

```

1 *****
2 *
3 * PARALLEL PRINTER
4 * INTERFACE FIRMWARE
5 *
6 * TYPE: PFO-1
7 * NEGATIVE DATA
8 * NEGATIVE STROBE
9 * NEGATIVE ACKNOWLEDGE
10 *
11 *
12 * WRITTEN BY FRED VILES
13 * SEPTEMBER 10, 1979
14 *
15 * VERSION 4.0
16 * DECEMBER 1, 1980
17 *
18 * COPYRIGHT 1979 BY
19 * SSM MICROCOMPUTER PRODUCTS
20 * ALL RIGHTS RESERVED
21 *
22 *****
23 *
24 *
25 *
26 * MODE - CONTAINS TWO STATUS FLAGS IN THE HIGH ORDER TWO
27 * BITS WHICH SELECT THE OPTIONAL AUTO-LINE FEED
28 * AND VIDEO-DISABLED MODES OF OPERATION.
29 * B7 - SELECTS NOVID MODE (APPLE VIDEO DISABLED) WHEN
30 * SET (1), DEFAULTS TO 0 (OFF)
31 * B6 - SELECTS AUTOLF MODE WHEN SET (1), DEFAULT IS 0.
32 *
33 * WINDOW - A CARRIAGE RETURN WILL BE OUTPUT AUTOMATICALLY
34 * WHEN ANY LINE EXCEEDS THIS VALUE. MAY BE USED
35 * TO CAUSE 'WRAP-AROUND' WHEN THE PRINTER'S
36 * LINE LENGTH IS EXCEEDED IF THE PRINTER ITSELF
37 * CAN'T DO IT, OR WHEN NARROW PAPER IS USED ON
38 * A WIDER CARRIAGE. DEFAULT IS 255.
39 *
40 * MARGIN - A CR WILL BE OUTPUT IN PLACE OF THE FIRST BLANK
41 * PRINTED AFTER LINE LENGTH EXCEEDS THIS VALUE.
42 * CAN BE USED TO FORMAT LISTINGS SUCH THAT WORDS
43 * ARE NOT SPLIT BETWEEN LINES. DEFAULT IS 255.
44 *
45 * INDENT - THE FIRST CHARACTER OF EACH LINE IS INDENTED
46 * (PADDED WITH BLANKS ON THE LEFT) BY THIS NUMBER
47 *
48 * PAGE - A 'FORMFEED' (SEVEN BLANK LINES) WILL BE OUTPUT
49 * AFTER EACH 'PAGE' (THE NUMBER OF LINES GIVEN
50 * BY THIS VALUE) HAS BEEN PRINTED. SETTING PAGE
51 * TO ZERO DEFEATS FORM FEED. DEFAULT IS 58 FOR
52 * A PAGE OF 11.5 INCHES ON MOST PRINTERS.
53 *
54 * DATA - CONTAINS A VALUE TO BE EXCLUSIVE-OR'ED WITH THE
55 * CHAR BEFORE IT IS TRANSMITTED. SET TO $00 FOR
56 * POSITIVE GOING DATA, OR TO $FF FOR NEGATIVE
57 * GOING DATA. NOTE - THE USER CAN SET DATA
58 * TO $80 OR $7F INSTEAD TO FORCE THE HIGH
59 * ORDER DATA BIT TO BE '1' INSTEAD OF '0'
60 *

```

```

61 *
62 MODE EQU $3B8 ( 478+N:?? POKE 1144+N,?? )
63 WINDOW EQU $438 ( 4F8+N:?? POKE 1272+N,?? )
64 MARGIN EQU $4B8 ( 578+N:?? POKE 1400+N,?? )
65 INDENT EQU $538 ( 5F8+N:?? POKE 1528+N,?? )
66 PAGE EQU $5B8 ( 678+N:?? POKE 1656+N,?? )
67 DATA EQU $638 ( 6F8+N:?? POKE 1784+N,?? )
68 *
69 * * * * *
70 *
71 * THE FOLLOWING COUNTERS AND FLAGS ARE USED
72 * INTERNALLY AND SHOULD NOT BE ALTERED BY
73 * THE USER.
74 *
75 * COLUMN - PRINTER COLUMN COUNTER (NUMBER
76 * OF CHARS OUTPUT SINCE LAST
77 * CARRIAGE RETURN)
78 *
79 * LINE - CURRENT PRINTER LINE NUMBER
80 * (NUMBER OF CR'S OUTPUT SINCE
81 * THE LAST FORM FEED)
82 *
83 *
84 * INITF - THIS FLAG IS USED TO AVOID GETTING HUNG
85 * UP IN THE 'WAIT FOR ACKNOWLEDGE' LOOP
86 * ON THE INITIALIZATION ENTRY.
87 *
88 LINE EQU $6B8
89 COLUMN EQU $738
90 INITF EQU $478
91 *
92 * ADDR OF THE MONITOR'S CURRENT
93 * HORIZONTAL CURSOR POSITION
94 *
95 MONCH EQU $24
96 *
97 * MONITOR ENTRIES USED
98 * COUT1 - THE OUTPUT ROUTINE
99 * IORTS - DOES AN IMMEDIATE RTS
100 *
101 COUT1 EQU $FDF0
102 IORTS EQU $FF58
103 *
104 *
105 * ($C080+$N0) IS THE A-SIDE DATA DIRECTION REG. (DDRA)
106 * IF CRA BIT 2 IS "1", AND IS THE A-SIDE OUTPUT REG.
107 * (ORA) IF CRA2 IS "0"
108 * ($C081+$N0) IS THE A-SIDE CONTROL REGISTER (CRA).
109 * ($C082+$N0) AND ($C083+$N0) ARE THE CORRESPONDING B-SIDE
110 * REG. ADDRESSES
111 *
112 DDRA EQU $C080
113 ORA EQU $C080
114 CRA EQU $C081
115 DDRB EQU $C082
116 ORB EQU $C082
117 CRB EQU $C083
118 *
119 *
120 *

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121 *****
122 * *
123 ORG $00 *
124 OBJ $5200 *
125 * *
126 *****
127 *****
128 *
129 * PR#N OR N CNTRL-P ENTRY. MONITOR DESTORYS
130 * LINK ADDR ALREADY IN $36,$37 HEX
131 *
0000 18 132 ENT0 CLC * INDICATE INITIALIZATION ENTRY
0001 B0 FE 133 BCS * MASK THE SEC
134 ORG *-1
135 OBJ *+$5200
136 *
137 * SOFT ENTRY PRINT VECTOR
138 *
0002 38 139 ENTW SEC ; NORMAL PRINT ENTRY POINT
0003 48 140 PHA ; SAVE THE
0004 98 141 TYA ; REGISTERS
0005 48 142 PHA ; ON THE
0006 8A 143 TXA ; STACK
0007 48 144 PHA $
0008 78 145 SEI ; STACK PROCESSING
0009 20 58 FF 146 JSR IORTS MUST NOT BE
000C BA 147 TSX ; INTERRUPTED.
000D 68 148 PLA $
000E 68 149 PLA ; RETRIEVE CHAR
000F 68 150 PLA ; FROM UNDER STACK
0010 A8 151 TAY ; INTO REG Y AND
0011 CA 152 DEX ; GET $CN FROM
0012 9A 153 TXS ; ABOVE STACK (RTS
0013 68 154 PLA ; LEFT IT THERE) -
0014 AA 155 TAX ; WITHOUT HARMING
0015 58 156 CLI ; CONTENTS
0016 98 157 TYA $
0017 29 7F 158 AND #$7F FORCE B7 TO ZERO
0019 48 159 PHA ; SAVE CHAR
001A 08 160 PHP ; SAVE STATUS
161 * GET $N0 INTO REG Y
001B 8A 162 TXA $
001C 0A 163 ASL
001D 0A 164 ASL
001E 0A 165 ASL
001F 0A 166 ASL
0020 A8 167 TAY $
0021 28 168 PLP ; RESTORE STATUS
0022 B0 2F 169 BCS PRINT0 BRANCH AROUND INITS IF SOFT ENTRY
170 *
171 * DEFAULT INITS FOR 1-ST ENTRY
172 *
0024 A9 02 173 INITAL LDA #$02 SET OUTPUT VECTOR TO POINT
0026 85 36 174 STA $36 TO THE SOFT ENTRY
0028 4A 175 LSR ;
0029 4A 176 LSR ; LDA ZERO AND SET CARRY
002A 99 83 C0 177 STA CRB,Y ASSURE ADDRESSING DDRB
178 * STA DATA,X DATA WILL BE ACTIVE POSITIVE
002D 9D 38 07 179 STA COLUMN,X WE START AT THE BEGINNING
0030 9D B8 06 180 STA LINE,X OF LINE ZERO.

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0033 9D 38 05 181 STA INDENT,X NO INDENTING ON LEFT
0036 9D B8 03 182 STA MODE,X MONITOR VIDEO IS ENABLED AND
183 * AUTO LINE FEED IS DISABLED
0039 A9 FF 184 LDA #$FF DEFAULT WINDOW IS SET TO
003B 9D 38 04 185 STA WINDOW,X 255 TO DEFEAT AUTO CR GENERATION
003E 9D B8 04 186 STA MARGIN,X NO MARGIN FORMATTING.
187 * SET UP DATA DIRECTION REG. FOR
0041 99 82 C0 188 STA DDRB,Y ALL BITS AS OUTPUT.
0044 9D 38 06 189 STA DATA,X DATA WILL BE ACTIVE NEGATIVE.
190 * INITIALIZE THE PIA FOR DEFAULT OPERATION - MANUAL STROBE
191 * $36 - POS STROBE, POS ACK OR BUSY (TRAILING EDGE SENSED)
192 * $34 - POS STROBE, NEG ACK OR BUSY "
193 * $3E - NEG STROBE, POS ACK OR BUSY "
194 * $3C - NEG STROBE, NEG ACK OR BUSY "
0047 A9 3C 195 LDA #$3C
0049 99 83 C0 196 STA CRB,Y
197 *
004C A9 3A 198 LDA #$3A PAGE LENGTH IS 59 LINES
004E 9D B8 05 199 STA PAGE,X FOR ABOUT 11.5" PAPER.
0051 A9 80 200 LDA #$80 SET INIT FLAG TRUE
201 *
202 * NORMAL PATH FOR OUTPUT. TEST FOR WINDOW WIDTH
203 * EXCEEDED, FOR RIGHT MARGIN FORMATTING, AND FOR TAB
204 * GENERATION IN THAT ORDER UNLESS COLUMN OVERFLOWED.
205 *
0053 8D 78 04 206 PRINT0 STA INITF
0056 BD 38 07 207 PRINT1 LDA COLUMN,X
0059 C9 FF 208 CMP #$FF 1-ST CHECK FOR COLUMN OVERFLOW.
005B F0 36 209 BEQ SKIP2 YES - SKIP ALL FURTHER TESTS.
005D DD 38 04 210 CMP WINDOW,X CHECK FOR WINDOW EXCEEDED
0060 B0 0D 211 BCS WNDCR YES - GO GENERATE A CARR. RET.
212 *
213 * CODE TO GENERATE A CR IN PLACE OF THE
214 * FIRST BLANK CHAR AFTER THE USER-SPECIFIED
215 * MARGIN IS EXCEEDED.
216 *
0062 DD B8 04 217 FMTTST CMP MARGIN,X PAST MARGIN?
0065 90 0E 218 BCC TABTST NO, GO CHECK FOR TAB
0067 68 219 PLA ; YES, TEST FOR A
0068 2C 83 FD 220 BIT $FD83 BLANK CHARACTER.
006B D0 14 221 BNE NOTAB IF SO, GO GENERATE
006D F0 01 222 BEQ FMTCR A CR AND DROP THE BLANK
223 *
224 *
006F 18 225 WNDCR CLC
0070 08 226 FMTCR PHP
0071 A9 0D 227 PAGCR LDA #$0D
0073 D0 20 228 BNE OUT2
229 *
230 *****
231 *
232 * CHECK FOR LEFT-MARGIN PADDING REQUIRED
233 * AND FOR BASIC TAB OR COLUMN PRINT FORMATTING.
234 *
0075 DD 38 05 235 TABTST CMP INDENT,X
0078 90 02 236 BCC SPGEN IF INDENT (LEFT MARGIN) OR
007A C5 24 237 CMP MONCH IF MONCH IS GREATER THAN COLUMN
007C A9 20 238 SPGEN LDA #$20 GENERATE SPACES TO CATCH UP TO
007E 90 0F 239 BCC INCCOL IF (BASIC TAB FORMATTING)
0080 68 240 PLA

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0081	2C 58 FF	241	NOTAB	BIT	IORTS	
0084	F0 0E	242		BEQ	OUT	DON'T BUMP POINTERS IF CNTRL
0086	48	243		PHA		
0087	BD B8 03	244		LDA	MODE,X	MAINTAIN MONCH IF IN NOVID
008A	10 02	245		BPL	SKIPL	MODE SO THAT BASIC COMMA
008C	E6 24	246		INC	MONCH	FORMATTING WILL STILL WORK
008E	68	247	SKIPL	PLA		
008F	FE 38 07	248	INCCOL	INC	COLUMN,X	BUMP THE COLUMN COUNTER
		249	*			
0092	F0 FE	250		BEQ	*	FAKE BRANCH TO HIDE THE PLA
		251		ORG	*-1	INSTRUCTION FROM THE
		252		OBJ	*+\$5200	FALL-THRU PATH.
		253	*			
0093	68	254	SKIP2	PLA	GET CHAR WHEN COLUMN=255	
		255	*			
		256	*			
0094	08	257	OUT	PHP		
0095	48	258	OUT2	PHA		
		259	*			DON'T WAIT FOR PRINTER
0096	AD 78 04	260		LDA	INITF	IF THIS IS THE FIRST TIME
0099	30 08	261		BMI	PRINT2	THROUGH THE CODE. (THERE
		262	*			WAS NO PREV. CHAR TO ACK.)
		263	*			
009B	B9 83 C0	264	PLOOP	LDA	CRB,Y	CHECK BUSY/ACK FLAG (BIT 7)
009E	10 FB	265		BPL	PLOOP	AND LOOP UNTIL IT IS SET.
		266	*			
00A0	B9 82 C0	267		LDA	ORB,Y	RESET FLAG BIT.
		268	*			
		269	*		O.K. TO TRANSFER THE CHARACTER NOW. IF IN	
		270	*		SLOT ONE USE AN ABSOLUTE STORE RATHER THAN	
		271	*		AN INDEXED STORE IN CASE OF HANDSHAKE PROBLEMS	
00A3	68	272	PRINT2	PLA	;	
00A4	48	273		PHA	;	GET THE CHAR AND INVERT IT IFF
00A5	5D 38 06	274		EOR	DATA,X	PERIPHERAL USES ACTIVE NEGATIVE
00A8	C0 10	275		CPY	#\$10	
00AA	D0 05	276		BNE	INDXD	
00AC	8D 92 C0	277		STA	ORB+\$10	
00AF	F0 03	278		BEQ	STRBCH	
00B1	99 82 C0	279	INDXD	STA	ORB,Y	
		280	*			
		281	*		GENERATE A STROBE SIGNAL ON CB2 TO SIGNAL PRESENCE	
		282	*		OF THE CHARACTER ON THE OUTPUT PORT	
		283	*			
00B4	B9 83 C0	284	STRBCH	LDA	CRB,Y	;
00B7	49 08	285		EOR	#\$08	;
00B9	99 83 C0	286		STA	CRB,Y	;
00BC	49 08	287		EOR	#\$08	;
00BE	99 83 C0	288		STA	CRB,Y	;
		289	*			
00C1	68	290	SKIP0	PLA		
00C2	49 0D	291		EOR	#\$0D	CHECK FOR CR
00C4	F0 12	292		BEQ	CRCODE	
00C6	28	293	EXIT	PLP		
00C7	90 8D	294		BCC	PRINT1	GO BACK FOR THE REAL CHAR IF
		295	*			THIS WAS A GENERATED TAB OR CR.
00C9	BD B8 03	296		LDA	MODE,X	SKIP JUMP TO MONITOR COUT ROUTINE
		297	*			IF NOVID FLAG IS SET.
00CC	0A	298		ASL		
00CD	68	299	DONE2	PLA	;	RESTORE REGS &
00CE	AA	300		TAX	;	EITHER JUMP TO

```

00C8 68          301      PLA      ;      MONITOR'S I/O
00D0 A8          302      TAY      ;      ROUTINE OR RTS
00D1 68          303      PLA      ;      BACK TO CALLER
304 * CARRY SET MEANS NOVID MODE - BYPASS MONITOR ROUTINE
00D2 B0 03      305      BCS      RETURN
00D4 4C F0 FD    306      JMP      COUT1
307 *
00D7 60          308 RETURN RTS
309 *
310 * END-OF-LINE REACHED. CHECK FOR END-OF-PAGE
311 * IF PAGE>0 AND DO A FORM FEED IF NECCESARY.
312 *
00D8 BD B8 05    313 CRCODE LDA    PAGE,X
00DB F0 0F      314      BEQ      RESET      OPTION DEFEATED
00DD FE B8 06    315      INC      LINE,X    BUMP LINE COUNTER
00E0 FD B8 06    316      SBC      LINE,X    GET PAGE LEN - LINE #
00E3 10 07      317      BPL      RESET      NOT YET
00E5 49 F8      318      EOR      #$F8     FINISHED DOING FORM
00E7 D0 88      319      BNE      PAGCR     FEED? NO, DO A CR.
00E9 9D B8 06    320      STA      LINE,X    YES, ZERO LINE COUNTER
321 *
322 * ZERO THE COLUMN AND MONCH POINTERS AND OPTIONALLY
323 * GENERATE A LINE FEED (DEFAULT IS NO AUTOMATIC LF).
324 * IF CR WAS GENERATED, THE ACTUAL CHR WILL BE OUTPUT
325 * AFTER THE LF - ELSE WE WILL RETURN AFTER LF.
326 *
00EC A9 00      327 RESET  LDA    #$00
00EE 9D 38 07   328      STA    COLUMN,X
00F1 85 24      329      STA    MONCH
00F3 BD B8 03   330      LDA    MODE,X      ;
00F6 0A          331      ASL    ;          ; PUTS AUTOLF FLAG IN CARRY
00F7 0A          332      ASL    ;          ;
00F8 90 CC      333      BCC    EXIT
00FA A9 0A      334      LDA    #$0A
00FC D0 97      335      BNE    OUT2
336 *
337 *          END

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--- END ASSEMBLY ---

TOTAL ERRORS: 00

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1 *****
2 *
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4 * INTERFACE FIRMWARE *
5 *
6 * TYPE: PFO-2 *
7 * NEGATIVE DATA *
8 * NEGATIVE STROBE *
9 * POSITIVE ACKNOWLEDGE *
10 *
11 *
12 * WRITTEN BY FRED VILES *
13 * SEPTEMBER 10, 1979 *
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23 *
24 *
25 *
26 * MODE - CONTAINS TWO STATUS FLAGS IN THE HIGH ORDER TWO
27 * BITS WHICH SELECT THE OPTIONAL AUTO-LINE FEED
28 * AND VIDEO-DISABLED MODES OF OPERATION.
29 * B7 - SELECTS NOVID MODE (APPLE VIDEO DISABLED) WHEN
30 * SET (1), DEFAULTS TO 0 (OFF)
31 * B6 - SELECTS AUTOLF MODE WHEN SET (1), DEFAULT IS 0.
32 *
33 * WINDOW - A CARRIAGE RETURN WILL BE OUTPUT AUTOMATICALLY
34 * WHEN ANY LINE EXCEEDS THIS VALUE. MAY BE USED
35 * TO CAUSE 'WRAP-AROUND' WHEN THE PRINTER'S
36 * LINE LENGTH IS EXCEEDED IF THE PRINTER ITSELF
37 * CAN'T DO IT, OR WHEN NARROW PAPER IS USED ON
38 * A WIDER CARRIAGE. DEFAULT IS 255.
39 *
40 * MARGIN - A CR WILL BE OUTPUT IN PLACE OF THE FIRST BLANK
41 * PRINTED AFTER LINE LENGTH EXCEEDS THIS VALUE.
42 * CAN BE USED TO FORMAT LISTINGS SUCH THAT WORDS
43 * ARE NOT SPLIT BETWEEN LINES. DEFAULT IS 255.
44 *
45 * INDENT - THE FIRST CHARACTER OF EACH LINE IS INDENTED
46 * (PADDED WITH BLANKS ON THE LEFT) BY THIS NUMBER
47 *
48 * PAGE - A 'FORMFEED' (SEVEN BLANK LINES) WILL BE OUTPUT
49 * AFTER EACH 'PAGE' (THE NUMBER OF LINES GIVEN
50 * BY THIS VALUE) HAS BEEN PRINTED. SETTING PAGE
51 * TO ZERO DEFEATS FORM FEED. DEFAULT IS 58 FOR
52 * A PAGE OF 11.5 INCHES ON MOST PRINTERS.
53 *
54 * DATA - CONTAINS A VALUE TO BE EXCLUSIVE-OR'ED WITH THE
55 * CHAR BEFORE IT IS TRANSMITTED. SET TO $00 FOR
56 * POSITIVE GOING DATA, OR TO $FF FOR NEGATIVE
57 * GOING DATA. NOTE - THE USER CAN SET DATA
58 * TO $80 OR $7F INSTEAD TO FORCE THE HIGH
59 * ORDER DATA BIT TO BE '1' INSTEAD OF '0'
60 *

```

```

61 *
62 MODE EQU $3B8 ( 478+N:?? POKE 1144+N,?? )
63 WINDOW EQU $438 ( 4F8+N:?? POKE 1272+N,?? )
64 MARGIN EQU $4B8 ( 578+N:?? POKE 1400+N,?? )
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66 PAGE EQU $5B8 ( 678+N:?? POKE 1656+N,?? )
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68 *
69 * * * * *
70 *
71 * THE FOLLOWING COUNTERS AND FLAGS ARE USED
72 * INTERNALLY AND SHOULD NOT BE ALTERED BY
73 * THE USER.
74 *
75 * COLUMN - PRINTER COLUMN COUNTER (NUMBER
76 * OF CHARS OUTPUT SINCE LAST
77 * CARRIAGE RETURN)
78 *
79 * LINE - CURRENT PRINTER LINE NUMBER
80 * (NUMBER OF CR'S OUTPUT SINCE
81 * THE LAST FORM FEED)
82 *
83 *
84 * INITF - THIS FLAG IS USED TO AVOID GETTING HUNG
85 * UP IN THE 'WAIT FOR ACKNOWLEDGE' LOOP
86 * ON THE INITIALIZATION ENTRY.
87 *
88 LINE EQU $6B8
89 COLUMN EQU $738
90 INITF EQU $478
91 *
92 * ADDR OF THE MONITOR'S CURRENT
93 * HORIZONTAL CURSOR POSITION
94 *
95 MONCH EQU $24
96 *
97 * MONITOR ENTRIES USED
98 * COUT1 - THE OUTPUT ROUTINE
99 * IORTS - DOES AN IMMEDIATE RTS
100 *
101 COUT1 EQU $FDF0
102 IORTS EQU $FF58
103 *
104 *
105 * ($C080+$N0) IS THE A-SIDE DATA DIRECTION REG. (DDRA)
106 * IF CRA BIT 2 IS "1", AND IS THE A-SIDE OUTPUT REG.
107 * (ORA) IF CRA2 IS "0"
108 * ($C081+$N0) IS THE A-SIDE CONTROL REGISTER (CRA).
109 * ($C082+$N0) AND ($C083+$N0) ARE THE CORRESPONDING B-SIDE
110 * REG. ADDRESSES
111 *
112 DDRA EQU $C080
113 ORA EQU $C080
114 CRA EQU $C081
115 DDRB EQU $C082
116 ORB EQU $C082
117 CRB EQU $C083
118 *
119 *
120 *

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121 *****
122 *
123          ORG      $00      *
124          OBJ      $5200    *
125 *
126 *****
127 *****
128 *
129 *   PR#N OR N CNTRL-P ENTRY. MONITOR DESTORYS
130 *   LINK ADDR ALREADY IN $36,$37 HEX
131 *
0000 18      132 ENT0    CLC      *           INDICATE INITIALIZATION ENTRY
0001 B0 FE    133          BCS      *           MASK THE SEC
134          ORG      *-1
135          OBJ      *+$5200
136 *
137 *   SOFT ENTRY PRINT VECTOR
138 *
0002 38      139 ENTW    SEC      ;           NORMAL PRINT ENTRY POINT
0003 48      140          PHA      ;           SAVE THE
0004 98      141          TYA      ;           REGISTERS
0005 48      142          PHA      ;           ON THE
0006 8A      143          TXA      ;           STACK
0007 48      144          PHA      $
0008 78      145          SEI      ;           STACK PROCESSING
0009 20 58 FF 146          JSR      IORTS  MUST NOT BE
000C BA      147          TSX      ;           INTERRUPTED.
000D 68      148          PLA      $
000E 68      149          PLA      ;           RETRIEVE CHAR
000F 68      150          PLA      ;           FROM UNDER STACK
0010 A8      151          TAY      ;           INTO REG Y AND
0011 CA      152          DEX      ;           GET $CN FROM
0012 9A      153          TXS      ;           ABOVE STACK (RTS
0013 68      154          PLA      ;           LEFT IT THERE) -
0014 AA      155          TAX      ;           WITHOUT HARMING
0015 58      156          CLI      ;           CONTENTS
0016 98      157          TYA      $
0017 29 7F    158          AND      #$7F    FORCE B7 TO ZERO
0019 48      159          PHA      ;           SAVE CHAR
001A 08      160          PHP      ;           SAVE STATUS
161 *   GET $NO INTO REG Y
001B 8A      162          TXA      $
001C 0A      163          ASL
001D 0A      164          ASL
001E 0A      165          ASL
001F 0A      166          ASL
0020 A8      167          TAY      $
0021 28      168          PLP      ;           RESTORE STATUS
0022 B0 2F    169          BCS      PRINT0  BRANCH AROUND INITS IF SOFT ENTRY
170 *
171 *   DEFAULT INITS FOR 1-ST ENTRY
172 *
0024 A9 02    173 INITAL  LDA      #$02      SET OUTPUT VECTOR TO POINT
0026 85 36    174          STA      $36      TO THE SOFT ENTRY
0028 4A      175          LSR      ;
0029 4A      176          LSR      ;           LDA ZERO AND SET CARRY
002A 99 83 C0 177          STA      CRB,Y    ASSURE ADDRESSING DDRB
178 *   STA      DATA,X    DATA WILL BE ACTIVE POSITIVE
002D 9D 38 07 179          STA      COLUMN,X  WE START AT THE BEGINNING
0030 9D B8 06 180          STA      LINE,X    OF LINE ZERO.

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0033 9D 38 05 181 STA INDENT,X NO INDENTING ON LEFT
0036 9D B8 03 182 STA MODE,X MONITOR VIDEO IS ENABLED AND
183 * AUTO LINE FEED IS DISABLED
0039 A9 FF 184 LDA #$FF DEFAULT WINDOW IS SET TO
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194 * $3C - NEG STROBE, NEG ACK OR BUSY "
0047 A9 3E 195 LDA #$3E
0049 99 83 C0 196 STA CRB,Y
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004C A9 3A 198 LDA #$3A PAGE LENGTH IS 59 LINES
004E 9D B8 05 199 STA PAGE,X FOR ABOUT 11.5" PAPER.
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0065 90 0E 218 BCC TABTST NO, GO CHECK FOR TAB
0067 68 219 PLA ; YES, TEST FOR A
0068 2C 83 FD 220 BIT $FD83 BLANK CHARACTER.
006B D0 14 221 BNE NOTAB IF SO, GO GENERATE
006D F0 01 222 BEQ FMTCR A CR AND DROP THE BLANK
223 *
224 *
006F 18 225 WNDCR CLC
0070 08 226 FMTCR PHP
0071 A9 0D 227 PAGCR LDA #$0D
0073 D0 20 228 BNE OUT2
229 *
230 *****
231 *
232 * CHECK FOR LEFT-MARGIN PPADDING REQUIRED
233 * AND FOR BASIC TAB OR COMMA PRINT FORMATTING.
234 *
0075 DD 38 05 235 TABTST CMP INDENT,X
0078 90 02 236 BCC SPGEN IF INDENT (LEFT MARGIN) OR
007A C5 24 237 CMP MONCH IF MONCH IS GREATER THAN COLUMN
007C A9 20 238 SPGEN LDA #$20 GENERATE SPACES TO CATCH UP TO
007E 90 0F 239 BCC INCCOL IT (BASIC TAB FORMATTING)
0080 68 240 PLA

```

```

00CF 68      301      PLA      ;      MONITOR'S I/O
00D0 A8      302      TAY      ;      ROUTINE OR RTS
00D1 68      303      PLA      ;      BACK TO CALLER
          304 *      CARRY SET MEANS NOVID MODE - BYPASS MONITOR ROUTINE
          305      BCS      RETURN
          306      JMP      COUT1
          307 *
00D7 60      308 RETURN RTS
          309 *
          310 *      END-OF-LINE REACHED. CHECK FOR END-OF-PAGE
          311 *      IF PAGE>0 AND DO A FORM FEED IF NECESSARY.
          312 *
00D8 BD B8 05 313 CRCODE LDA      PAGE,X
00DB F0 0F      314      BEQ      RESET      OPTION DEFEATED
00DD FE B8 06 315      INC      LINE,X      BUMP LINE COUNTER
00E0 FD B8 06 316      SBC      LINE,X      GET PAGE LEN - LINE #
00E3 10 07      317      BPL      RESET      NOT YET
00E5 49 F8      318      EOR      #$F8      FINISHED DOING FORM
00E7 D0 88      319      BNE      PAGCR      FEED? NO, DO A CR.
00E9 9D B8 06 320      STA      LINE,X      YES, ZERO LINE COUNTER
          321 *
          322 *      ZERO THE COLUMN AND MONCH POINTERS AND OPTIONALLY
          323 *      GENERATE A LINE FEED (DEFAULT IS NO AUTOMATIC LF).
          324 *      IF CR WAS GENERATED, THE ACTUAL CHR WILL BE OUTPUT
          325 *      AFTER THE LF - ELSE WE WILL RETURN AFTER LF.
          326 *
00EC A9 00      327 RESET LDA      #$00
00EE 9D 38 07 328      STA      COLUMN,X
00F1 85 24      329      STA      MONCH
          330      LDA      MODE,X      ;
          331      ASL      ;      ; PUTS AUTOLF FLAG IN CARRY
          332      ASL      ;      ;
          333      BCC      EXIT
00F8 90 CC      334      LDA      #$0A
00FA A9 0A      335      BNE      OUT2
00FC D0 97      336 *
          337 *      END

```

--- END ASSEMBLY ---

TOTAL ERRORS: 00

:

0081	2C	58	FF	241	NOTAB	BIT	IORTS		
0084	F0	0E		242		BEQ	OUT	DON'T BUMP POINTERS IF CNTRL	
0086	48			243		PHA			
0087	BD	B8	03	244		LDA	MODE,X	MAINTAIN MONCH IF IN NOVID	
008A	10	02		245		BPL	SKIPL	MAKE SURE SO THAT BASIC COMMA	
008C	E6	24		246		INC	MONCH	FORMATTING WILL STILL WORK	
008E	68			247	SKIPL	PLA			
008F	FE	38	07	248	INCCOL	INC	COLUMN,X	INCR THE COLUMN COUNTER	
				249	*				
0092	F0	FE		250		BEQ	*	GO TO BRANCH TO HIDE THE PLA	
				251		ORG	*-1	INSTRUCTION FROM THE	
				252		OBJ	*+\$5200	FALL-THRU PATH.	
				253	*				
0093	68			254	SKIP2	PLA	GET CHAR WHEN COLUMN=255		
				255	*				
				256	*				
0094	08			257	OUT	PHP			
0095	48			258	OUT2	PHA			
				259	*			DON'T WAIT FOR PRINTER	
0096	AD	78	04	260		LDA	INITF	IF THIS IS THE FIRST TIME	
0099	30	08		261		EMI	PRINT2	THROUGH THE CODE. (THERE	
				262	*			WAS NO PREV. CHAR TO ACK.)	
				263	*				
009B	B9	83	C0	264	PLOOP	LDA	CRB,Y	CHECK BUSY/ACK FLAG (BIT 7)	
009E	10	FB		265		BPL	PLOOP	AND LOOP UNTIL IT IS SET.	
				266	*				
00A0	B9	82	C0	267		LDA	ORB,Y	RESET FLAG BIT.	
				268	*				
				269	*			O.K. TO TRANSFER THE CHARACTER NOW. IF IN	
				270	*			SLOT ONE USE AN ABSOLUTE STORE RATHER THAN	
				271	*			AN INDEXED STORE IN CASE OF HANDSHAKE PROBLEMS	
00A3	68			272	PRINT2	PLA	;		
00A4	48			273		PHA	;	GET THE CHAR AND INVERT IT IFF	
00A5	5D	38	06	274		EOR	DATA,X	PERIPHERAL USES ACTIVE NEGATIVE	
00A8	C0	10		275		CPY	#\$10		
00AA	D0	05		276		BNE	INDXD		
00AC	8D	92	C0	277		STA	ORB+\$10		
00AF	F0	03		278		BEQ	STRBCH		
00B1	99	82	C0	279	INDXD	STA	ORB,Y		
				280	*				
				281	*			GENERATE A STROBE SIGNAL ON CB2 TO SIGNAL PRESENCE	
				282	*			OF THE CHARACTER ON THE OUTPUT PORT	
				283	*				
00B4	B9	83	C0	284	STRBCH	LDA	CRB,Y	;	
00B7	49	08		285		EOR	#\$08	;	ISSUE THE STROBE (POS OR NEG
00B9	99	83	C0	286		STA	CRB,Y	;	DEPENDING ON FLAG) WITHOUT
00BC	49	08		287		EOR	#\$08	;	CHANGING THE OTHER CONTROL BITS
00BE	99	83	C0	288		STA	CRB,Y	;	
				289	*				
00C1	68			290	SKIPO	PLA			
00C2	49	0D		291		EOR	#\$0D	CHECK FOR CR	
00C4	F0	12		292		BEQ	CRCODE		
00C6	28			293	EXIT	PLP			
00C7	90	8D		294		BCC	PRINT1	GO BACK FOR THE REAL CHAR IF	
				295	*			THIS WAS A GENERATED TAB OR CR.	
00C9	BD	B8	03	296		LDA	MODE,X	SKIP JUMP TO MONITOR COUT ROUTINE	
				297	*			IF NOVID FLAG IS SET.	
00CC	0A			298		ASL			
00CD	68			299	DONE2	PLA	;	RESTORE REGS &	
00CE	AA			300		TAX	;	EITHER JUMP TO	

```

1 *****
2 *
3 * PARALLEL PRINTER *
4 * INTERFACE FIRMWARE *
5 * *
6 * TYPE: PFC-3 *
7 * NEGATIVE DATA *
8 * POSITIVE STROBE *
9 * NEGATIVE ACKNOWLEDGE *
10 * *
11 * *
12 * WRITTEN BY FRED VILES *
13 * SEPTEMBER 10, 1979 *
14 * *
15 * VERSION 4.0 *
16 * DECEMBER 1, 1980 *
17 * *
18 * COPYRIGHT 1979 BY *
19 * SSI MICROCOMPUTER PRODUCTS *
20 * ALL RIGHTS RESERVED *
21 * *
22 *****
23 *
24 *
25 *
26 * MODE - CONTAINS TWO STATUS FLAGS IN THE HIGH ORDER TWO
27 * BITS WHICH SELECT THE OPTIONAL AUTO-LINE FEED
28 * AND VIDEO-DISABLED MODES OF OPERATION.
29 * B7 - SELECTS NOVID MODE (APPLE VIDEO DISABLED) WHEN
30 * SET (1), DEFAULTS TO 0 (OFF)
31 * B6 - SELECTS AUTOLF MODE WHEN SET (1), DEFAULT IS 0.
32 *
33 * WINDOW - A CARRIAGE RETURN WILL BE OUTPUT AUTOMATICALLY
34 * WHEN ANY LINE EXCEEDS THIS VALUE. MAY BE USED
35 * TO CAUSE 'WRAP-AROUND' WHEN THE PRINTER'S
36 * LINE LENGTH IS EXCEEDED IF THE PRINTER ITSELF
37 * CAN'T DO IT, OR WHEN NARROW PAPER IS USED ON
38 * A WIDER CARRIAGE. DEFAULT IS 255.
39 *
40 * MARGIN - A CR WILL BE OUTPUT IN PLACE OF THE FIRST BLANK
41 * PRINTED AFTER LINE LENGTH EXCEEDS THIS VALUE.
42 * CAN BE USED TO FORMAT LISTINGS SUCH THAT WORDS
43 * ARE NOT SPLIT BETWEEN LINES. DEFAULT IS 255.
44 *
45 * INDENT - THE FIRST CHARACTER OF EACH LINE IS INDENTED
46 * (PADDED WITH BLANKS ON THE LEFT) BY THIS NUMBER
47 *
48 * PAGE - A 'FORMFEED' (SEVEN BLANK LINES) WILL BE OUTPUT
49 * AFTER EACH 'PAGE' (THE NUMBER OF LINES GIVEN
50 * BY THIS VALUE) HAS BEEN PRINTED. SETTING PAGE
51 * TO ZERO DEFEATS FORM FEED. DEFAULT IS 58 FOR
52 * A PAGE OF 11.5 INCHES ON MOST PRINTERS.
53 *
54 * DATA - CONTAINS A VALUE TO BE EXCLUSIVE-OR'ED WITH THE
55 * CHAR BEFORE IT IS TRANSMITTED. SET TO $00 FOR
56 * POSITIVE GOING DATA, OR TO $FF FOR NEGATIVE
57 * GOING DATA. NOTE - THE USER CAN SET DATA
58 * TO $80 OR $7F INSTEAD TO FORCE THE HIGH
59 * ORDER DATA BIT TO BE '1' INSTEAD OF '0'
60 *

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61 *
62 MODE EQU $3B8 ( 478+N:?? POKE 1144+N,?? )
63 WINDOW EQU $438 ( 4F8+N:?? POKE 1272+N,?? )
64 MARGIN EQU $4B8 ( 578+N:?? POKE 1400+N,?? )
65 INDENT EQU $538 ( 5F8+N:?? POKE 1528+N,?? )
66 PAGE EQU $5B8 ( 678+N:?? POKE 1656+N,?? )
67 DATA EQU $638 ( 6F8+N:?? POKE 1784+N,?? )
68 *
69 * * * * *
70 *
71 * THE FOLLOWING COUNTERS AND FLAGS ARE USED
72 * INTERNALLY AND SHOULD NOT BE ALTERED BY
73 * THE USER.
74 *
75 * COLUMN - PRINTER COLUMN COUNTER (NUMBER
76 * OF CHARS OUTPUT SINCE LAST
77 * CARRIAGE RETURN)
78 *
79 * LINE - CURRENT PRINTER LINE NUMBER
80 * (NUMBER OF CR'S OUTPUT SINCE
81 * THE LAST FORM FEED)
82 *
83 *
84 * INITF - THIS FLAG IS USED TO AVOID GETTING HUNG
85 * UP IN THE 'WAIT FOR ACKNOWLEDGE' LOOP
86 * ON THE INITIALIZATION ENTRY.
87 *
88 LINE EQU $6B8
89 COLUMN EQU $738
90 INITF EQU $478
91 *
92 * ADDR OF THE MONITOR'S CURRENT
93 * HORIZONTAL CURSOR POSITION
94 *
95 MONCH EQU $24
96 *
97 * MONITOR ENTRIES USED
98 * COUT1 - THE OUTPUT ROUTINE
99 * IORTS - DOES AN IMMEDIATE RTS
100 *
101 COUT1 EQU $FDF0
102 IORTS EQU $FF58
103 *
104 *
105 * ($C080+$N0) IS THE A-SIDE DATA DIRECTION REG. (DDRA)
106 * IF CRA BIT 2 IS "1", AND IS THE A-SIDE OUTPUT REG.
107 * (ORA) IF CRA2 IS "0"
108 * ($C081+$N0) IS THE A-SIDE CONTROL REGISTER (CRA).
109 * ($C082+$N0) AND ($C083+$N0) ARE THE CORRESPONDING B-SIDE
110 * REG. ADDRESSES
111 *
112 DDRA EQU $C080
113 ORA EQU $C080
114 CRA EQU $C081
115 DDRB EQU $C082
116 ORB EQU $C082
117 CRB EQU $C083
118 *
119 *
120 *

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121 *****
122 *
123          ORG      $00      *
124          OBJ      $5200    *
125 *
126 *****
127 *****
128 *
129 *   PR#N OR N CMTRL-P ENTRY. MONITOR DESTORYS
130 *   LINK ADDR ALREADY IN $36,$37 HEX
131 *
0000 18      132 ENT0   CLC      *           INDICATE INITIALIZATION ENTRY
0001 B0 FE    133          BCS      *           MASK THE SEC
134          ORG      *-1
135          OBJ      *+$5200
136 *
137 *   SOFT ENTRY PRINT VECTOR
138 *
0002 38      139 ENTW   SEC      ;           NORMAL PRINT ENTRY POINT
0003 48      140          PHA      ;           SAVE THE
0004 98      141          TYA      ;           REGISTERS
0005 48      142          PHA      ;           ON THE
0006 8A      143          TXA      ;           STACK
0007 48      144          PHA      $
0008 78      145          SEI      ;           STACK PROCESSING
0009 20 58 FF 146          JSR     IORTS  MUST NOT BE
000C BA      147          TSX      ;           INTERRUPTED.
000D 68      148          PLA      $
000E 68      149          PLA      ;           RETRIEVE CHAR
000F 68      150          PLA      ;           FROM UNDER STACK
0010 A8      151          TAY      ;           INTO REG Y AND
0011 CA      152          DEX      ;           GET $CN FROM
0012 9A      153          TXS      ;           ABOVE STACK (RTS
0013 68      154          PLA      ;           LEFT IT THERE) -
0014 AA      155          TAX      ;           WITHOUT HARMING
0015 58      156          CLI      ;           CONTENTS
0016 98      157          TYA      $
0017 29 7F    158          AND     #$7F   FORCE B7 TO ZERO
0019 48      159          PHA      ;           SAVE CHAR
001A 08      160          PHP      ;           SAVE STATUS
161 *   GET $N0 INTO REG Y
001B 8A      162          TXA      $
001C 0A      163          ASL      ;
001D 0A      164          ASL      ;
001E 0A      165          ASL      ;
001F 0A      166          ASL      ;
0020 A8      167          TAY      $
0021 28      168          PLP      ;           RESTORE STATUS
0022 B0 2F    169          BCS     PRINT0  BRANCH AROUND INITS IF SOFT ENTRY
170 *
171 *   DEFAULT INITS FOR 1-ST ENTRY
172 *
0024 A9 02    173 INITAL LDA     #$02      SET OUTPUT VECTOR TO POINT
0026 85 36    174          STA     $36      TO THE SOFT ENTRY
0028 4A      175          LSR      ;
0029 4A      176          LSR      ;           LDA ZERO AND SET CARRY
002A 99 83 C0 177          STA     CRB,Y    ASSURE ADDRESSING DDRB
178 *   STA     DATA,X    DATA WILL BE ACTIVE POSITIVE
002D 9D 38 07 179          STA     COLUMN,X  WE START AT THE BEGINNING
0030 9D B8 06 180          STA     LINE,X    OF LINE ZERO.

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0033 9D 38 05 181 STA INDENT,X NO INDENTING ON LEFT
0036 9D B8 03 182 STA MODE,X MONITOR VIDEO IS ENABLED AND
183 * AUTO LINE FEED IS DISABLED
0039 A9 FF 184 LDA #$FF DEFAULT WINDOW IS SET TO
003B 9D 38 04 185 STA WINDOW,X 255 TO DEFEAT AUTO CR GENERATION
003E 9D B8 04 186 STA MARGIN,X NO MARGIN FORMATTING.
187 * SET UP DATA DIRECTION REG. FOR
0041 99 82 C0 188 STA DDRB,Y ALL BITS AS OUTPUT.
0044 9D 38 06 189 STA DATA,X DATA WILL BE ACTIVE NEGATIVE.
190 * INITIALIZE THE PIA FOR DEFAULT OPERATION - MANUAL STROBE
191 * $36 - POS STROBE, POS ACK OR BUSY (TRAILING EDGE SENSED)
192 * $34 - POS STROBE, NEG ACK OR BUSY "
193 * $3E - NEG STROBE, POS ACK OR BUSY "
194 * $3C - NEG STROBE, NEG ACK OR BUSY "
0047 A9 34 195 LDA #$34
0049 99 83 C0 196 STA CRB,Y
197 *
004C A9 3A 198 LDA #$3A PAGE LENGTH IS 59 LINES
004E 9D B8 05 199 STA PAGE,X FOR ABOUT 11.5" PAPER.
0051 A9 80 200 LDA #$80 SET INIT FLAG TRUE
201 *
202 * NORMAL PATH FOR OUTPUT. TEST FOR WINDOW WIDTH
203 * EXCEEDED, FOR RIGHT MARGIN FORMATTING, AND FOR TAB
204 * GENERATION IN THAT ORDER UNLESS COLUMN OVERFLOWED.
205 *
0053 8D 78 04 206 PRINT0 STA INITF
0056 BD 38 07 207 PRINT1 LDA COLUMN,X
0059 C9 FF 208 CMP #$FF 1-ST CHECK FOR COLUMN OVERFLOW.
005B F0 36 209 BEQ SKIP2 YES - SKIP ALL FURTHER TESTS.
005D DD 38 04 210 CMP WINDOW,X CHECK FOR WINDOW EXCEEDED
0060 B0 0D 211 BCS WNDCCR YES - GO GENERATE A CARR. RET.
212 *
213 * CODE TO GENERATE A CR IN PLACE OF THE
214 * FIRST BLANK CHAR AFTER THE USER-SPECIFIED
215 * MARGIN IS EXCEEDED.
216 *
0062 DD B8 04 217 FMTTST CMP MARGIN,X PAST MARGIN?
0065 90 0E 218 BCC TABTST NO, GO CHECK FOR TAB
0067 68 219 PLA ; YES, TEST FOR A
0068 2C 83 FD 220 BIT $FD83 BLANK CHARACTER.
006B D0 14 221 BNE NOTAB IF SO, GO GENERATE
006D F0 01 222 BEQ FMTCR A CR AND DROP THE BLANK
223 *
224 *
006F 18 225 WNDCCR CLC
0070 08 226 FMTCR PHP
0071 A9 0D 227 PAGCR LDA #$0D
0073 D0 20 228 BNE OUT2
229 *
230 *****
231 *
232 * CHECK FOR LEFT-MARGIN PPADDING REQUIRED
233 * AND FOR BASIC TAB OR COMMA PRINT FORMATTING.
234 *
0075 DD 38 05 235 TABTST CMP INDENT,X
0078 90 02 236 BCC SPGEN IF INDENT (LEFT MARGIN) OR
007A C5 24 237 CMP MONCH IF MONCH IS GREATER THAN COLUMN
007C A9 20 238 SPGEN LDA #$20 GENERATE SPACES TO CATCH UP TO
007E 90 0F 239 BCC INCCOL IT (BASIC TAB FORMATTING)
0080 68 240 PLA

```



```

0081 2C 58 FF 241 NOTAB BIT IORTS
0084 F0 0E 242 BEQ OUT DON'T BUMP POINTERS IF CNTRL
0086 48 243 PHA
0087 BD B8 03 244 LDA MODE,X MAINTAIN MONCH IF IN NOVID
008A 10 02 245 BPL SKIP1 MODE SO THAT BASIC COMMA
008C E6 24 246 INC MONCH FORMATTING WILL STILL WORK
008E 68 247 SKIP1 PLA
008F FE 38 07 248 INCCOL INC COLUMN,X BUMP THE COLUMN COUNTER
249 *
0092 F0 FE 250 BEQ * FAKE BRANCH TO HIDE THE PLA
251 ORG *-1 INSTRUCTION FROM THE
252 OBJ **$5200 FALL-THRU PATH.
253 *
0093 68 254 SKIP2 PLA GET CHAR WHEN COLUMN=255
255 *
256 *
0094 08 257 OUT PHP
0095 48 258 OUT2 PHA
259 *
0096 AD 78 04 260 LDA INITF DON'T WAIT FOR PRINTER
0099 30 08 261 BMI PRINT2 IF THIS IS THE FIRST TIME
262 * THROUGH THE CODE. (THERE
263 * WAS NO PREV. CHAR TO ACK.)
009B B9 83 C0 264 PLOOP LDA CRB,Y CHECK BUSY/ACK FLAG (BIT 7)
009E 10 FB 265 BPL PLOOP AND LOOP UNTIL IT IS SET.
266 *
00A0 B9 82 C0 267 LDA ORB,Y RESET FLAG BIT.
268 *
269 * O.K. TO TRANSFER THE CHARACTER NOW. IF IN
270 * SLOT ONE USE AN ABSOLUTE STORE RATHER THAN
271 * AN INDEXED STORE IN CASE OF HANDSHAKE PROBLEMS
00A3 68 272 PRINT2 PLA ;
00A4 48 273 PHA ; GET THE CHAR AND INVERT IT IFF
00A5 5D 38 06 274 EOR DATA,X PERIPHERAL USES ACTIVE NEGATIVE
00A8 C0 10 275 CPY #$10
00AA D0 05 276 BNE INDXD
00AC 8D 92 C0 277 STA ORB+$10
00AF F0 03 278 BEQ STRBCH
00B1 99 82 C0 279 INDXD STA ORB,Y
280 *
281 * GENERATE A STROBE SIGNAL ON CB2 TO SIGNAL PRESENCE
282 * OF THE CHARACTER ON THE OUTPUT PORT
283 *
00B4 B9 83 C0 284 STRBCH LDA CRB,Y ;
00B7 49 08 285 EOR #$08 ; ISSUE THE STROBE (POS OR NEG
00B9 99 83 C0 286 STA CRB,Y ; DEPENDING ON FLAG) WITHOUT
00BC 49 08 287 EOR #$08 ; CHANGING THE OTHER CONTROL BITS
00BE 99 83 C0 288 STA CRB,Y ;
289 *
00C1 68 290 SKIP0 PLA
00C2 49 0D 291 EOR #$0D CHECK FOR CR
00C4 F0 12 292 BEQ CRCODE
00C6 28 293 EXIT PLF
00C7 90 8D 294 ECC PRINT1 GO BACK FOR THE REAL CHAR IF
295 * THIS WAS A GENERATED TAB OR CR.
00C9 BD B8 03 296 LDA MODE,X SKIP JUMP TO MONITOR COUT ROUTINE
297 * IF NOVID FLAG IS SET.
00CC 0A 298 ASL
00CD 68 299 DONE2 PLA ; RESTORE REGS &
00CE AA 300 TAX ; EITHER JUMP TO

```

```

00CF 68          301          PLA      ;      MONITOR'S I/O
00D0 A8          302          TAY      ;      ROUTINE OR RTS
00D1 68          303          PLA      ;      BACK TO CALLER
          304 *      CARRY SET MEANS NOVID MODE - BYPASS MONITOR ROUTINE
00D2 B0 03      305          BCS      RETURN
00D4 4C F0 FD   306          JMP      COUT1
          307 *
00D7 60          308 RETURN RTS
          309 *
          310 *      END-OF-LINE REACHED. CHECK FOR END-OF-PAGE
          311 *      IF PAGE>0 AND DO A FORM FEED IF NECCESARY.
          312 *
00D8 BD B8 05   313 CRCODE LDA      PAGE,X
00DB F0 0F      314          BEQ      RESET      OPTION DEFEATED
00DD FE B8 06   315          INC      LINE,X      BUMP LINE COUNTER
00E0 FD B8 06   316          SBC      LINE,X      GET PAGE LEN - LINE #
00E3 10 07      317          BPL      RESET      NOT YET
00E5 49 F8      318          EOR      #$F8      FINISHED DOING FORM
00E7 D0 88      319          BNE      PAGCR      FEED? NO, DO A CR.
00E9 9D B8 06   320          STA      LINE,X      YES, ZERO LINE COUNTER
          321 *
          322 *      ZERO THE COLUMN AND MONCH POINTERS AND OPTIONALLY
          323 *      GENERATE A LINE FEED (DEFAULT IS NO AUTOMATIC LF).
          324 *      IF CR WAS GENERATED, THE ACTUAL CHR WILL BE OUTPUT
          325 *      AFTER THE LF - ELSE WE WILL RETURN AFTER LF.
          326 *
00EC A9 00      327 RESET  LDA      #$00
00EE 9D 38 07   328          STA      COLUMN,X
00F1 85 24      329          STA      MONCH
00F3 BD B8 03   330          LDA      MODE,X      ;
00F6 0A          331          ASL      ;      ; PUTS AUTOLF FLAG IN CARRY
00F7 0A          332          ASL      ;      ;
00F8 90 CC      333          BCC      EXIT
00FA A9 0A      334          LDA      #$0A
00FC D0 97      335          BNE      OUT2
          336 *
          337 *      END

```

--- END ASSEMBLY ---

TOTAL ERRORS: 00

:

```

1 *****
2 *
3 * PARALLEL PRINTER *
4 * INTERFACE FIRMWARE *
5 * *
6 * TYPE: PFO-4 *
7 * NEGATIVE DATA *
8 * POSITIVE STROBE *
9 * POSITIVE ACKNOWLEDGE *
10 * *
11 * *
12 * WRITTEN BY FRED VILES *
13 * SEPTEMBER 10, 1979 *
14 * *
15 * VERSION 4.0 *
16 * DECEMBER 1, 1980 *
17 * *
18 * COPYRIGHT 1979 BY *
19 * SSM MICROCOMPUTER PRODUCTS *
20 * ALL RIGHTS RESERVED *
21 * *
22 *****
23 *
24 *
25 *
26 * MODE - CONTAINS TWO STATUS FLAGS IN THE HIGH ORDER TWO
27 * BITS WHICH SELECT THE OPTIONAL AUTO-LINE FEED
28 * AND VIDEO-DISABLED MODES OF OPERATION.
29 * B7 - SELECTS NOVID MODE (APPLE VIDEO DISABLED) WHEN
30 * SET (1), DEFAULTS TO 0 (OFF)
31 * B6 - SELECTS AUTOLF MODE WHEN SET (1), DEFAULT IS 0.
32 *
33 * WINDOW - A CARRIAGE RETURN WILL BE OUTPUT AUTOMATICALLY
34 * WHEN ANY LINE EXCEEDS THIS VALUE. MAY BE USED
35 * TO CAUSE 'WRAP-AROUND' WHEN THE PRINTER'S
36 * LINE LENGTH IS EXCEEDED IF THE PRINTER ITSELF
37 * CAN'T DO IT, OR WHEN NARROW PAPER IS USED ON
38 * A WIDER CARRIAGE. DEFAULT IS 255.
39 *
40 * MARGIN - A CR WILL BE OUTPUT IN PLACE OF THE FIRST BLANK
41 * PRINTED AFTER LINE LENGTH EXCEEDS THIS VALUE.
42 * CAN BE USED TO FORMAT LISTINGS SUCH THAT WORDS
43 * ARE NOT SPLIT BETWEEN LINES. DEFAULT IS 255.
44 *
45 * INDENT - THE FIRST CHARACTER OF EACH LINE IS INDENTED
46 * (PADDED WITH BLANKS ON THE LEFT) BY THIS NUMBER
47 *
48 * PAGE - A 'FORMFEED' (SEVEN BLANK LINES) WILL BE OUTPUT
49 * AFTER EACH 'PAGE' (THE NUMBER OF LINES GIVEN
50 * BY THIS VALUE) HAS BEEN PRINTED. SETTING PAGE
51 * TO ZERO DEFEATS FORM FEED. DEFAULT IS 58 FOR
52 * A PAGE OF 11.5 INCHES ON MOST PRINTERS.
53 *
54 * DATA - CONTAINS A VALUE TO BE EXCLUSIVE-OR'ED WITH THE
55 * CHAR BEFORE IT IS TRANSMITTED. SET TO $00 FOR
56 * POSITIVE GOING DATA, OR TO $FF FOR NEGATIVE
57 * GOING DATA. NOTE - THE USER CAN SET DATA
58 * TO $80 OR $7F INSTEAD TO FORCE THE HIGH
59 * ORDER DATA BIT TO BE '1' INSTEAD OF '0'
60 *

```

```

61 *
62 MODE EQU $3B8 ( 478+N:?? POKE 1144+N,?? )
63 WINDOW EQU $438 ( 4F8+N:?? POKE 1272+N,?? )
64 MARGIN EQU $4B8 ( 578+N:?? POKE 1400+N,?? )
65 INDENT EQU $538 ( 5F8+N:?? POKE 1528+N,?? )
66 PAGE EQU $5B8 ( 678+N:?? POKE 1656+N,?? )
67 DATA EQU $638 ( 6F8+N:?? POKE 1784+N,?? )
68 *
69 * * * * *
70 *
71 * THE FOLLOWING COUNTERS AND FLAGS ARE USED
72 * INTERNALLY AND SHOULD NOT BE ALTERED BY
73 * THE USER.
74 *
75 * COLUMN - PRINTER COLUMN COUNTER (NUMBER
76 * OF CHARS OUTPUT SINCE LAST
77 * CARRIAGE RETURN)
78 *
79 * LINE - CURRENT PRINTER LINE NUMBER
80 * (NUMBER OF CR'S OUTPUT SINCE
81 * THE LAST FORM FEED)
82 *
83 *
84 * INITF - THIS FLAG IS USED TO AVOID GETTING HUNG
85 * UP IN THE 'WAIT FOR ACKNOWLEDGE' LOOP
86 * ON THE INITIALIZATION ENTRY.
87 *
88 LINE EQU $6B8
89 COLUMN EQU $738
90 INITF EQU $478
91 *
92 * ADDR OF THE MONITOR'S CURRENT
93 * HORIZONTAL CURSOR POSITION
94 *
95 MONCH EQU $24
96 *
97 * MONITOR ENTRIES USED
98 * COUT1 - THE OUTPUT ROUTINE
99 * IORTS - DOES AN IMMEDIATE RTS
100 *
101 COUT1 EQU $FDF0
102 IORTS EQU $FF58
103 *
104 *
105 * ($C080+$N0) IS THE A-SIDE DATA DIRECTION REG. (DDRA)
106 * IF CRA BIT 2 IS "1", AND IS THE A-SIDE OUTPUT REG.
107 * (ORA) IF CRA2 IS "0"
108 * ($C081+$N0) IS THE A-SIDE CONTROL REGISTER (CRA).
109 * ($C082+$N0) AND ($C083+$N0) ARE THE CORRESPONDING B-SIDE
110 * REG. ADDRESSES
111 *
112 DDRA EQU $C080
113 ORA EQU $C080
114 CRA EQU $C081
115 DDRB EQU $C082
116 ORB EQU $C082
117 CRB EQU $C083
118 *
119 *
120 *

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121 *****
122 *
123 ORG $00 *
124 OBJ $5200 *
125 *
126 *****
127 *****
128 *
129 * PR#N OR N CNTRL-P ENTRY. MONITOR DESTORYS
130 * LINK ADDR ALREADY IN $36,$37 HEX
131 *
0000 18 132 ENT0 CLC * INDICATE INITIALIZATION ENTRY
0001 B0 FE 133 BCS * MASK THE SEC
134 ORG *-1
135 OBJ *+$5200
136 *
137 * SOFT ENTRY PRINT VECTOR
138 *
0002 38 139 ENTW SEC ; NORMAL PRINT ENTRY POINT
0003 48 140 PHA ; SAVE THE
0004 98 141 TYA ; REGISTERS
0005 48 142 PHA ; ON THE
0006 8A 143 TXA ; STACK
0007 48 144 PHA $
0008 78 145 SEI ; STACK PROCESSING
0009 20 58 FF 146 JSR IORTS MUST NOT BE
000C BA 147 TSX ; INTERRUPTED.
000D 68 148 PLA $
000E 68 149 PLA ; RETRIEVE CHAR
000F 68 150 PLA ; FROM UNDER STACK
0010 A8 151 TAY ; INTO REG Y AND
0011 CA 152 DEX ; GET $CN FROM
0012 9A 153 TXS ; ABOVE STACK (RTS
0013 68 154 PLA ; LEFT IT THERE) -
0014 AA 155 TAX ; WITHOUT HARMING
0015 58 156 CLI ; CONTENTS
0016 98 157 TYA $
0017 29 7F 158 AND #$7F FORCE B7 TO ZERO
0019 48 159 PHA ; SAVE CHAR
001A 08 160 PHP ; SAVE STATUS
161 * GET $NO INTO REG Y
001B 8A 162 TXA $
001C 0A 163 ASL
001D 0A 164 ASL
001E 0A 165 ASL
001F 0A 166 ASL
0020 A8 167 TAY $
0021 28 168 PLP ; RESTORE STATUS
0022 B0 2F 169 BCS PRINT0 BRANCH AROUND INITS IF SOFT ENTRY
170 *
171 * DEFAULT INITS FOR 1-ST ENTRY
172 *
0024 A9 02 173 INITAL LDA #$02 SET OUTPUT VECTOR TO POINT
0026 85 36 174 STA $36 TO THE SOFT ENTRY
0028 4A 175 LSR ;
0029 4A 176 LSR ; LDA ZERO AND SET CARRY
002A 99 83 C0 177 STA CRB,Y ASSURE ADDRESSING DDRB
178 * STA DATA,X DATA WILL BE ACTIVE POSITIVE
002D 9D 38 07 179 STA COLUMN,X WE START AT THE BEGINNING
0030 9D B8 06 180 STA LINE,X OF LINE ZERO.

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0033 9D 38 05 181 STA INDENT,X NO INDENTING ON LEFT
0036 9D B8 03 182 STA MODE,X MONITOR VIDEO IS ENABLED AND
183 * AUTO LINE FEED IS DISABLED
0039 A9 FF 134 LDA #$FF DEFAULT WINDOW IS SET TO
003B 9D 38 04 185 STA WINDOW,X 255 TO DEFEAT AUTO CR GENERATION
003E 9D B8 04 186 STA MARGIN,X NO MARGIN FORMATTING.
187 * SET UP DATA DIRECTION REG. FOR
0041 99 82 C0 188 STA DDRB,Y ALL BITS AS OUTPUT.
0044 9D 38 05 189 STA DATA,X DATA WILL BE ACTIVE NEGATIVE.
190 * INITIALIZE THE PIA FOR DEFAULT OPERATION - MANUAL STROBE
191 * $36 - POS STROBE, POS ACK OR BUSY (TRAILING EDGE SENSED)
192 * $34 - POS STROBE, NEG ACK OR BUSY "
193 * $3E - NEG STROBE, POS ACK OR BUSY "
194 * $3C - NEG STROBE, NEG ACK OR BUSY "
0047 A9 36 195 LDA #$36
0049 99 83 C0 196 STA CRB,Y
197 *
004C A9 3A 198 LDA #$3A PAGE LENGTH IS 59 LINES
004E 9D B8 05 199 STA PAGE,X FOR ABOUT 11.5" PAPER.
0051 A9 80 200 LDA #$80 SET INIT FLAG TRUE
201 *
202 * NORMAL PATH FOR OUTPUT. TEST FOR WINDOW WIDTH
203 * EXCEEDED, FOR RIGHT MARGIN FORMATTING, AND FOR TAB
204 * GENERATION IN THAT ORDER UNLESS COLUMN OVERFLOWED.
205 *
0053 8D 78 04 206 PRINT0 STA INITF
0056 BD 38 07 207 PRINT1 LDA COLUMN,X
0059 C9 FF 208 CMP #$FF 1-ST CHECK FOR COLUMN OVERFLOW.
005B F0 36 209 BEQ SKIP2 YES - SKIP ALL FURTHER TESTS.
005D DD 38 04 210 CMP WINDOW,X CHECK FOR WINDOW EXCEEDED
0060 B0 0D 211 BCS WNDCCR YES - GO GENERATE A CARR. RET.
212 *
213 * CODE TO GENERATE A CR IN PLACE OF THE
214 * FIRST BLANK CHAR AFTER THE USER-SPECIFIED
215 * MARGIN IS EXCEEDED.
216 *
0062 DD B8 04 217 FMTTST CMP MARGIN,X PAST MARGIN?
0065 90 0E 218 BCC TABTST NO, GO CHECK FOR TAB
0067 68 219 PLA ; YES, TEST FOR A
0068 2C 83 FD 220 BIT $FD83 BLANK CHARACTER.
006B D0 14 221 BNE NOTAB IF SO, GO GENERATE
006D F0 01 222 BEQ FMTCR A CR AND DROP THE BLANK
223 *
224 *
006F 18 225 WNDCCR CLC
0070 08 226 FMTCR PHP
0071 A9 0D 227 PAGCR LDA #$0D
0073 D0 20 228 BNE OUT2
229 *
230 *****
231 *
232 * CHECK FOR LEFT-MARGIN PPADDING REQUIRED
233 * AND FOR BASIC TAB OR COMMA PRINT FORMATTING.
234 *
0075 DD 38 05 235 TABTST CMP INDENT,X
0078 90 02 236 BCC SPGEN IF INDENT (LEFT MARGIN) OR
007A C5 24 237 CMP MONCH IF MONCH IS GREATER THAN COLUMN
007C A9 20 238 SPGEN LDA #$20 GENERATE SPACES TO CATCH UP TO
007E 90 0F 239 BCC INCCOL IT (BASIC TAB FORMATTING)
0080 68 240 PLA

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0081 2C 58 FF 241 NOTAB BIT IORTS
0084 F0 0E 242 BEQ OUT DON'T BUMP POINTERS IF CNTRL
0086 48 243 PHA
0087 BD B8 03 244 LDA MODE,X MAINTAIN MONCH IF IN NOVID
008A 10 02 245 BPL SKIP1 MODE SO THAT BASIC COMMA
008C E6 24 246 INC MONCH FORMATTING WILL STILL WORK
008E 68 247 SKIP1 PLA
008F FE 38 07 248 INCCOL INC COLUMN,X BUMP THE COLUMN COUNTER
249 *
0092 F0 FE 250 BEQ * FAKE BRANCH TO HIDE THE PLA
251 ORG *-1 INSTRUCTION FROM THE
252 OBJ *+$5200 FALL-THRU PATH.
253 *
0093 68 254 SKIP2 PLA GET CHAR WHEN COLUMN=255
255 *
256 *
0094 08 257 OUT PHP
0095 48 258 OUT2 PHA
259 *
0096 AD 78 04 260 LDA INITF DON'T WAIT FOR PRINTER
0099 30 08 261 BMI PRINT2 IF THIS IS THE FIRST TIME
262 * THROUGH THE CODE. (THERE
263 * WAS NO PREV. CHAR TO ACK.)
009B B9 83 C0 264 PLOOP LDA CRB,Y CHECK BUSY/ACK FLAG (BIT 7)
009E 10 FB 265 BPL PLOOP AND LOOP UNTIL IT IS SET.
266 *
00A0 B9 82 C0 267 LDA ORB,Y RESET FLAG BIT.
268 *
269 * O.K. TO TRANSFER THE CHARACTER NOW. IF IN
270 * SLOT ONE USE AN ABSOLUTE STORE RATHER THAN
271 * AN INDEXED STORE IN CASE OF HANDSHAKE PROBLEMS
00A3 68 272 PRINT2 PLA ;
00A4 48 273 PHA ; GET THE CHAR AND INVERT IT IFF
00A5 5D 38 06 274 EOR DATA,X PERIPHERAL USES ACTIVE NEGATIVE
00A8 C0 10 275 CPY #$10
00AA D0 05 276 BNE INDXD
00AC 8D 92 C0 277 STA ORB+$10
00AF F0 03 278 BEQ STRBCH
00B1 99 82 C0 279 INDXD STA ORB,Y
280 *
281 * GENERATE A STROBE SIGNAL ON CB2 TO SIGNAL PRESENCE
282 * OF THE CHARACTER ON THE OUTPUT PORT
283 *
00B4 B9 83 C0 284 STRBCH LDA CRB,Y ;
00B7 49 08 285 EOR #$08 ; ISSUE THE STROBE (POS OR NEG
00B9 99 83 C0 286 STA CRB,Y ; DEPENDING ON FLAG) WITHOUT
00BC 49 08 287 EOR #$08 ; CHANGING THE OTHER CONTROL BITS
00BE 99 83 C0 288 STA CRB,Y ;
289 *
00C1 68 290 SKIP0 PLA
00C2 49 0D 291 EOR #$0D CHECK FOR CR
00C4 F0 12 292 BEQ CRCODE
00C6 28 293 EXIT PLP
00C7 90 8D 294 BCC PRINT1 GO BACK FOR THE REAL CHAR IF
295 * THIS WAS A GENERATED TAB OR CR.
00C9 BD B8 03 296 LDA MODE,X SKIP JUMP TO MONITOR COUT ROUTINE
297 * IF NOVID FLAG IS SET.
00CC 0A 298 ASL
00CD 68 299 DONE2 PLA ; RESTORE REGS &
00CE AA 300 TAX ; EITHER JUMP TO

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00CF 68          301      PLA      ;      MONITOR'S I/O
00D0 A8          302      TAY      ;      ROUTINE OR RTS
00D1 68          303      PLA      ;      BACK TO CALLER
          304 * CARRY SET MEANS NOVID MODE - BYPASS MONITOR ROUTINE
00D2 B0 03      305      BCS      RETURN
00D4 4C F0      306      JMP      COUT1
          307 *
00D7 60          308 RETURN RTS
          309 *
          310 * END-OF-LINE REACHED. CHECK FOR END-OF-PAGE
          311 * IF PAGE>0 AND DO A FORM FEED IF NECESSARY.
          312 *
00D6 B0 B8 05   313 CRCODE LDA    PAGE,X
00DB F0 0F      314      BEQ    RESET    OPTION DEFEATED
00DD FE B8 06   315      INC    LINE,X   BUMP LINE COUNTER
00E0 FD B8 06   316      SBC    LINE,X   GET PAGE LEN - LINE #
00E3 10 07      317      BPL    RESET    NOT YET
00E5 49 F8      318      EOR    #$F8    FINISHED DOING FORM
00E7 D0 88      319      BNE    PAGCR   FEED? NO, DO A CR.
00E9 9D B8 06   320      STA    LINE,X   YES, ZERO LINE COUNTER
          321 *
          322 * ZERO THE COLUMN AND MONCH POINTERS AND OPTIONALLY
          323 * GENERATE A LINE FEED (DEFAULT IS NO AUTOMATIC LF).
          324 * IF CR WAS GENERATED, THE ACTUAL CHR WILL BE OUTPUT
          325 * AFTER THE LF - ELSE WE WILL RETURN AFTER LF.
          326 *
00EC A9 00      327 RESET  LDA    #$00
00EE 9D 38 07   328      STA    COLUMN,X
00F1 85 24      329      STA    MONCH
00F3 BD B8 03   330      LDA    MODE,X   ;
00F6 0A          331      ASL    ;           ; PUTS AUTOLF FLAG IN CARRY
00F7 0A          332      ASL    ;           ;
00F8 90 CC      333      BCC    EXIT
00FA A9 0A      334      LDA    #$0A
00FC D0 97      335      BNE    OUT2
          336 *
          337 *          END

```

--- END ASSEMBLY ---

TOTAL ERRORS: 00

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1 *****
2 *
3 * PARALLEL PRINTER *
4 * INTERFACE FIRMWARE *
5 *
6 * TYPE: PFO-5 *
7 * POSITIVE DATA *
8 * NEGATIVE STROBE *
9 * NEGATIVE ACKNOWLEDGE *
10 * FOR USE WITH "CENTRONICS- *
11 * COMPATIBLE" INTERFACES *
12 *
13 * WRITTEN BY FRED VILES *
14 * SEPTEMBER 10, 1979 *
15 *
16 * VERSION 4.0 *
17 * NOVEMBER 17, 1980 *
18 *
19 * COPYRIGHT 1979 BY *
20 * SSM MICROCOMPUTER PRODUCTS *
21 * ALL RIGHTS RESERVED *
22 *
23 *****
24 *
25 *
26 *
27 * MODE - CONTAINS TWO STATUS FLAGS IN THE HIGH ORDER TWO
28 * BITS WHICH SELECT THE OPTIONAL AUTO-LINE FEED
29 * AND VIDEO-DISABLED MODES OF OPERATION.
30 * B7 - SELECTS NOVID MODE (APPLE VIDEO DISABLED) WHEN
31 * SET (1), DEFAULTS TO 0 (OFF)
32 * B6 - SELECTS AUTOLF MODE WHEN SET (1), DEFAULT IS 0.
33 *
34 * WINDOW - A CARRIAGE RETURN WILL BE OUTPUT AUTOMATICALLY
35 * WHEN ANY LINE EXCEEDS THIS VALUE. MAY BE USED
36 * TO CAUSE 'WRAP-AROUND' WHEN THE PRINTER'S
37 * LINE LENGTH IS EXCEEDED IF THE PRINTER ITSELF
38 * CAN'T DO IT, OR WHEN NARROW PAPER IS USED ON
39 * A WIDER CARRIAGE. DEFAULT IS 255.
40 *
41 * MARGIN - A CR WILL BE OUTPUT IN PLACE OF THE FIRST BLANK
42 * PRINTED AFTER LINE LENGTH EXCEEDS THIS VALUE.
43 * CAN BE USED TO FORMAT LISTINGS SUCH THAT WORDS
44 * ARE NOT SPLIT BETWEEN LINES. DEFAULT IS 255.
45 *
46 * INDENT - THE FIRST CHARACTER OF EACH LINE IS INDENTED
47 * (PADDED WITH BLANKS ON THE LEFT) BY THIS NUMBER
48 *
49 * PAGE - A 'FORMFEED' (SEVEN BLANK LINES) WILL BE OUTPUT
50 * AFTER EACH 'PAGE' (THE NUMBER OF LINES GIVEN
51 * BY THIS VALUE) HAS BEEN PRINTED. SETTING PAGE
52 * TO ZERO DEFEATS FORM FEED. DEFAULT IS 58 FOR
53 * A PAGE OF 11.5 INCHES ON MOST PRINTERS.
54 *
55 * DATA - CONTAINS A VALUE TO BE EXCLUSIVE-OR'ED WITH THE
56 * CHAR BEFORE IT IS TRANSMITTED. SET TO $00 FOR
57 * POSITIVE GOING DATA, OR TO $FF FOR NEGATIVE
58 * GOING DATA. NOTE - THE USER CAN SET DATA
59 * TO $80 OR $7F INSTEAD TO FORCE THE HIGH
60 * ORDER DATA BIT TO BE '1' INSTEAD OF '0'

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61 *
62 *
63 MODE EQU $3B8 ( 478+N:?? POKE 1144+N,?? )
64 WINDOW EQU $438 ( 4F8+N:?? POKE 1272+N,?? )
65 MARGIN EQU $4B8 ( 578+N:?? POKE 1400+N,?? )
66 INDENT EQU $538 ( 5F8+N:?? POKE 1528+N,?? )
67 PAGE EQU $5B8 ( 678+N:?? POKE 1656+N,?? )
68 DATA EQU $638 ( 6F8+N:?? POKE 1784+N,?? )
69 *
70 * * * * *
71 *
72 * THE FOLLOWING COUNTERS AND FLAGS ARE USED
73 * INTERNALLY AND SHOULD NOT BE ALTERED BY
74 * THE USER.
75 *
76 * COLUMN - PRINTER COLUMN COUNTER (NUMBER
77 * OF CHARS OUTPUT SINCE LAST
78 * CARRIAGE RETURN)
79 *
80 * LINE - CURRENT PRINTER LINE NUMBER
81 * (NUMBER OF CR'S OUTPUT SINCE
82 * THE LAST FORM FEED)
83 *
84 *
85 * INITF - THIS FLAG IS USED TO AVOID GETTING HUNG
86 * UP IN THE 'WAIT FOR ACKNOWLEDGE' LOOP
87 * ON THE INITIALIZATION ENTRY.
88 *
89 LINE EQU $6B8
90 COLUMN EQU $738
91 INITF EQU $478
92 *
93 * ADDR OF THE MONITOR'S CURRENT
94 * HORIZONTAL CURSOR POSITION
95 *
96 MONCH EQU $24
97 *
98 * MONITOR ENTRIES USED
99 * COUT1 - THE OUTPUT ROUTINE
100 * IORTS - DOES AN IMMEDIATE RTS
101 *
102 COUT1 EQU $FDF0
103 IORTS EQU $FF58
104 *
105 *
106 * ($C080+$N0) IS THE A-SIDE DATA DIRECTION REG. (DDRA)
107 * IF CRA BIT 2 IS "1", AND IS THE A-SIDE OUTPUT REG.
108 * (ORA) IF CRA2 IS "0"
109 * ($C081+$N0) IS THE A-SIDE CONTROL REGISTER (CRA).
110 * ($C082+$N0) AND ($C083+$N0) ARE THE CORRESPONDING B-SIDE
111 * REG. ADDRESSES
112 *
113 DDRA EQU $C080
114 ORA EQU $C080
115 CRA EQU $C081
116 DDRB EQU $C082
117 ORB EQU $C082
118 CRB EQU $C083
119 *
120 *

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```

121 *****
122 *
123          ORG    $00    *
124          OBJ    $5200  *
125 *
126 *****
127 *****
128 *
129 *   PR#N OR N CNTRL-P ENTRY. MONITOR DESTORYS
130 *   LINK ADDR ALREADY IN $36,$37 HEX
131 *
0000 18      132 ENT0   CLC    *           INDICATE INITIALIZATION ENTRY
0001 B0 FE   133          BCS    *           MASK THE SEC
134          ORG    *-1
135          OBJ    *+$5200
136 *
137 *   SOFT ENTRY PRINT VECTOR
138 *
0002 38      139 ENTW   SEC    ;           NORMAL PRINT ENTRY POINT
0003 48      140          PHA    ;           SAVE THE
0004 98      141          TYA    ;           REGISTERS
0005 48      142          PHA    ;           ON THE
0006 8A      143          TXA    ;           STACK
0007 48      144          PHA    $
0008 78      145          SEI    ;           STACK PROCESSING
0009 20 58 FF 146          JSR   IORTS  MUST NOT BE
000C BA      147          TSX    ;           INTERRUPTED.
000D 68      148          PLA    $
000E 68      149          PLA    ;           RETRIEVE CHAR
000F 68      150          PLA    ;           FROM UNDER STACK
0010 A8      151          TAY    ;           INTO REG Y AND
   11 CA      152          DEX    ;           GET $CN FROM
0012 9A      153          TXS    ;           ABOVE STACK (RTS
0013 68      154          PLA    ;           LEFT IT THERE) -
0014 AA      155          TAX    ;           WITHOUT HARMING
0015 58      156          CLI    ;           CONTENTS
0016 98      157          TYA    $
0017 29 7F   158          AND    #$7F  FORCE B7 TO ZERO
0019 48      159          PHA    ;           SAVE CHAR
001A 08      160          PHP    ;           SAVE STATUS
161 *   GET $N0 INTO REG Y
001B 8A      162          TXA    $
001C 0A      163          ASL
001D 0A      164          ASL
001E 0A      165          ASL
001F 0A      166          ASL
0020 A8      167          TAY    $
0021 28      168          PLP    ;           RESTORE STATUS
0022 B0 2F   169          BCS    PRINT0  BRANCH AROUND INITS IF SOFT ENTRY
170 *
171 *   DEFAULT INITS FOR 1-ST ENTRY
172 *
0024 A9 02   173 INITAL LDA    #$02    SET OUTPUT VECTOR TO POINT
0026 85 36   174          STA    $36    TO THE SOFT ENTRY
0028 4A      175          LSR    ;
0029 4A      176          LSR    ;           LDA ZERO AND SET CARRY
   2A 99 83 C0 177          STA    CRB,Y  ASSURE ADDRESSING DDRB
   2D 9D 38 06 178          STA    DATA,X  DATA WILL BE ACTIVE POSITIVE
0030 9D 38 07 179          STA    COLUMN,X  WE START AT THE BEGINNING
0033 9D B8 06 180          STA    LINE,X   OF LINE ZERO.

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0036 9D 38 05 181 STA INDENT,X NO INDENTING ON LEFT
0039 9D B8 03 182 STA MODE,X MONITOR VIDEO IS ENABLED AND
183 * AUTO LINE FEED IS DISABLED
003C A9 FF 184 LDA #$FF DEFAULT WINDOW IS SET TO
003E 9D 38 04 185 STA WINDOW,X 255 TO DEFEAT AUTO CR GENERATION
0041 9D B8 04 186 STA MARGIN,X NO MARGIN FORMATTING.
187 * SET UP DATA DIRECTION REG. FOR
0044 99 82 C0 188 STA DDRB,Y ALL BITS AS OUTPUT.
189 * STA DATA,X DATA WILL BE ACTIVE NEGATIVE.
190 * INITIALIZE THE PIA FOR DEFAULT OPERATION - MANUAL STROBE
191 * $36 - POS STROBE, POS ACK OR BUSY (TRAILING EDGE SENSED)
192 * $34 - POS STROBE, NEG ACK OR BUSY "
193 * $3E - NEG STROBE, POS ACK OR BUSY "
194 * $3C - NEG STROBE, NEG ACK OR BUSY "
0047 A9 3C 195 LDA #$3C
0049 99 83 C0 196 STA CRB,Y
197 *
004C A9 3A 198 LDA #$3A PAGE LENGTH IS 59 LINES
004E 9D B8 05 199 STA PAGE,X FOR ABOUT 11.5" PAPER.
0051 A9 80 200 LDA #$80 SET INIT FLAG TRUE
201 *
202 * NORMAL PATH FOR OUTPUT. TEST FOR WINDOW WIDTH
203 * EXCEEDED, FOR RIGHT MARGIN FORMATTING, AND FOR TAB
204 * GENERATION IN THAT ORDER UNLESS COLUMN OVERFLOWED.
205 *
0053 8D 78 04 206 PRINT0 STA INITF
0056 BD 38 07 207 PRINT1 LDA COLUMN,X
0059 C9 FF 208 CMP #$FF 1-ST CHECK FOR COLUMN OVERFLOW.
005B F0 36 209 BEQ SKIP2 YES - SKIP ALL FURTHER TESTS.
005D DD 38 04 210 CMP WINDOW,X CHECK FOR WINDOW EXCEEDED
0060 B0 0D 211 BCS WNDCR YES - GO GENERATE A CARR. RET.
212 *
213 * CODE TO GENERATE A CR IN PLACE OF THE
214 * FIRST BLANK CHAR AFTER THE USER-SPECIFIED
215 * MARGIN IS EXCEEDED.
216 *
0062 DD B8 04 217 FMTTST CMP MARGIN,X PAST MARGIN?
0065 90 0E 218 BCC TABTST NO, GO CHECK FOR TAB
0067 68 219 PLA ; YES, TEST FOR A
0068 2C 83 FD 220 BIT $FD83 BLANK CHARACTER.
006B D0 14 221 BNE NOTAB IF SO, GO GENERATE
006D F0 01 222 BEQ FMTCR A CR AND DROP THE BLANK
223 *
224 *
006F 18 225 WNDCR CLC
0070 08 226 FMTCR PHP
0071 A9 0D 227 PAGCR LDA #$0D
0073 D0 20 228 BNE OUT2
229 *
230 *****
231 *
232 * CHECK FOR LEFT-MARGIN PPADDING REQUIRED
233 * AND FOR BASIC TAB OR COMMA PRINT FORMATTING.
234 *
0075 DD 38 05 235 TABTST CMP INDENT,X
0078 90 02 236 BCC SPGEN IF INDENT (LEFT MARGIN) OR
007A C5 24 237 CMP MONCH IF MONCH IS GREATER THAN COLUMN
007C A9 20 238 SPGEN LDA #$20 GENERATE SPACES TO CATCH UP TO
007E 90 0F 239 BCC INCCOL IT (BASIC TAB FORMATTING)
0080 68 240 PLA

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0081 2C 58 FF      241 NOTAB BIT   IORTS
0084 F0 0E         242          BEQ   OUT           DON'T BUMP POINTERS IF CNTRL
0086 48           243          PHA
0087 BD B8 03     244          LDA   MODE,X      MAINTAIN MONCH IF IN NOVID
008A 10 02         245          BPL   SKIPL      MODE SO THAT BASIC COMMA
      8C E6 24      246          INC   MONCH      FORMATTING WILL STILL WORK
008E 68           247 SKIPL  PLA
008F FE 38 07     248 INCCOL INC   COLUMN,X    BUMP THE COLUMN COUNTER
      *           249 *
0092 F0 FE         250          BEQ   *           FAKE BRANCH TO HIDE THE PLA
      *           251          ORG   *-1        INSTRUCTION FROM THE
      *           252          OBJ   *+$5200    FALL-THRU PATH.
      *           253 *
0093 68           254 SKIP2  PLA   GET CHAR WHEN COLUMN=255
      *           255 *
      *           256 *
0094 08           257 OUT    PHP
0095 48           258 OUT2   PHA
      *           259 *
      *           DON'T WAIT FOR PRINTER
0096 AD 78 04     260          LDA   INITF      IF THIS IS THE FIRST TIME
0099 30 08         261          BMI   PRINT2    THROUGH THE CODE. (THERE
      *           262 *           WAS NO PREV. CHAR TO ACK.)
      *           263 *
009B B9 83 C0     264 PLOOP  LDA   CRB,Y    CHECK BUSY/ACK FLAG (BIT 7)
009E 10 FB         265          BPL   PLOOP      AND LOOP UNTIL IT IS SET.
      *           266 *
00A0 B9 82 C0     267          LDA   ORB,Y    RESET FLAG BIT.
      *           268 *
      *           269 * O.K. TO TRANSFER THE CHARACTER NOW. IF IN
      *           270 * SLOT ONE USE AN ABSOLUTE STORE RATHER THAN
      *           271 * AN INDEXED STORE IN CASE OF HANDSHAKE PROBLEMS
00A3 68           272 PRINT2 PLA   ;
00A4 48           273          PHA   ;           GET THE CHAR AND INVERT IT IFF
00A5 5D 38 06     274          EOR   DATA,X  PERIPHERAL USES ACTIVE NEGATIVE
00A8 C0 10         275          CPY   #$10
00AA D0 05         276          BNE   INDXD
00AC 8D 92 C0     277          STA   ORB+$10
00AF F0 03         278          BEQ   STRBCH
00B1 99 82 C0     279 INDXD  STA   ORB,Y
      *           280 *
      *           281 * GENERATE A STROBE SIGNAL ON CB2 TO SIGNAL PRESENCE
      *           282 * OF THE CHARACTER ON THE OUTPUT PORT
      *           283 *
00B4 B9 83 C0     284 STRBCH LDA   CRB,Y    ;
00B7 49 08         285          EOR   #$08      ; ISSUE THE STROBE (POS OR NEG
00B9 99 83 C0     286          STA   CRB,Y    ; DEPENDING ON FLAG) WITHOUT
00BC 49 08         287          EOR   #$08      ; CHANGING THE OTHER CONTROL BITS
00BE 99 83 C0     288          STA   CRB,Y    ;
      *           289 *
00C1 68           290 SKIP0  PLA
00C2 49 0D         291          EOR   #$0D      CHECK FOR CR
00C4 F0 12         292          BEQ   CRCODE
00C6 28           293 EXIT   PLP
00C7 90 8D         294          BCC   PRINT1    GO BACK FOR THE REAL CHAR IF
      *           295 *           THIS WAS A GENERATED TAB OR CR.
00C9 BD B8 03     296          LDA   MODE,X    SKIP JUMP TO MONITOR COUT ROUTINE
      *           297 *           IF NOVID FLAG IS SET.
00CC 0A           298          ASL
00CD 68           299 DONE2  PLA   ; RESTORE REGS &
00CE AA           300          TAX   ; EITHER JUMP TO

```

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00CF 68      301      PLA      ;      MONITOR'S I/O
00D0 A8      302      TAY      ;      ROUTINE OR RTS
00D1 68      303      PLA      ;      BACK TO CALLER
              304 *    CARRY SET MEANS NOVID MODE - BYPASS MONITOR ROUTINE
00D2 B0 03   305      BCS      RETURN
00D4 4C F0 FD 306      JMP      COUT1
              307 *
00D7 60      308 RETURN RTS
              309 *
              310 *    END-OF-LINE REACHED. CHECK FOR END-OF-PAGE
              311 *    IF PAGE>0 AND DO A FORM FEED IF NECCESARY.
              312 *
00D8 BD B8 05 313 CRCODE LDA    PAGE,X
00DB F0 0F    314      BEQ      RESET    OPTION DEFEATED
00DD FE B8 06 315      INC      LINE,X    BUMP LINE COUNTER
00E0 FD B8 06 316      SBC      LINE,X    GET PAGE LEN - LINE #
00E3 10 07    317      BPL      RESET    NOT YET
00E5 49 F8    318      EOR      #$F8    FINISHED DOING FORM
00E7 D0 88    319      BNE      PAGCR    FEED? NO, DO A CR.
00E9 9D B8 06 320      STA      LINE,X    YES, ZERO LINE COUNTER
              321 *
              322 *    ZERO THE COLUMN AND MONCH POINTERS AND OPTIONALLY
              323 *    GENERATE A LINE FEED (DEFAULT IS NO AUTOMATIC LF).
              324 *    IF CR WAS GENERATED, THE ACTUAL CHR WILL BE OUTPUT
              325 *    AFTER THE LF - ELSE WE WILL RETURN AFTER LF.
              326 *
00EC A9 00    327 RESET  LDA    #$00
00EE 9D 38 07 328      STA    COLUMN,X
00F1 85 24    329      STA    MONCH
00F3 BD B8 03 330      LDA    MODE,X      ;
00F6 0A      331      ASL      ;      ; PUTS AUTOLF FLAG IN CARRY
00F7 0A      332      ASL      ;      ;
00F8 90 CC    333      BCC      EXIT
00FA A9 0A    334      LDA    #$0A
00FC D0 97    335      BNE      OUT2
              336 *
              337 *          END

```

--- END ASSEMBLY ---

TOTAL ERRORS: 00

:

```

1 *****
2 *
3 * PARALLEL PRINTER *
4 * INTERFACE FIRMWARE *
5 *
6 * TYPE: PFO-6 *
7 * POSITIVE DATA *
8 * NEGATIVE STROBE *
9 * POSITIVE ACKNOWLEDGE *
10 *
11 *
12 * WRITTEN BY FRED VILES *
13 * SEPTEMBER 10, 1979 *
14 *
15 * VERSION 4.0 *
16 * DECEMBER 1, 1980 *
17 *
18 * COPYRIGHT 1979 BY *
19 * SSM MICROCOMPUTER PRODUCTS *
20 * ALL RIGHTS RESERVED *
21 *
22 *****
23 *
24 *
25 *
26 * MODE - CONTAINS TWO STATUS FLAGS IN THE HIGH ORDER TWO
27 * BITS WHICH SELECT THE OPTIONAL AUTO-LINE FEED
28 * AND VIDEO-DISABLED MODES OF OPERATION.
29 * B7 - SELECTS NOVID MODE (APPLE VIDEO DISABLED) WHEN
30 * SET (1), DEFAULTS TO 0 (OFF)
31 * B6 - SELECTS AUTOLF MODE WHEN SET (1), DEFAULT IS 0.
32 *
33 * WINDOW - A CARRIAGE RETURN WILL BE OUTPUT AUTOMATICALLY
34 * WHEN ANY LINE EXCEEDS THIS VALUE. MAY BE USED
35 * TO CAUSE 'WRAP-AROUND' WHEN THE PRINTER'S
36 * LINE LENGTH IS EXCEEDED IF THE PRINTER ITSELF
37 * CAN'T DO IT, OR WHEN NARROW PAPER IS USED ON
38 * A WIDER CARRIAGE. DEFAULT IS 255.
39 *
40 * MARGIN - A CR WILL BE OUTPUT IN PLACE OF THE FIRST BLANK
41 * PRINTED AFTER LINE LENGTH EXCEEDS THIS VALUE.
42 * CAN BE USED TO FORMAT LISTINGS SUCH THAT WORDS
43 * ARE NOT SPLIT BETWEEN LINES. DEFAULT IS 255.
44 *
45 * INDENT - THE FIRST CHARACTER OF EACH LINE IS INDENTED
46 * (PADDED WITH BLANKS ON THE LEFT) BY THIS NUMBER
47 *
48 * PAGE - A 'FORMFEED' (SEVEN BLANK LINES) WILL BE OUTPUT
49 * AFTER EACH 'PAGE' (THE NUMBER OF LINES GIVEN
50 * BY THIS VALUE) HAS BEEN PRINTED. SETTING PAGE
51 * TO ZERO DEFEATS FORM FEED. DEFAULT IS 58 FOR
52 * A PAGE OF 11.5 INCHES ON MOST PRINTERS.
53 *
54 * DATA - CONTAINS A VALUE TO BE EXCLUSIVE-OR'ED WITH THE
55 * CHAR BEFORE IT IS TRANSMITTED. SET TO $00 FOR
56 * POSITIVE GOING DATA, OR TO $FF FOR NEGATIVE
57 * GOING DATA. NOTE - THE USER CAN SET DATA
58 * TO $80 OR $7F INSTEAD TO FORCE THE HIGH
59 * ORDER DATA BIT TO BE '1' INSTEAD OF '0'
60 *

```

```

61 *
62 MODE EQU $3B8 ( 478+N:?? POKE 1144+N,?? )
63 WINDOW EQU $438 ( 4F8+N:?? POKE 1272+N,?? )
64 MARGIN EQU $4B8 ( 578+N:?? POKE 1400+N,?? )
65 INDENT EQU $538 ( 5F8+N:?? POKE 1528+N,?? )
66 PAGE EQU $5B8 ( 678+N:?? POKE 1656+N,?? )
67 DATA EQU $638 ( 6F8+N:?? POKE 1784+N,?? )
68 *
69 * * * * * * * * * * *
70 *
71 * THE FOLLOWING COUNTERS AND FLAGS ARE USED
72 * INTERNALLY AND SHOULD NOT BE ALTERED BY
73 * THE USER.
74 *
75 * COLUMN - PRINTER COLUMN COUNTER (NUMBER
76 * OF CHARS OUTPUT SINCE LAST
77 * CARRIAGE RETURN)
78 *
79 * LINE - CURRENT PRINTER LINE NUMBER
80 * (NUMBER OF CR'S OUTPUT SINCE
81 * THE LAST FORM FEED)
82 *
83 *
84 * INITF - THIS FLAG IS USED TO AVOID GETTING HUNG
85 * UP IN THE 'WAIT FOR ACKNOWLEDGE' LOOP
86 * ON THE INITIALIZATION ENTRY.
87 *
88 LINE EQU $6B8
89 COLUMN EQU $738
90 INITF EQU $478
91 *
92 * ADDR OF THE MONITOR'S CURRENT
93 * HORIZONTAL CURSOR POSITION
94 *
95 MONCH EQU $24
96 *
97 * MONITOR ENTRIES USED
98 * COUT1 - THE OUTPUT ROUTINE
99 * IORTS - DOES AN IMMEDIATE RTS
100 *
101 COUT1 EQU $FDF0
102 IORTS EQU $FF58
103 *
104 *
105 * ($C080+$N0) IS THE A-SIDE DATA DIRECTION REG. (DDRA)
106 * IF CRA BIT 2 IS "1", AND IS THE A-SIDE OUTPUT REG.
107 * (ORA) IF CRA2 IS "0"
108 * ($C081+$N0) IS THE A-SIDE CONTROL REGISTER (CRA).
109 * ($C082+$N0) AND ($C083+$N0) ARE THE CORRESPONDING B-SIDE
110 * REG. ADDRESSES
111 *
112 DDRA EQU $C080
113 ORA EQU $C080
114 CRA EQU $C081
115 DDRB EQU $C082
116 ORB EQU $C082
117 CRB EQU $C083
118 *
119 *
120 *

```



```

121 *****
122 *
123     ORG     $00     *
124     OBJ     $5200   *
125 *
126 *****
127 *****
128 *
129 *   PR#N OR N CNTRL-P ENTRY. MONITOR DESTORYS
130 *   LINK ADDR ALREADY IN $36,$37 HEX
131 *
0000 18      132 ENT0   CLC     *           INDICATE INITIALIZATION ENTRY
0001 B0 FE    133         BCS     *           MASK THE SEC
134         ORG     *-1
135         OBJ     *+$5200
136 *
137 *   SOFT ENTRY PRINT VECTOR
138 *
0002 38      139 ENTW   SEC     ;           NORMAL PRINT ENTRY POINT
0003 48      140         PHA     ;           SAVE THE
0004 98      141         TYA     ;           REGISTERS
0005 48      142         PHA     ;           ON THE
0006 8A      143         TXA     ;           STACK
0007 48      144         PHA     $
0008 78      145         SEI     ;           STACK PROCESSING
0009 20 58 FF 146     JSR   IORTS  MUST NOT BE
000C BA      147     TSX     ;           INTERRUPTED.
000D 68      148     PLA     $
000E 68      149     PLA     ;           RETRIEVE CHAR
000F 68      150     PLA     ;           FROM UNDER STACK
0010 A8      151     TAY     ;           INTO REG Y AND
0011 CA      152     DEX     ;           GET $CN FROM
0012 9A      153     TXS     ;           ABOVE STACK (RTS
0013 68      154     PLA     ;           LEFT IT THERE) -
0014 AA      155     TAX     ;           WITHOUT HARMING
0015 58      156     CLI     ;           CONTENTS
0016 98      157     TYA     $
0017 29 7F   158     AND     #$7F   FORCE B7 TO ZERO
0019 48      159     PHA     ;           SAVE CHAR
001A 08      160     PHP     ;           SAVE STATUS
001B 8A      161 *   GET   $NO   INTO REG Y
001C 0A      162     TXA     $
001D 0A      163     ASL
001E 0A      164     ASL
001F 0A      165     ASL
0020 A8      166     ASL
0021 28      167     TAY     $
0022 B0 2F   168     PLP     ;           RESTORE STATUS
169     BCS     PRINT0   BRANCH AROUND INITS IF SOFT ENTRY
170 *
171 *   DEFAULT INITS FOR 1-ST ENTRY
172 *
0024 A9 02   173 INITIAL LDA   #$02   SET OUTPUT VECTOR TO POINT
0026 85 36   174     STA   $36   TO THE SOFT ENTRY
0028 4A      175     LSR     ;
0029 4A      176     LSR     ;           LDA ZERO AND SET CARRY
002A 99 83 C0 177     STA   CRB,Y   ASSURE ADDRESSING DDRB
002D 9D 38 06 178     STA   DATA,X  DATA WILL BE ACTIVE POSITIVE
0030 9D 38 07 179     STA   COLUMN,X  WE START AT THE BEGINNING
0033 9D B8 06 180     STA   LINE,X   OF LINE ZERO.

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0030 9D 38 05      181      STA      INDENT,X      NO INDENTING ON LEFT
0039 9D B8 03      182      STA      MODE,X        MONITOR VIDEO IS ENABLED AND
                                183 *                AUTO LINE FEED IS DISABLED
003C A9 FF          184      LDA      #$FF          DEFAULT WINDOW IS SET TO
003E 9D 38 04      185      STA      WINDOW,X      255 TO DEFEAT AUTO CR GENERATION
0041 9D B8 04      186      STA      MARGIN,X      NO MARGIN FORMATTING.
                                187 *                SET UP DATA DIRECTION REG. FOR
0044 99 82 C0      188      STA      DDRB,Y        ALL BITS AS OUTPUT.
                                189 *                STA      DATA,X      DATA WILL BE ACTIVE NEGATIVE.
                                190 *                INITIALIZE THE PIA FOR DEFAULT OPERATION - MANUAL STROBE
                                191 *                $36 - POS STROBE, POS ACK OR BUSY (TRAILING EDGE SENSE)
                                192 *                $34 - POS STROBE, NEG ACK OR BUSY
                                193 *                $3E - NEG STROBE, POS ACK OR BUSY
                                194 *                $3C - NEG STROBE, NEG ACK OR BUSY
0047 A9 3E          195      LDA      #$3E
0049 99 83 C0      196      STA      CRB,Y
                                197 *
004C A9 3A          198      LDA      #$3A          PAGE LENGTH IS 59 LINES
004E 9D B8 05      199      STA      PAGE,X        FOR ABOUT 11.5" PAPER.
0051 A9 80          200      LDA      #$80          SET INIT FLAG TRUE
                                201 *
                                202 *                NORMAL PATH FOR OUTPUT. TEST FOR WINDOW WIDTH
                                203 *                EXCEEDED, FOR RIGHT MARGIN FORMATTING, AND FOR TAB
                                204 *                GENERATION IN THAT ORDER UNLESS COLUMN OVERFLOWED.
                                205 *
0053 8D 78 04      206 PRINT0 STA      INITF
0056 BD 38 07      207 PRINT1 LDA     COLUMN,X
0059 C9 FF          208      CMP      #$FF          1-ST CHECK FOR COLUMN OVERFLOW.
005B F0 36          209      BEQ     SKIP2          YES - SKIP ALL FURTHER TESTS.
005D DD 38 04      210      CMP     WINDOW,X      CHECK FOR WINDOW EXCEEDED
0060 B0 0D          211      BCS     WNDCCR        YES - GO GENERATE A CARR. RET.
                                212 *
                                213 *                CODE TO GENERATE A CR IN PLACE OF THE
                                214 *                FIRST BLANK CHAR AFTER THE USER-SPECIFIED
                                215 *                MARGIN IS EXCEEDED.
                                216 *
0062 DD B8 04      217 FMTTST CMP     MARGIN,X      PAST MARGIN?
0065 90 0E          218      BCC     TABTST        NO, GO CHECK FOR TAB
0067 68             219      PLA     ;            YES, TEST FOR A
0068 2C 83 FD      220      BIT     $FD83        BLANK CHARACTER.
006B D0 14          221      BNE     NOTAB        IF SO, GO GENERATE
006D F0 01          222      BEQ     FMTCCR        A CR AND DROP THE BLANK
                                223 *
                                224 *
006F 18             225 WNDCCR CLC
0070 08             226 FMTCCR PHP
0071 A9 0D          227 PAGCR  LDA     #$0D
0073 D0 20          228      BNE     OUT2
                                229 *
0075 DD 38 05      230 *****
                                231 *
                                232 *                CHECK FOR LEFT-MARGIN PADDING REQUIRED
                                233 *                AND FOR BASIC TAB OR COMMA PRINT FORMATTING.
                                234 *
0075 DD 38 05      235 TABTST CMP     INDENT,X
0078 90 02          236      BCC     SPGEN        IF INDENT (LEFT MARGIN) OR
007A C5 24          237      CMP     MONCH        IF MONCH IS GREATER THAN COLUMN
007C A9 20          238 SPGEN  LDA     #$20        GENERATE SPACES TO CATCH UP TO
007E 90 0F          239      BCC     INCCOL       IT (BASIC TAB FORMATTING)
0080 68             240      PLA

```

0081	2C	58	FF	241	NOTAB	BIT	IORTS	
0084	F0	0E		242		BEQ	OUT	DON'T BUMP POINTERS IF CNTRL
0086	48			243		PHA		
0087	BD	B8	03	244		LDA	MODE,X	MAINTAIN MONCH IF IN NOVID
008A	10	02		245		BPL	SKIPL	MODE SO THAT BASIC COMMA
008C	E6	24		246		INC	MONCH	FORMATTING WILL STILL WORK
008E	68			247	SKIPL	PLA		
008F	FE	38	07	248	INCCOL	INC	COLUMN,X	BUMP THE COLUMN COUNTER
				249	*			
0092	F0	FE		250		BEQ	*	FAKE BRANCH TO HIDE THE PLA
				251		ORG	*-1	INSTRUCTION FROM THE
				252		OBJ	*+\$5200	FALL-THRU PATH.
				253	*			
0093	68			254	SKIP2	PLA	GET CHAR WHEN COLUMN=255	
				255	*			
				256	*			
0094	08			257	OUT	PHP		
0095	48			258	OUT2	PHA		
				259	*			
0096	AD	78	04	260		LDA	INITF	DON'T WAIT FOR PRINTER
0099	30	08		261		BMI	PRINT2	IF THIS IS THE FIRST TIME
				262	*			THROUGH THE CODE. (THERE
				263	*			WAS NO PREV. CHAR TO ACK.)
009B	B9	83	C0	264	PLOOP	LDA	CRB,Y	CHECK BUSY/ACK FLAG (BIT 7)
009E	10	FB		265		BPL	PLOOP	AND LOOP UNTIL IT IS SET.
				266	*			
00A0	B9	82	C0	267		LDA	ORB,Y	RESET FLAG BIT.
				268	*			
				269	*			O.K. TO TRANSFER THE CHARACTER NOW. IF IN
				270	*			SLOT ONE USE AN ABSOLUTE STORE RATHER THAN
				271	*			AN INDEXED STORE IN CASE OF HANDSHAKE PROBLEMS
00A3	68			272	PRINT2	PLA	;	
00A4	48			273		PHA	;	GET THE CHAR AND INVERT IT IFF
00A5	5D	38	06	274		EOR	DATA,X	PERIPHERAL USES ACTIVE NEGATIVE
00A8	C0	10		275		CPY	#\$10	
00AA	D0	05		276		BNE	INDXD	
00AC	8D	92	C0	277		STA	ORB+\$10	
00AF	F0	03		278		BEQ	STRBCH	
00B1	99	82	C0	279	INDXD	STA	ORB,Y	
				280	*			
				281	*			GENERATE A STROBE SIGNAL ON CB2 TO SIGNAL PRESENCE
				282	*			OF THE CHARACTER ON THE OUTPUT PORT
				283	*			
00B4	B9	83	C0	284	STRBCH	LDA	CRB,Y	;
00B7	49	08		285		EOR	#\$08	;
00B9	99	83	C0	286		STA	CRB,Y	;
00BC	49	08		287		EOR	#\$08	;
00BE	99	83	C0	288		STA	CRB,Y	;
				289	*			
00C1	68			290	SKIPO	PLA		
00C2	49	0D		291		EOR	#\$0D	CHECK FOR CR
00C4	F0	12		292		BEQ	CRCODE	
00C6	28			293	EXIT	PLP		
00C7	90	8D		294		BCC	PRINT1	GO BACK FOR THE REAL CHAR IF
				295	*			THIS WAS A GENERATED TAB OR CR.
00CB	BD	B8	03	296		LDA	MODE,X	SKIP JUMP TO MONITOR COUT ROUTINE
				297	*			IF NOVID FLAG IS SET.
00CC	0A			298		ASL		
00CD	68			299	DONE2	PLA	;	RESTORE REGS &
00CE	AA			300		TAX	;	EITHER JUMP TO

```

00CF 66          301          PLA      ;      MONITOR'S I/O
00D0 A8          302          TAY      ;      ROUTINE OR RTS
00D1 68          303          PLA      ;      BACK TO CALLER
304 * CARRY SET MEANS NOVID MODE - BYPASS MONITOR ROUTINE
00D2 B0 03      305          BCS      RETURN
00D4 4C F0 FD   306          JMP      COUT1
307 *
00D7 60          308 RETURN RTS
309 *
310 * END-OF-LINE REACHED. CHECK FOR END-OF-PAGE
311 * IF PAGE>0 AND DO A FORM FEED IF NECCESARY.
312 *
00D8 BD B8 05   313 CRCODE LDA    PAGE,X
00DB F0 0F      314          BEQ     RESET    OPTION DEFEATED
00DD FE B8 06   315          INC     LINE,X   BUMP LINE COUNTER
00E0 FD B8 06   316          SBC     LINE,X   GET PAGE LEN - LINE #
00E3 10 07      317          BPL     RESET    NOT YET
00E5 49 F8      318          EOR     #$F8    FINISHED DOING FORM
00E7 D0 88      319          BNE     PAGCR   FEED? NO, DO A CR.
00E9 9D B8 06   320          STA     LINE,X   YES, ZERO LINE COUNTER
321 *
322 * ZERO THE COLUMN AND MONCH POINTERS AND OPTIONALLY
323 * GENERATE A LINE FEED (DEFAULT IS NO AUTOMATIC LF).
324 * IF CR WAS GENERATED, THE ACTUAL CHR WILL BE OUTPUT
325 * AFTER THE LF - ELSE WE WILL RETURN AFTER LF.
326 *
00EC A9 00      327 RESET  LDA     #$00
00EE 9D 38 07   328          STA     COLUMN,X
00F1 85 24      329          STA     MONCH
00F3 BD B8 03   330          LDA     MODE,X   ;
00F6 0A          331          ASL     ;           ; PUTS AUTOLF FLAG IN CARRY
00F7 0A          332          ASL     ;           ;
00F8 90 CC      333          BCC     EXIT
00FA A9 0A      334          LDA     #$0A
00FC D0 97      335          BNE     OUT2
336 *
337 *          END

```

--- END ASSEMBLY ---

TOTAL ERRORS: 00

:

```

1 *****
2 *
3 * PARALLEL PRINTER *
4 * INTERFACE FIRMWARE *
5 *
6 * TYPE: PFO-7 *
7 * POSITIVE DATA *
8 * POSITIVE STROBE *
9 * NEGATIVE ACKNOWLEDGE *
10 *
11 *
12 * WRITTEN BY FRED VILES *
13 * SEPTEMBER 10, 1979 *
14 *
15 * VERSION 4.0 *
16 * DECEMBER 1, 1980 *
17 *
18 * COPYRIGHT 1979 BY *
19 * SSM MICROCOMPUTER PRODUCTS *
20 * ALL RIGHTS RESERVED *
21 *
22 *****
23 *
24 *
25 *
26 * MODE - CONTAINS TWO STATUS FLAGS IN THE HIGH ORDER TWO
27 * BITS WHICH SELECT THE OPTIONAL AUTO-LINE FEED
28 * AND VIDEO-DISABLED MODES OF OPERATION.
29 * B7 - SELECTS NOVID MODE (APPLE VIDEO DISABLED) WHEN
30 * SET (1), DEFAULTS TO 0 (OFF)
31 * B6 - SELECTS AUTOLF MODE WHEN SET (1), DEFAULT IS 0.
32 *
33 * WINDOW - A CARRIAGE RETURN WILL BE OUTPUT AUTOMATICALLY
34 * WHEN ANY LINE EXCEEDS THIS VALUE. MAY BE USED
35 * TO CAUSE 'WRAP-AROUND' WHEN THE PRINTER'S
36 * LINE LENGTH IS EXCEEDED IF THE PRINTER ITSELF
37 * CAN'T DO IT, OR WHEN NARROW PAPER IS USED ON
38 * A WIDER CARRIAGE. DEFAULT IS 255.
39 *
40 * MARGIN - A CR WILL BE OUTPUT IN PLACE OF THE FIRST BLANK
41 * PRINTED AFTER LINE LENGTH EXCEEDS THIS VALUE.
42 * CAN BE USED TO FORMAT LISTINGS SUCH THAT WORDS
43 * ARE NOT SPLIT BETWEEN LINES. DEFAULT IS 255.
44 *
45 * INDENT - THE FIRST CHARACTER OF EACH LINE IS INDENTED
46 * (PADDED WITH BLANKS ON THE LEFT) BY THIS NUMBER
47 *
48 * PAGE - A 'FORMFEED' (SEVEN BLANK LINES) WILL BE OUTPUT
49 * AFTER EACH 'PAGE' (THE NUMBER OF LINES GIVEN
50 * BY THIS VALUE) HAS BEEN PRINTED. SETTING PAGE
51 * TO ZERO DEFEATS FORM FEED. DEFAULT IS 58 FOR
52 * A PAGE OF 11.5 INCHES ON MOST PRINTERS.
53 *
54 * DATA - CONTAINS A VALUE TO BE EXCLUSIVE-OR'ED WITH THE
55 * CHAR BEFORE IT IS TRANSMITTED. SET TO $00 FOR
56 * POSITIVE GOING DATA, OR TO $FF FOR NEGATIVE
57 * GOING DATA. NOTE - THE USER CAN SET DATA
58 * TO $80 OR $7F INSTEAD TO FORCE THE HIGH
59 * GROUP DATA BIT TO BE '1' INSTEAD OF '0'
60 *

```

```

61 *
62 MODE EQU $3B8 ( 478+N:?? POKE 1144+N,?? )
63 WINDOW EQU $438 ( 4F8+N:?? POKE 1272+N,?? )
64 MARGIN EQU $4B8 ( 578+N:?? POKE 1400+N,?? )
65 INDENT EQU $538 ( 5F8+N:?? POKE 1528+N,?? )
66 PAGE EQU $5B8 ( 678+N:?? POKE 1656+N,?? )
67 DATA EQU $638 ( 6F8+N:?? POKE 1784+N,?? )
68 *
69 * * * * *
70 *
71 * THE FOLLOWING COUNTERS AND FLAGS ARE USED
72 * INTERNALLY AND SHOULD NOT BE ALTERED BY
73 * THE USER.
74 *
75 * COLUMN - PRINTER COLUMN COUNTER (NUMBER
76 * OF CHARS OUTPUT SINCE LAST
77 * CARRIAGE RETURN)
78 *
79 * LINE - CURRENT PRINTER LINE NUMBER
80 * (NUMBER OF CR'S OUTPUT SINCE
81 * THE LAST FORM FEED)
82 *
83 *
84 * INITF - THIS FLAG IS USED TO AVOID GETTING HUNG
85 * UP IN THE 'WAIT FOR ACKNOWLEDGE' LOOP
86 * ON THE INITIALIZATION ENTRY.
87 *
88 LINE EQU $6B8
89 COLUMN EQU $738
90 INITF EQU $478
91 *
92 * ADDR OF THE MONITOR'S CURRENT
93 * HORIZONTAL CURSOR POSITION
94 *
95 MONCH EQU $24
96 *
97 * MONITOR ENTRIES USED
98 * COUT1 - THE OUTPUT ROUTINE
99 * IORTS - DOES AN IMMEDIATE RTS
100 *
101 COUT1 EQU $FDF0
102 IORTS EQU $FF58
103 *
104 *
105 * ($C080+$E0) IS THE A-SIDE DATA DIRECTION REG. (DDRA)
106 * IF CRA BIT 2 IS "1", AND IS THE A-SIDE OUTPUT REG.
107 * (ORA) IF CRA2 IS "0"
108 * ($C081+$E0) IS THE A-SIDE CONTROL REGISTER (CRA).
109 * ($C082+$E0) AND ($C083+$E0) ARE THE CORRESPONDING B-SIDE
110 * REG. ADDRESSES
111 *
112 DDRA EQU $C080
113 ORA EQU $C080
114 CRA EQU $C081
115 DDRE EQU $C082
116 ORB EQU $C082
117 CRB EQU $C083
118 *
119 *
120 *

```

```

0036 9D 38 05 181 STA INDENT,X NO INDENTING ON LEFT
0039 9D B8 03 182 STA MODE,X MONITOR VIDEO IS ENABLED AND
183 * AUTO LINE FEED IS DISABLED
003C A9 FF 184 LDA #$FF DEFAULT WINDOW IS SET TO
003E 9D 38 04 185 STA WINDOW,X 255 TO DEFEAT AUTO CR GENERATION
0041 9D B8 04 186 STA MARGIN,X NO MARGIN FORMATTING.
187 * SET UP DATA DIRECTION REG. FOR
0044 99 82 C0 188 STA DDRB,Y ALL BITS AS OUTPUT.
189 * STA DATA,X DATA WILL BE ACTIVE NEGATIVE.
190 * INITIALIZE THE PIA FOR DEFAULT OPERATION - MANUAL STROBE
191 * $36 - POS STROBE, POS ACK OR BUSY (TRAILING EDGE SENSE)
192 * $34 - POS STROBE, NEG ACK OR BUSY "
193 * $3E - NEG STROBE, POS ACK OR BUSY "
194 * $3C - NEG STROBE, NEG ACK OR BUSY "
0047 A9 34 195 LDA #$34
0049 99 83 C0 196 STA CRB,Y
197 *
004C A9 3A 198 LDA #$3A PAGE LENGTH IS 59 LINES
004E 9D B8 05 199 STA PAGE,X FOR ABOUT 11.5" PAPER.
0051 A9 80 200 LDA #$80 SET INIT FLAG TRUE
201 *
202 * NORMAL PATH FOR OUTPUT. TEST FOR WINDOW WIDTH
203 * EXCEEDED, FOR RIGHT MARGIN FORMATTING, AND FOR TAB
204 * GENERATION IN THAT ORDER UNLESS COLUMN OVERFLOWED.
205 *
0053 8D 78 04 206 PRINT0 STA INITF
0056 BD 38 07 207 PRINT1 LDA COLUMN,X
0059 C9 FF 208 CMP #$FF 1-ST CHECK FOR COLUMN OVERFLOW.
005B F0 36 209 BEQ SKIP2 YES - SKIP ALL FURTHER TESTS.
005D DD 38 04 210 CMP WINDOW,X CHECK FOR WINDOW EXCEEDED
0050 B0 0D 211 BCS WNDCR YES - GO GENERATE A CARR. RET.
212 *
213 * CODE TO GENERATE A CR IN PLACE OF THE
214 * FIRST BLANK CHAR AFTER THE USER-SPECIFIED
215 * MARGIN IS EXCEEDED.
216 *
0062 DD B8 04 217 FMTTST CMP MARGIN,X PAST MARGIN?
0065 90 0E 218 BCC TABTST NO, GO CHECK FOR TAB
0067 68 219 PLA ; YES, TEST FOR A
0068 2C 83 FD 220 BIT $FD83 BLANK CHARACTER.
006B D0 14 221 BNE NOTAB IF SO, GO GENERATE
006D F0 01 222 BEQ FMTCR A CR AND DROP THE BLANK
223 *
224 *
006F 18 225 WNDCR CLC
0070 08 226 FMTCR PHP
0071 A9 0D 227 PAGCR LDA #$0D
0073 D0 20 228 BNE OUT2
229 *
230 *****
231 *
232 * CHECK FOR LEFT-MARGIN PADDING REQUIRED
233 * AND FOR BASIC TAB OR COMMA PRINT FORMATTING.
234 *
0075 DD 38 05 235 TABTST CMP INDENT,X
0078 90 02 236 BCC SPGEN IF INDENT (LEFT MARGIN) OR
007A C5 24 237 CMP MONCH IF MONCH IS GREATER THAN COLUMN
007C A9 20 238 SPGEN LDA #$20 GENERATE SPACES TO CATCH UP TO
007E 90 0F 239 BCC FUCCOL LT (BASIC TAB FORMATTING)
0080 68 240 PLA

```

```

121 *****
122 * *
123          ORG    $00      *
124          OBJ    $5200   *
125 * *
126 *****
127 *****
128 *
129 *   PR#N OR N CNTRL-P ENTRY. MONITOR DESTORYS
130 *   LINK ADDR ALREADY IN $36,$37 HEX
131 *
0000 18      132 ENTO    CLC    *           INDICATE INITIALIZATION ENTRY
0001 B0 FE    133          BCS    *           MASK THE SEC
134          ORG    *-1
135          OBJ    *+$5200
136 *
137 *   SOFT ENTRY PRINT VECTOR
138 *
0002 38      139 ENTW    SEC    ;           NORMAL PRINT ENTRY POINT
0003 48      140          PHA    ;           SAVE THE
0004 98      141          TYA    ;           REGISTERS
0005 48      142          PHA    ;           ON THE
0006 8A      143          TXA    ;           STACK
0007 48      144          PHA    $
0008 78      145          SEI    ;           STACK PROCESSING
0009 20 58 FF 146          JSR    IORTS  MUST NOT BE
000C BA      147          TSX    ;           INTERRUPTED.
000D 68      148          PLA    $
000E 68      149          PLA    ;           RETRIEVE CHAR
000F 68      150          PLA    ;           FROM UNDER STACK
0010 A8      151          TAY    ;           INTO REG Y AND
0011 CA      152          DEX    ;           GET $CN FROM
0012 9A      153          TXS    ;           ABOVE STACK (RTS
0013 68      154          PLA    ;           LEFT IT THERE) -
0014 AA      155          TAX    ;           WITHOUT HARMING
0015 58      156          CLI    ;           CONTENTS
0016 98      157          TYA    $
0017 29 7F    158          AND    #$7F   FORCE B7 TO ZERO
0019 48      159          PHA    ;           SAVE CHAR
001A 08      160          PHP    ;           SAVE STATUS
161 *   GET $N0 INTO REG Y
001B 8A      162          TXA    $
001C 0A      163          ASL
001D 0A      164          ASL
001E 0A      165          ASL
001F 0A      166          ASL
0020 A8      167          TAY    $
0021 28      168          PLP    ;           RESTORE STATUS
0022 B0 2F    169          BCS    PRINTO  BRANCH AROUND INITS IF SOFT ENTRY
170 *
171 *   DEFAULT INITS FOR 1-ST ENTRY
172 *
0024 A9 02    173 INITAL  LDA    #$02      SET OUTPUT VECTOR TO POINT
0026 85 36    174          STA    $36      TO THE SOFT ENTRY
0028 4A      175          LSR    ;
0029 4A      176          LSR    ;           LDA ZERO AND SET CARRY
002A 99 83 C0 177          STA    CRB,Y   ASSURE ADDRESSING DDRB
002D 9D 38 06 178          STA    DATA,X  DATA WILL BE ACTIVE POSITIVE
0030 9D 38 07 179          STA    COLUMN,X  WE START AT THE BEGINNING
0033 9D B8 06 180          STA    LINE,X   OF LINE ZERO.

```


0081	2C	58	FF	241	NOTAB	BIT	IORTS		
0084	F0	0E		242		BEQ	OUT		DON'T BUMP POINTERS IF CNTRL
0086	48			243		PHA			
0087	BD	B8	03	244		LDA	MODE,X		MAINTAIN MONCH IF IN NOVID
008A	10	02		245		BPL	SKIPL		MODE SO THAT BASIC COMMA
008C	E6	24		246		INC	MONCH		FORMATTING WILL STILL WORK
008E	68			247	SKIPL	PLA			
008F	FE	38	07	248	INCCOL	INC	COLUMN,X		BUMP THE COLUMN COUNTER
				249	*				
0092	F0	FE		250		BEQ	*		FAKE BRANCH TO HIDE THE PLA
				251		ORG	*-1		INSTRUCTION FROM THE
				252		OBJ	*\$5200		FALL-THRU PATH.
				253	*				
0093	68			254	SKIP2	PLA			GET CHAR WHEN COLUMN=255
				255	*				
				256	*				
0094	08			257	OUT	PHP			
0095	48			258	OUT2	PHA			
				259	*				
0096	AD	78	04	260		LDA	INITF		DON'T WAIT FOR PRINTER
0099	30	08		261		BMI	PRINT2		IF THIS IS THE FIRST TIME
				262	*				THROUGH THE CODE. (THERE
				263	*				WAS NO PREV. CHAR TO ACK.)
009B	B9	83	C0	264	PLOOP	LDA	CRB,Y		CHECK BUSY/ACK FLAG (BIT 7)
009E	10	FB		265		BPL	PLOOP		AND LOOP UNTIL IT IS SET.
				266	*				
00A0	B9	82	C0	267		LDA	ORB,Y		RESET FLAG BIT.
				268	*				
				269	*				O.K. TO TRANSFER THE CHARACTER NOW. IF IN
				270	*				SLOT ONE USE AN ABSOLUTE STORE RATHER THAN
				271	*				AN INDEXED STORE IN CASE OF HANDSHAKE PROBLEMS
00A3	68			272	PRINT2	PLA			
00A4	48			273		PHA			
00A5	5D	38	06	274		EOR	DATA,X		GET THE CHAR AND INVERT IT IFF
00A8	C0	10		275		CPY	#\$10		PERIPHERAL USES ACTIVE NEGATIVE
00AA	D0	05		276		BNE	INDXD		
00AC	8D	92	C0	277		STA	ORB+\$10		
00AF	F0	03		278		BEQ	STRBCH		
00B1	99	82	C0	279	INDXD	STA	ORB,Y		
				280	*				
				281	*				GENERATE A STROBE SIGNAL ON CB2 TO SIGNAL PRESENCE
				282	*				OF THE CHARACTER ON THE OUTPUT PORT
				283	*				
00B4	B9	83	C0	284	STRBCH	LDA	CRB,Y		
00B7	49	08		285		EOR	#\$08		; ISSUE THE STROBE (POS OR NEG
00B9	99	83	C0	286		STA	CRB,Y		; DEPENDING ON FLAG) WITHOUT
00BC	49	08		287		EOR	#\$08		; CHANGING THE OTHER CONTROL BITS
00BE	99	83	C0	288		STA	CRB,Y		
				289	*				
00C1	68			290	SKIPO	PLA			
00C2	49	0D		291		EOR	#\$0D		CHECK FOR CR
00C4	F0	12		292		BEQ	CRCODE		
00C6	28			293	EXIT	PLP			
00C7	90	8D		294		BCC	PRINT1		GO BACK FOR THE REAL CHAR IF
				295	*				THIS WAS A GENERATED TAB OR CR.
00C9	BD	B8	03	296		LDA	MODE,X		SKIP JUMP TO MONITOR COUNT ROUTINE
				297	*				IF NOVID FLAG IS SET.
00CC	0A			298		ASL			
00CD	68			299	DONE2	PLA			RESTORE REGS &
00CE	AA			300		TAX			EITHER JUMP TO

```

00CF 68          301          PLA      ;      MONITOR'S I/O
00D0 A8          302          TAY      ;      ROUTINE OR RTS
00D1 68          303          PLA      ;      BACK TO CALLER
                 304 *      CARRY SET MEANS NOVID MODE - BYPASS MONITOR ROUTINE
00D2 B0 03      305          BCS      RETURN
00D4 4C F0 FD   306          JMP      COUT1
                 307 *
00D7 60          308 RETURN RTS
                 309 *
                 310 *      END-OF-LINE REACHED. CHECK FOR END-OF-PAGE
                 311 *      IF PAGE>0 AND DO A FORM FEED IF NECCESARY.
                 312 *
00D8 BD B8 05   313 CRCODE LDA    PAGE,X
00DB F0 0F      314          BEQ      RESET      OPTION DEFEATED
00DD FE B8 06   315          INC     LINE,X    BUMP LINE COUNTER
00E0 FD B8 06   316          SBC     LINE,X    GET PAGE LEN - LINE #
00E3 10 07      317          BPL     RESET      NOT YET
00E5 49 F8      318          EOR     #$F8     FINISHED DOING FORM
00E7 D0 88      319          BNE     PAGCR    FEED? NO, DO A CR.
00E9 9D B8 06   320          STA     LINE,X    YES, ZERO LINE COUNTER
                 321 *
                 322 *      ZERO THE COLUMN AND MONCH POINTERS AND OPTIONALLY
                 323 *      GENERATE A LINE FEED (DEFAULT IS NO AUTOMATIC LF).
                 324 *      IF CR WAS GENERATED, THE ACTUAL CHR WILL BE OUTPUT
                 325 *      AFTER THE LF - ELSE WE WILL RETURN AFTER LF.
                 326 *
00EC A9 00      327 RESET   LDA    #$00
00EE 9D 38 07   328          STA    COLUMN,X
00F1 85 24      329          STA    MONCH
00F3 BD B8 03   330          LDA    MODE,X      ;
00F6 0A          331          ASL     ;          ; PUTS AUTOLF FLAG IN CARRY
00F7 0A          332          ASL     ;          ;
00F8 90 CC      333          BCC     EXIT
00FA A9 0A      334          LDA    #$0A
00FC D0 97      335          BNE     OUT2
                 336 *
                 337 *          END

```

--- END ASSEMBLY ---

TOTAL ERRORS: 00

:

```

1 *****
2 *
3 * PARALLEL PRINTER *
4 * INTERFACE FIRMWARE *
5 *
6 * TYPE: PFO-8 *
7 * POSITIVE DATA *
8 * POSITIVE STROBE *
9 * POSITIVE ACKNOWLEDGE *
10 *
11 *
12 * WRITTEN BY FRED VILES *
13 * SEPTEMBER 10, 1979 *
14 *
15 * VERSION 4.0 *
16 * DECEMBER 1, 1980 *
17 *
18 * COPYRIGHT 1979 BY *
19 * SSM MICROCOMPUTER PRODUCTS *
20 * ALL RIGHTS RESERVED *
21 *
22 *****
23 *
24 *
25 *
26 * MODE - CONTAINS TWO STATUS FLAGS IN THE HIGH ORDER TWO
27 * BITS WHICH SELECT THE OPTIONAL AUTO-LINE FEED
28 * AND VIDEO-DISABLED MODES OF OPERATION.
29 * B7 - SELECTS NOVID MODE (APPLE VIDEO DISABLED) WHEN
30 * SET (1), DEFAULTS TO 0 (OFF)
31 * B6 - SELECTS AUTOLF MODE WHEN SET (1), DEFAULT IS 0.
32 *
33 * WINDOW - A CARRIAGE RETURN WILL BE OUTPUT AUTOMATICALLY
34 * WHEN ANY LINE EXCEEDS THIS VALUE. MAY BE USED
35 * TO CAUSE 'WRAP-AROUND' WHEN THE PRINTER'S
36 * LINE LENGTH IS EXCEEDED IF THE PRINTER ITSELF
37 * CAN'T DO IT, OR WHEN NARROW PAPER IS USED ON
38 * A WIDER CARRIAGE. DEFAULT IS 255.
39 *
40 * MARGIN - A CR WILL BE OUTPUT IN PLACE OF THE FIRST BLANK
41 * PRINTED AFTER LINE LENGTH EXCEEDS THIS VALUE.
42 * CAN BE USED TO FORMAT LISTINGS SUCH THAT WORDS
43 * ARE NOT SPLIT BETWEEN LINES. DEFAULT IS 255.
44 *
45 * INDENT - THE FIRST CHARACTER OF EACH LINE IS INDENTED
46 * (PADDED WITH BLANKS ON THE LEFT) BY THIS NUMBER
47 *
48 * PAGE - A 'FORMFEED' (SEVEN BLANK LINES) WILL BE OUTPUT
49 * AFTER EACH 'PAGE' (THE NUMBER OF LINES GIVEN
50 * BY THIS VALUE) HAS BEEN PRINTED. SETTING PAGE
51 * TO ZERO DEFEATS FORM FEED. DEFAULT IS 58 FOR
52 * A PAGE OF 11.5 INCHES ON MOST PRINTERS.
53 *
54 * DATA - CONTAINS A VALUE TO BE EXCLUSIVE-OR'ED WITH THE
55 * CHAR BEFORE IT IS TRANSMITTED. SET TO $00 FOR
56 * POSITIVE GOING DATA, OR TO $FF FOR NEGATIVE
57 * GOING DATA. NOTE - THE USER CAN SET DATA
58 * TO $80 OR $7F INSTEAD TO FORCE THE HIGH
59 * ORDER DATA BIT TO BE '1' INSTEAD OF '0'
60 *

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62 MODE EQU $3B8 ( 478+N:?? POKE 1144+N,?? )
63 WINDOW EQU $438 ( 4F8+N:?? POKE 1272+N,?? )
64 MARGIN EQU $4B8 ( 578+N:?? POKE 1400+N,?? )
65 INDENT EQU $538 ( 5F8+N:?? POKE 1528+N,?? )
66 PAGE EQU $5B8 ( 678+N:?? POKE 1656+N,?? )
67 DATA EQU $638 ( 6F8+N:?? POKE 1784+N,?? )
68 *
69 * * * * *
70 *
71 * THE FOLLOWING COUNTERS AND FLAGS ARE USED
72 * INTERNALLY AND SHOULD NOT BE ALTERED BY
73 * THE USER.
74 *
75 * COLUMN - PRINTER COLUMN COUNTER (NUMBER
76 * OF CHARS OUTPUT SINCE LAST
77 * CARRIAGE RETURN)
78 *
79 * LINE - CURRENT PRINTER LINE NUMBER
80 * (NUMBER OF CR'S OUTPUT SINCE
81 * THE LAST FORM FEED)
82 *
83 *
84 * INITF - THIS FLAG IS USED TO AVOID GETTING HUNG
85 * UP IN THE 'WAIT FOR ACKNOWLEDGE' LOOP
86 * ON THE INITIALIZATION ENTRY.
87 *
88 LINE EQU $6B8
89 COLUMN EQU $738
90 INITF EQU $478
91 *
92 * ADDR OF THE MONITOR'S CURRENT
93 * HORIZONTAL CURSOR POSITION
94 *
95 MONCH EQU $24
96 *
97 * MONITOR ENTRIES USED
98 * COUT1 - THE OUTPUT ROUTINE
99 * IORTS - DOES AN IMMEDIATE RTS
100 *
101 COUT1 EQU $FDF0
102 IORTS EQU $FF58
103 *
104 *
105 * ($C080+$N0) IS THE A-SIDE DATA DIRECTION REG. (DDRA)
106 * IF CRA BIT 2 IS "1", AND IS THE A-SIDE OUTPUT REG.
107 * (ORA) IF CRA2 IS "0"
108 * ($C081+$N0) IS THE A-SIDE CONTROL REGISTER (CRA).
109 * ($C082+$N0) AND ($C083+$N0) ARE THE CORRESPONDING B-SIDE
110 * REG. ADDRESSES
111 *
112 DDRA EQU $C080
113 ORA EQU $C080
114 CRA EQU $C081
115 DDRB EQU $C082
116 ORB EQU $C082
117 CRB EQU $C083
118 *
119 *
120 *

```

```

121 *****
122 *
123          ORG    $00    *
124          OBJ    $5200  *
125 *
126 *****
127 *****
128 *
129 *   PR#N OR N CNTRL-P ENTRY. MONITOR DESTORYS
130 *   LINK ADDR ALREADY IN $36,$37 HEX
131 *
0000 18      132 ENT0   CLC    *           INDICATE INITIALIZATION ENTRY
0001 B0 FE   133         BCS    *           MASK THE SEC
134         ORG    *-1
135         OBJ    *+$5200
136 *
137 *   SOFT ENTRY PRINT VECTOR
138 *
0002 38      139 ENTW   SEC    ;           NORMAL PRINT ENTRY POINT
0003 48      140         PHA    ;           SAVE THE
0004 98      141         TYA    ;           REGISTERS
0005 48      142         PHA    ;           ON THE
0006 8A      143         TXA    ;           STACK
0007 48      144         PHA    $
0008 78      145         SEI    ;           STACK PROCESSING
0009 20 58 FF 146         JSR    IORTS  MUST NOT BE
000C BA      147         TSX    ;           INTERRUPTED.
000D 68      148         PLA    $
000E 68      149         PLA    ;           RETRIEVE CHAR
000F 68      150         PLA    ;           FROM UNDER STACK
0010 A8      151         TAY    ;           INTO REG Y AND
0011 CA      152         DEX    ;           GET $CN FROM
0012 9A      153         TXS    ;           ABOVE STACK (RTS
0013 68      154         PLA    ;           LEFT IT THERE) -
0014 AA      155         TAX    ;           WITHOUT HARMING
0015 58      156         CLI    ;           CONTENTS
0016 98      157         TYA    $
0017 29 7F   158         AND    #$7F  FORCE B7 TO ZERO
0019 48      159         PHA    ;           SAVE CHAR
001A 08      160         PHP    ;           SAVE STATUS
161 *   GET $NO INTO REG Y
001B 8A      162         TXA    $
001C 0A      163         ASL
001D 0A      164         ASL
001E 0A      165         ASL
001F 0A      166         ASL
0020 A8      167         TAY    $
0021 28      168         PLP    ;           RESTORE STATUS
0022 B0 2F   169         BCS    PRINT0  BRANCH AROUND INITS IF SOFT ENTRY
170 *
171 *   DEFAULT INITS FOR 1-ST ENTRY
172 *
0024 A9 02   173 INITAL LDA    #$02    SET OUTPUT VECTOR TO POINT
0026 85 36   174         STA    $36    TO THE SOFT ENTRY
0028 4A      175         LSR    ;
0029 4A      176         LSR    ;
002A 99 83 C0 177         STA    CRB,Y    LDA ZERO AND SET CARRY
002D 9D 38 06 178         STA    DATA,X  ASSURE ADDRESSING DDRB
0030 9D 38 07 179         STA    COLUMN,X  DATA WILL BE ACTIVE POSITIVE
0033 9D B8 06 180         STA    LINE,X    WE START AT THE BEGINNING
                                OF LINE ZERO.

```

```

0036 9D 38 05 181 STA INDENT,X NO INDENTING ON LEFT
0039 9D B8 03 182 STA MODE,X MONITOR VIDEO IS ENABLED AND
183 * AUTO LINE FEED IS DISABLED
003C A9 FF 184 LDA #$FF DEFAULT WINDOW IS SET TO
003E 9D 38 04 185 STA WINDOW,X 255 TO DEFEAT AUTO CR GENERATION
0041 9D B8 04 186 STA MARGIN,X NO MARGIN FORMATTING.
187 * SET UP DATA DIRECTION REG. FOR
0044 99 82 C0 188 STA DDRB,Y ALL BITS AS OUTPUT.
189 * STA DATA,X DATA WILL BE ACTIVE NEGATIVE.
190 * INITIALIZE THE PIA FOR DEFAULT OPERATION - MANUAL STROBE
191 * $36 - POS STROBE, POS ACK OR BUSY (TRAILING EDGE SENSE)
192 * $34 - POS STROBE, NEG ACK OR BUSY
193 * $3E - NEG STROBE, POS ACK OR BUSY
194 * $3C - NEG STROBE, NEG ACK OR BUSY
0047 A9 36 195 LDA #$36
0049 99 83 C0 196 STA CRB,Y
197 *
004C A9 3A 198 LDA #$3A PAGE LENGTH IS 59 LINES
004E 9D B8 05 199 STA PAGE,X FOR ABOUT 11.5" PAPER.
0051 A9 80 200 LDA #$80 SET INIT FLAG TRUE
201 *
202 * NORMAL PATH FOR OUTPUT. TEST FOR WINDOW WIDTH
203 * EXCEEDED, FOR RIGHT MARGIN FORMATTING, AND FOR TAB
204 * GENERATION IN THAT ORDER UNLESS COLUMN OVERFLOWED.
205 *
0053 8D 78 04 206 PRINT0 STA INITF
0056 BD 38 07 207 PRINT1 LDA COLUMN,X
0059 C9 FF 208 CMP #$FF 1-ST CHECK FOR COLUMN OVERFLOW.
005B F0 36 209 BEQ SKIP2 YES - SKIP ALL FURTHER TESTS.
005D DD 38 04 210 CMP WINDOW,X CHECK FOR WINDOW EXCEEDED
0060 B0 0D 211 BCS WNDCR YES - GO GENERATE A CARR. RET.
212 *
213 * CODE TO GENERATE A CR IN PLACE OF THE
214 * FIRST BLANK CHAR AFTER THE USER-SPECIFIED
215 * MARGIN IS EXCEEDED.
216 *
0062 DD B8 04 217 FMTTST CMP MARGIN,X PAST MARGIN?
0065 90 0E 218 BCC TABTST NO, GO CHECK FOR TAB
0067 68 219 PLA ; YES, TEST FOR A
0068 2C 83 FD 220 BIT $FD83 BLANK CHARACTER.
006B D0 14 221 BNE NOTAB IF SO, GO GENERATE
006D F0 01 222 BEQ FMTCR A CR AND DROP THE BLANK
223 *
224 *
006F 18 225 WNDCR CLC
0070 08 226 FMTCR PHP
0071 A9 0D 227 PAGCR LDA #$0D
0073 D0 20 228 BNE OUT2
229 *
230 *****
231 *
232 * CHECK FOR LEFT-MARGIN PPADDING REQUIRED
233 * AND FOR BASIC TAB OR COMMA PRINT FORMATTING.
234 *
0075 DD 38 05 235 TABTST CMP INDENT,X
0078 90 02 236 BCC SPGEN IF INDENT (LEFT MARGIN) OR
007A C5 24 237 CMP MONCH IF MONCH IS GREATER THAN COLUMN
007C A9 20 238 SPGEN LDA #$20 GENERATE SPACES TO CATCH UP TO
007E 90 0F 239 BCC INCCOL IT (BASIC TAB FORMATTING)
0080 68 240 PLA

```

0081	2C	58	FF	241	NOTAB	BIT	IORTS		
0084	F0	0E		242		BEQ	OUT	DON'T BUMP POINTERS IF CNTRL	
0086	48			243		PHA			
0087	BD	B8	03	244		LDA	MODE,X	MAINTAIN MONCH IF IN NOVID	
008A	10	02		245		BPL	SKIPL	MODE SO THAT BASIC COMMA	
008C	E6	24		246		INC	MONCH	FORMATTING WILL STILL WORK	
008E	68			247	SKIPL	PLA			
008F	FE	38	07	248	INCCOL	INC	COLUMN,X	BUMP THE COLUMN COUNTER	
				249	*				
0092	F0	FE		250		BEQ	*	FAKE BRANCH TO HIDE THE PLA	
				251		ORG	*-1	INSTRUCTION FROM THE	
				252		OBJ	*+\$5200	FALL-THRU PATH.	
				253	*				
0093	68			254	SKIP2	PLA	GET CHAR WHEN COLUMN=255		
				255	*				
				256	*				
0094	08			257	OUT	PHP			
0095	48			258	OUT2	PHA			
				259	*			DON'T WAIT FOR PRINTER	
0096	AD	78	04	260		LDA	INITF	IF THIS IS THE FIRST TIME	
0099	30	08		261		EMI	PRINT2	THROUGH THE CODE. (THERE	
				262	*			WAS NO PREV. CHAR TO ACK.)	
				263	*				
009B	B9	83	C0	264	PLOOP	LDA	CRB,Y	CHECK BUSY/ACK FLAG (BIT 7)	
009E	10	FE		265		BPL	PLOOP	AND LOOP UNTIL IT IS SET.	
				266	*				
00A0	B9	82	C0	267		LDA	ORB,Y	RESET FLAG BIT.	
				268	*				
				269	*	O.K.	TO TRANSFER THE CHARACTER NOW. IF IN		
				270	*	SLOT ONE	USE AN ABSOLUTE STORE RATHER THAN		
				271	*	AN INDEXED	STORE IN CASE OF HANDSHAKE PROBLEMS		
0A3	68			272	PRINT2	PLA	;		
00A4	48			273		PHA	;	GET THE CHAR AND INVERT IT IFF	
00A5	5D	38	06	274		EOR	DATA,X	PERIPHERAL USES ACTIVE NEGATIVE	
00A8	C0	10		275		CPY	#\$10		
00AA	D0	05		276		BNE	INDXD		
00AC	8D	92	C0	277		STA	ORB+\$10		
00AF	F0	03		278		BEQ	STPBCH		
00B1	99	82	C0	279	INDXD	STA	ORB,Y		
				280	*				
				281	*	GENERATE A STROBE	SIGNAL ON CB2 TO SIGNAL PRESENCE		
				282	*	OF THE CHARACTER	ON THE OUTPUT PORT		
				283	*				
00B4	B9	83	C0	284	STPBCH	LDA	CRB,Y	;	
00B7	49	08		285		EOR	#\$08	;	ISSUE THE STROBE (POS OR NEG
00B9	99	83	C0	286		STA	CRB,Y	;	DEPENDING ON FLAG) WITHOUT
00BC	49	08		287		EOR	#\$08	;	CHANGING THE OTHER CONTROL BITS
00BE	99	83	C0	288		STA	CRB,Y	;	
				289	*				
00C1	68			290	SKIPO	PLA			
00C2	49	0D		291		EOR	#\$0D	CHECK FOR CR	
00C4	F0	12		292		BEQ	CRCODE		
00C6	28			293	EXIT	PLP			
00C7	90	8D		294		BCC	PRINT1	GO BACK FOR THE REAL CHAR IF	
				295	*			THIS WAS A GENERATED TAB OR CR.	
00C9	BD	B8	03	296		LEA	MODE,X	SKIP JUMP TO MONITOR COUT ROUTINE	
				297	*			IF NOVID FLAG IS SET.	
00CC	0A			298		ASL			
00CD	68			299	DONE2	PLA	;	RESTORE REGS &	
00CE	AA			300		TAX	;	EITHER JUMP TO	

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00CF 68          301      PLA      ;      MONITOR'S I/O
00D0 A8          302      TAY      ;      ROUTINE OR RTS
00D1 68          303      PLA      ;      BACK TO CALLER
                 304 *    CARRY SET MEANS NOVID MODE - BYPASS MONITOR ROUTINE
00D2 B0 03      305      BCS      RETURN
00D4 4C F0 FD   306      JMP      COUT1
                 307 *
00D7 60          308 RETURN RTS
                 309 *
                 310 *    END-OF-LINE REACHED. CHECK FOR END-OF-PAGE
                 311 *    IF PAGE>0 AND DO A FORM FEED IF NECCESARY.
                 312 *
00D8 BD B8 05   313 CRCODE LDA    PAGE,X
00DB F0 0F      314      BEQ    RESET    OPTION DEFEATED
00DD FE B8 06   315      INC    LINE,X    BUMP LINE COUNTER
00E0 FD B8 06   316      SBC    LINE,X    GET PAGE LEN - LINE #
00E3 10 07      317      BPL    RESET    NOT YET
00E5 49 F8      318      EOR    #$F8    FINISHED DOING FORM
00E7 D0 88      319      BNE    PAGCR   FEED? NO, DO A CR.
00E9 9D B8 06   320      STA    LINE,X    YES, ZERO LINE COUNTER
                 321 *
                 322 *    ZERO THE COLUMN AND MONCH POINTERS AND OPTIONALLY
                 323 *    GENERATE A LINE FEED (DEFAULT IS NO AUTOMATIC LF).
                 324 *    IF CR WAS GENERATED, THE ACTUAL CHR WILL BE OUTPUT
                 325 *    AFTER THE LF - ELSE WE WILL RETURN AFTER LF.
                 326 *
00EC A9 00      327 RESET  LDA    #$00
00EE 9D 38 07   328      STA    COLUMN,X
00F1 85 24      329      STA    MONCH
00F3 BD B8 03   330      LDA    MODE,X    ;
00F6 0A          331      ASL    ;      ; PUTS AUTOLF FLAG IN CARRY
00F7 0A          332      ASL    ;      ;
00F8 90 CC      333      BCC    EXIT
00FA A9 0A      334      LDA    #$0A
00FC D0 97      335      BNE    OUT2
                 336 *
                 337 *          END

```

--- END ASSEMBLY ---

TOTAL ERRORS: 00

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