  LDA         #FALSE              ;Yes, resume output
000852                  STA         NO_OUTPUT
000853                  BEQ         RS_OUT              ;Always taken
000854
000855  $015            LDX         IBUFCNT             ;Check if max buffer level exceeded
000856                  CPX         MAXBUF              ;       (IBUFCNT >= MAXBUF ?)
000857                  BCC         $020                ;No, continue
000858
000859                  BIT         IN_PROG             ;Yes, check if XOFF in progress
000860                  BMI         $020                ;Yes, continue
000861
000862                  LDX         #BITON6             ;No, set XOFF needs to be sent
000863                  STX         IN_PROG
000864                  BNE         $020                ;Branch always taken
000865
000866  $016            BVC         $017                ;Is ENQ/ACK protocol mode set?
000867
000868                  CMP         CTLCHR2             ;Yes, check for ACK
000869                  BNE         $020                ;No, continue
000870
000871                  LDA         CHARCNT             ;Yes, reset output char count
000872                  STA         CHAR_OUT
000873                  LDA         #0
000874                  STA         IN_PROG1            ;Clear ENQ in progress
000875                  BEQ         RS_OUT              ;Always taken
000876
000877  $017            BIT         HDW_HSHAKE          ;Is Hardware handshake enabled?
000878                  BPL         $020                ;No, continue
000879
000880                  LDX         IBUFCNT             ;Check if max buffer level exceeded
000881                  CPX         MAXBUF              ;       (IBUFCNT >= MAXBUF ?)
000882                  BCC         $020                ;No, continue
000883
000884                  LDX         BRK_CNT             ;Check for Break in progress
000885                  BNE         $020                ;Yes, continue (can't change RTS)
000886
000887                  PHA                             ;No, save character on stack
000888                  LDA         #BITON7
000889                  STA         RTS_FALSE
000890                  SET_1MHZ
000891                  LDA         ACIACMD             ;Set RTS to false
000892                  AND         #0F3                ;  Xmit interrupt will be disabled
000893                  STA         ACIACMD             ;    ACIA set to [xxxx00xx]
000894                  SET_2MHZ
000895                  PLA                             ;Retrieve character from stack
000896
000897  $020            LDX         IBUFCNT             ;Is buffer full ?
000898                  INX
000899                  BNE         $025                ;No, continue
000900
000901                  LDA         #BITON7             ;Yes, latch char lost bit
000902                  ORA         STAT_LATCH
000903                  STA         STAT_LATCH
000904                  BMI         RS_OUT              ;Always taken
000905
000906  $025            LDX         IPRODPTR            ;Address in local buffer to store data
000907                  STA         ILOCBUF,X           ;Store char in local input buffer
000908                  INC         IBUFCNT
000909                  INC         IPRODPTR
000910
000911  RS_OUT          .EQU        *                   ;Output next character
000912
000913                  LDA         BRK_CNT             ;Check for Break in progress
000914                  BEQ         $001                ;No, continue
000915                  JMP         RETURN              ;Yes, return
000916
000917  $001            BIT         HDW_HSHAKE          ;Hardware handshake mode enabled ?
000918                  BPL         $003                ;No, continue
000919
000920                  BIT         RTS_FALSE           ;Yes, check for RTS false
000921                  BPL         $002                ;RTS true, continue
```

```
000922                  JMP         RETURN                  ;RTS false, return
000923
000924  $002            LDA         STAT_REG                ;Check DSR and DCD status
000925                  AND         #60
000926                  BEQ         $003                    ;DSR and DCD true, continue
000927
000928                  LDA         DLYCNT                  ;DSR or DCD false, disable xmit int
000929                  BNE         $011                    ;  unless delay in progress
000930                  JMP         D_XMIT
000931
000932  $003            LDA         #BITON4                 ;Check xmit data reg empty
000933                  BIT         STAT_REG
000934                  BNE         $004                    ;Reg empty, continue
000935
000936                  JMP         E_XMIT                  ;Reg not empty, enable xmit interrupt
000937
000938  $004            BIT         IN_PROG                 ;XOFF need to be sent ?
000939                  BVC         $005                    ;No, continue
000940
000941                  LDA         #BITON7                 ;Yes, set XOFF in progress
000942                  STA         IN_PROG
000943                  LDA         CTLCHR1                 ;Send XOFF
000944                  JMP         $020
000945
000946  $005            BIT         SEND_XON                ;XON need to be sent ?
000947                  BPL         $010                    ;No, continue
000948
000949                  LDA         #0                      ;Yes, clear flags
000950                  STA         SEND_XON
000951                  STA         IN_PROG
000952                  LDA         CTLCHR2                 ;Send XON
000953                  JMP         $020
000954
000955  $010            LDA         DLYCNT                  ;Any transmit delay in progress ?
000956                  BEQ         $015                    ;No
000957
000958  $011            DEC         DLYCNT                  ;Yes, decrement count
000959                  JMP         E_XMIT
000960
000961  $015            LDX         OBUFCNT                 ;Is local output buffer count zero ?
000962                  BEQ         D_XMIT                  ;Yes, disable xmit interrupt and return
000963
000964                  BIT         NO_OUTPUT               ;Is output suspended ?
000965                  BMI         D_XMIT                  ;Yes, disable xmit interrupt and return
000966
000967                  BIT         PROTOCOL                ;Is, ENQ/ACK protocol mode set?
000968                  BVC         $018                    ;No, continue
000969
000970                  LDA         CHAR_OUT                ;Yes, check output char count
000971                  BNE         $016                    ;Count not yet exhausted, send char
000972
000973                  BIT         IN_PROG1                ;Check for ENQ in progress
000974                  BMI         D_XMIT                  ;Yes, disable xmit interrupt and return
000975
000976                  LDA         #BITON7                 ;No, set ENQ in progress
000977                  STA         IN_PROG1
000978                  LDA         CTLCHR1                 ;Send ENQ
000979                  JMP         $020
000980
000981  $016            DEC         CHAR_OUT                ;Decrement output char count
000982  $018            LDX         OCSMRPTR                ;No, get consumer pointer
000983                  LDA         OLOCBUF,X               ;Get character from buffer
000984                  DEC         OBUFCNT
000985                  INC         OCSMRPTR
000986
000987  $020            TAX
000988                  SET_1MHZ
000989                  STX         ACIADATA                ;Send character
000990
000991                  CPX         #ASC_CR                 ;Check for any delay
000992                  BNE         $022
000993                  LDA         CRDELAY
000994                  JMP         $024
000995
000996  $022            CPX         #ASC_LF
000997                  BNE         $023
000998                  LDA         LFDELAY
000999                  JMP         $024
001000
001001  $023            CPX         #ASC_FF
001002                  BNE         E_XMIT
001003                  LDA         FFDELAY
001004
001005  $024            STA         DLYCNT
001006
001007  E_XMIT          SET_1MHZ
001008                  LDA         ACIACMD                 ;Enable transmit interrupt
001009                  AND         #0F2
001010                  ORA         #05                     ;Set to [xxxx01x1]
001011                  STA         ACIACMD
001012
001013                  RTS                                 ;Return to user
001014
```

```
001015  D_XMIT          SET_1MHZ
001016                  LDA         ACIACMD                 ;Disable transmit interrupt
001017                  AND         #0F2
001018                  ORA         #09                     ;Set to [xxxx10x1]
001019                  STA         ACIACMD
001020  RETURN          RTS                                 ;Return to user
001021
001022  PRIME_OUT       .EQU        *                       ;Called by Read, Write and Control
001023  ;  request routines
001024
001025                  PHP                                 ;Save interrupt status
001026                  SEI                                 ;Disable interrupt system
001027                  BIT         RTS_FALSE
001028                  BMI         $010                    ;Return if RTS false
001029                  JSR         E_XMIT                  ;Enable transmit interrupt
001030                  SET_2MHZ
001031  $010            PLP                                 ;Restore interrupt status
001032
001033                  RTS                                 ;Return
001034
001035                  .END
001036

; ##############################################################################################################
; #   END OF FILE:  RS232.text
; #   LINES      :  1036
; #   CHARACTERS :  51017
; #   Formatter  :  Assembly Language Reformatter 1.0.2 (07 January 1998)
; #   Author     :  David T. Craig -- 71533.606@compuserve.com -- Santa Fe, New Mexico USA
; ##############################################################################################################
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