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* MONITOR PROGRAM FOR THE SOUTHWEST TECHNICAL
* PRODUCTS MP-09 CPU BOARD AS COMMENTED BY....

* ALLEN CLARK                WALLACE WATSON
* 2502 REGAL OAKS LANE       4815 EAST 97th AVE.
* LUTZ, FLA. 33549          TEMPLE TERRACE, FLA. 33617
* PH. 813-977-0347          PH. 813-985-1359

* MODIFIED TO SBUG09 VER 1.8 BY:  RANDY JARRETT
*                                2561 NANTUCKET DR APT. E
*                                ATLANTA, GA 30345
*                                PH. 404-320-1043
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*** COMMANDS ***

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* CONTROL A = ALTER THE "A" ACCUMULATOR
* CONTROL B = ALTER THE "B" ACCUMULATOR
* CONTROL C = ALTER THE CONDITION CODE REGISTER
* CONTROL D = ALTER THE DIRECT PAGE REGISTER
* CONTROL P = ALTER THE PROGRAM COUNTER
* CONTROL U = ALTER USER STACK POINTER
* CONTROL X = ALTER "X" INDEX REGISTER
* CONTROL Y = ALTER "Y" INDEX REGISTER
* B hhhh    = SET BREAKPOINT AT LOCATION $hhhh
* D         = BOOT A SWTPC 8 INCH FLOPPY SYSTEM
* U         = BOOT A SWTPC 5 INCH FLOPPY SYSTEM
* E ssss-eeee = EXAMINE MEMORY FROM STARTING ADDRESS ssss
*           -TO ENDING ADDRESS eeee.
* G         = CONTINUE EXECUTION FROM BREAKPOINT OR SWI
* L         = LOAD TAPE
* M hhhh    = EXAMINE AND CHANGE MEMORY LOCATION hhhh
* P ssss-eeee = PUNCH TAPE, START ssss TO END eeee ADDR.
* Q ssss-eeee = TEST MEMORY FROM ssss TO eeee
* R         = DISPLAY REGISTER CONTENTS
* S         = DISPLAY STACK FROM ssss TO $DFC0
* X         = REMOVE ALL BREAKPOINTS
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55AA TSTPAT EQU \$55AA TEST PATTERN

DFC0		ORG	\$DFC0	
DFC0	STACK	RMB	2	TOP OF INTERNAL STACK / USER VECTOR
DFC2	SWI3	RMB	2	SOFTWARE INTERRUPT VECTOR #3
DFC4	SWI2	RMB	2	SOFTWARE INTERRUPT VECTOR #2
DFC6	FIRQ	RMB	2	FAST INTERRUPT VECTOR
DFC8	IRQ	RMB	2	INTERRUPT VECTOR
DFCA	SWI	RMB	2	SOFTWARE INTERRUPT VECTOR
DFCC	SVCVO	RMB	2	SUPERVISOR CALL VECTOR ORGIN
DFCE	SVCVL	RMB	2	SUPERVISOR CALL VECTOR LIMIT

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DFD0          LRARAM  RMB   16          LRA ADDRESSES
DFE0          CPORT   RMB    2          RE-VECTORABLE CONTROL PORT
DFE2          ECHO    RMB    1          ECHO FLAG
DFE3          BPTBL   RMB   24          BREAKPOINT TABLE BASE ADDR
          E004  ACIAS   EQU   $E004     CONTROL PORT
          E018  Comreg EQU   $E018     COMMAND REGISTER
          E014  Drvreg EQU   $E014     DRIVE REGISTER
          E01A  Secreg EQU   $E01A     SECTOR REGISTER
          E01B  Datreg EQU   $E01B     DATA REGISTER

          F000  ADDRREG EQU   $F000     ADDRESS REGISTER
          F002  CNTREG  EQU   $F002     COUNT REGISTER
          F010  CCREG   EQU   $F010     CHANNEL CONTROL REGISTER
          F014  PRIREG  EQU   $F014     DMA PRIORITY REGISTER
          F015  AAAREG  EQU   $F015     ???
          F016  BBBREG  EQU   $F016     ???
          F020  COMREG  EQU   $F020     1791 COMMAND REGISTER
          F022  SECREG  EQU   $F022     SECTOR REGISTER
          F024  DRVREG  EQU   $F024     DRIVE SELECT LATCH
          F040  CCCREG  EQU   $F040     ???

          FFF0  IC11   EQU   $FFF0     DAT RAM CHIP
    
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F800          ORG     $F800
F800 F814          FDB     MONITOR
F802 F861          FDB     NEXTCMD
F804 FDCF          FDB     INCH
F806 FDC9          FDB     INCHE
F808 FDDF          FDB     INCHEK
F80A FDEE          FDB     OUTCH
F80C FDBD          FDB     PDATA
F80E FDB1          FDB     PCRLF
F810 FDAD          FDB     PSTRNG
F812 FB81          FDB     LRA
    
```

* MONITOR

* VECTOR ADDRESS STRING IS.....

* \$F8A1-\$F8A1-\$F8A1-\$F8A1-\$F8A1-\$F8A1-\$FAB0-\$FFFF-\$FFFF

```

F814 8E FE4F      MONITOR LDX  #RAMVEC  POINT TO VECTOR ADDR. STRING
F817 108E DFC0          LDY  #STACK  POINT TO RAM VECTOR LOCATION
F81B C6  10          LDB  #$10   BYTES TO MOVE = 16
F81D A6  80          LOOPA LDA  ,X+   GET VECTOR BYTE
F81F A7  A0          STA  ,Y+   PUT VECTORS IN RAM / $DFC0-$DFCF
F821 5A          DECB          SUBTRACT 1 FROM NUMBER OF BYTES TO MOVE
F822 26 F9          BNE  LOOPA  CONTINUE UNTIL ALL VECTORS MOVED
    
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* CONTENTS      FROM      TO      FUNCTION
* $F8A1        $FE40      $DFC0    USER-V
* $F8A1        $FE42      $DFC2    SWI3-V
* $F8A1        $FE44      $DFC4    SWI2-V
* $F8A1        $FE46      $DFC6    FIRQ-V
* $F8A1        $FE48      $DFC8    IRQ-V
    
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* $FAB0      $FE4A      $DFCA      SWI-V
* $FFFF      $FE4C      $DFCC      SVC-VO
* $FFFF      $FE4E      $DFCE      SVC-VL

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F824 8E  E004          LDX  #ACIAS      GET CONTROL PORT ADDR.
F827 BF  DFE0          STX  CPORT      STORE ADDR. IN RAM
F82A 17  027A          LBSR XBKPNT     CLEAR OUTSTANDING BREAKPOINTS
F82D C6   0C           LDB  #12        CLEAR 12 BYTES ON STACK
F82F 6F  E2           CLRSTK CLR  ,-S
F831 5A          DECB
F832 26  FB           BNE  CLRSTK
F834 30  8C DD        LEAX MONITOR,PCR SET PC TO SBUG-E ENTRY
F837 AF  6A          STX  10,S        ON STACK
F839 86  D0          LDA  #$D0        PRESET CONDITION CODES ON STACK
F83B A7  E4          STA  ,S
F83D 1F  43          TFR  S,U
F83F 17  05BE        LBSR ACINIZ     INITIALIZE CONTROL PORT
F842 8E  FE5F        LDX  #MSG1      POINT TO 'SBUG 1.8' MESSAGE
F845 17  0575        LBSR PDATA      PRINT MSG
F848 8E  DFD0        LDX  #LRARAM    POINT TO LRA RAM STORAGE AREA
F84B 4F          CLRA      START TOTAL AT ZERO
F84C C6   0D          LDB  #13        TOTAL UP ALL ACTIVE RAM MEMORY
F84E 6D  85          FNDREL TST  B,X      TEST FOR RAM AT NEXT LOC.
F850 27  03          BEQ  RELPAS     IF NO RAM GO TO NEXT LOC.
F852 8B  04          ADDA #4         ELSE ADD 4K TO TOTAL
F854 19          DAA         ADJ. TOTAL FOR DECIMAL
F855 5A          RELPAS DECB      SUB. 1 FROM LOCS. TO TEST
F856 2A  F6          BPL  FNDREL    PRINT TOTAL OF RAM
F858 17  0526        LBSR OUT2H     OUTPUT HEX BYTE AS ASCII
F85B 8E  FE74        LDX  #MSG2     POINT TO MSG 'K' CR/LF + 3 NULS
F85E 17  055C        LBSR PDATA     PRINT MSG

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***** NEXTCMD *****

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F861 8E  FE7B        NEXTCMD LDX  #MSG3     POINT TO MSG ">"
F864 17  0546        LBSR PSTRNG    PRINT MSG
F867 17  0565        LBSR INCH      GET ONE CHAR. FROM TERMINAL
F86A 84  7F          ANDA #$7F      STRIP PARITY FROM CHAR.
F86C 81  0D          CMPA #$0D     IS IT CARRIAGE RETURN ?
F86E 27  F1          BEQ  NEXTCMD   IF CR THEN GET ANOTHER CHAR.
F870 1F  89          TFR  A,B      PUT CHAR. IN "B" ACCUM.
F872 81  20          CMPA #$20     IS IT CONTROL OR DATA CHAR ?
F874 2C  09          BGE  PRTCMD   IF CMD CHAR IS DATA, PRNT IT
F876 86  5E          LDA  #'^      ELSE CNTRL CHAR CMD SO...
F878 17  0573        LBSR OUTCH    PRINT "^"
F87B 1F  98          TFR  B,A      RECALL CNTRL CMD CHAR
F87D 8B  40          ADDA #$40     CONVERT IT TO ASCII LETTER
F87F 17  056C        PRTCMD LBSR OUTCH  PRNT CMD CHAR
F882 17  0567        LBSR OUT1S    PRNT SPACE
F885 C1  60          CMPB #$60
F887 2F  02          BLE  NXTCH0
F889 C0  20          SUBB #$20

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***** DO TABLE LOOKUP *****

* FOR COMMAND FUNCTIONS

F88B	8E	FE13	NXTCH0	LDX	#JMPTAB	POINT TO JUMP TABLE
F88E	E1	80	NXTCHR	CMPB	,X+	DOES COMMAND MATCH TABLE ENTRY ?
F890	27	0F		BEQ	JMPCMD	BRANCH IF MATCH FOUND
F892	30	02		LEAX	2,X	POINT TO NEXT ENTRY IN TABLE
F894	8C	FE4F		CMPX	#TABEND	REACHED END OF TABLE YET ?
F897	26	F5		BNE	NXTCHR	IF NOT END, CHECK NEXT ENTRY
F899	8E	FE7D		LDX	#MSG4	POINT TO MSG "WHAT?"
F89C	17	051E		LBSR	PDATA	PRINT MSG
F89F	20	C0		BRA	NEXTCMD	IF NO MATCH, PRMPT FOR NEW CMD
F8A1	AD	94	JMPCMD	JSR	[,X]	JUMP TO COMMAND ROUTINE
F8A3	20	BC		BRA	NEXTCMD	PROMPT FOR NEW COMMAND

*

* "G" GO OR CONTINUE

F8A5	1F	34	GO	TFR	U,S	
F8A7	3B		RTI	RTI		

* "R" DISPLAY REGISTERS

F8A8	8E	FE83	REGSTR	LDX	#MSG5	POINT TO MSG " - "
F8AB	17	04FF		LBSR	PSTRNG	PRINT MSG
F8AE	17	0411		LBSR	PRTSP	\$FCBF
F8B1	17	0419		LBSR	PRTUS	\$FCCA
F8B4	17	0421		LBSR	PRTDP	\$FCD5
F8B7	17	0429		LBSR	PRTIX	\$FCE0
F8BA	17	0431		LBSR	PRTIY	\$FCEB
F8BD	8E	FE83		LDX	#MSG5	POINT TO MSG " - "
F8C0	17	04EA		LBSR	PSTRNG	PRINT MSG
F8C3	17	0433		LBSR	PRTPC	\$FCF5
F8C6	17	043A		LBSR	PRTA	\$FCFF
F8C9	17	0441		LBSR	PRTB	\$FD09
F8CC	16	0448		LBRA	PRTCC	\$FD13

* ALTER "PC" PROGRAM COUNTER

F8CF	17	0427	ALTRPC	LBSR	PRTPC	\$FCF5 PRINT MSG " PC = "
F8D2	17	0517		LBSR	OUT1S	OUTPUT SPACE
F8D5	17	0457		LBSR	IN1ADR	GET NEW CONTENTS FOR "PC"
F8D8	29	02		BVS	ALTPCD	EXIT IF INVALID HEX
F8DA	AF	4A		STX	10,U	POKE IN NEW CONTENTS
F8DC	39		ALTPCD	RTS		

* ALTER "U" USER STACK POINTER

F8DD	17	03ED	ALTRU	LBSR	PRTUS	\$FCCA PRINT MSG " US = "
F8E0	17	0509		LBSR	OUT1S	OUTPUT SPACE

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F8E3 17 0449          LBSR  IN1ADR
F8E6 29 02           BVS   ALTUD
F8E8 AF 48           STX   8,U
F8EA 39              ALTUD  RTS

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*
* ALTER "Y" INDEX REGISTER

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F8EB 17 0400        ALTRY  LBSR  PRTIY    PRINT MSG " IY = "
F8EE 17 04FB          LBSR  OUT1S    OUTPUT SPACE
F8F1 17 043B          LBSR  IN1ADR
F8F4 29 02           BVS   ALTYD
F8F6 AF 46           STX   6,U      $F8F0
F8F8 39              ALTYD  RTS

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```

* ALTER "X" INDEX REGISTER

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```

F8F9 17 03E7        ALTRX  LBSR  PRTIX    $FCE0 PRINT MSG " IX = "
F8FC 17 04ED          LBSR  OUT1S    OUTPUT SPACE
F8FF 17 042D          LBSR  IN1ADR
F902 29 02           BVS   ALTXD
F904 AF 44           STX   4,U
F906 39              ALTXD  RTS

```

```

* ALTER "DP" DIRECT PAGE REGISTER

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```

F907 17 03CE        ALTRDP LBSR  PRTDP    $FCD5 PRINT MSG " DP = "
F90A 17 04DF          LBSR  OUT1S    OUTPUT SPACE
F90D 17 0430          LBSR  BYTE    INPUT BYTE (2 HEX CHAR)
F910 29 02           BVS   ALTRDP
F912 A7 43           STA   3,U
F914 39              ALTRDP RTS

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* ALTER "B" ACCUMULATOR

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F915 17 03F5        ALTRB  LBSR  PRTB    $FD09 PRINT MSG " B = "
F918 17 04D1          LBSR  OUT1S    OUTPUT SPACE
F91B 17 0422          LBSR  BYTE    INPUT BYTE (2 HEX CHAR)
F91E 29 02           BVS   ALTRB
F920 A7 42           STA   2,U
F922 39              ALTRB  RTS      $F91C

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* ALTER "A" ACCUMULATOR

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*
F923 17 03DD        ALTRA  LBSR  PRTA    $FCFF PRINT MSG " A = "

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F926	17	04C3		LBSR	OUT1S	OUTPUT SPACE
F929	17	0414		LBSR	BYTE	INPUT BYTE (2 HEX CHAR)
F92C	29	02		BVS	ALTAD	
F92E	A7	41		STA	1,U	
F930	39		ALTAD	RTS		

* ALTER "CC" REGISTER

F931	17	03E3	ALTRCC	LBSR	PRTCC	\$FD13 PRINT MSG " CC: "
F934	17	04B5		LBSR	OUT1S	OUTPUT SPACE
F937	17	0406		LBSR	BYTE	INPUT BYTE (2 HEX CHAR)
F93A	29	04		BVS	ALTCCD	
F93C	8A	80		ORA	#\$80	SETS "E" FLAG IN PRINT LIST
F93E	A7	C4		STA	,U	
F940	39		ALTCCD	RTS		

***** "M" MEMORY EXAMINE AND CHANGE *****

F941	17	03EB	MEMCHG	LBSR	IN1ADR	INPUT ADDRESS
F944	29	2D		BVS	CHRTN	IF NOT HEX, RETURN
F946	1F	12		TFR	X,Y	SAVE ADDR IN "Y"
F948	8E	FE83	MEMC2	LDX	#MSG5	POINT TO MSG " - "
F94B	17	045F		LBSR	PSTRNG	PRINT MSG
F94E	1F	21		TFR	Y,X	FETCH ADDRESS
F950	17	0426		LBSR	OUT4H	PRINT ADDR IN HEX
F953	17	0496		LBSR	OUT1S	OUTPUT SPACE
F956	A6	A4		LDA	,Y	GET CONTENTS OF CURRENT ADDR.
F958	17	0426		LBSR	OUT2H	OUTPUT CONTENTS IN ASCII
F95B	17	048E		LBSR	OUT1S	OUTPUT SPACE
F95E	17	03DF		LBSR	BYTE	LOOP WAITING FOR OPERATOR INPUT
F961	28	11		BVC	CHANGE	IF VALID HEX GO CHANGE MEM. LOC.
F963	81	08		CMPA	#8	IS IT A BACKSPACE (CNTRL H)?
F965	27	E1		BEQ	MEMC2	PROMPT OPERATOR AGAIN
F967	81	18		CMPA	#\$18	IS IT A CANCEL (CNTRL X)?
F969	27	DD		BEQ	MEMC2	PROMPT OPERATOR AGAIN
F96B	81	5E		CMPA	#'^	IS IT AN UP ARROW?
F96D	27	17		BEQ	BACK	DISPLAY PREVIOUS BYTE
F96F	81	0D		CMPA	#\$D	IS IT A CR?
F971	26	0F		BNE	FORWRD	DISPLAY NEXT BYTE
F973	39		CHRTN	RTS		EXIT ROUTINE
F974	A7	A4	CHANGE	STA	,Y	CHANGE BYTE IN MEMORY
F976	A1	A4		CMPA	,Y	DID MEMORY BYTE CHANGE?
F978	27	08		BEQ	FORWRD	\$F972
F97A	17	046F		LBSR	OUT1S	OUTPUT SPACE
F97D	86	3F		LDA	#'?	LOAD QUESTION MARK
F97F	17	046C		LBSR	OUTCH	PRINT IT
F982	31	21	FORWRD	LEAY	1,Y	POINT TO NEXT HIGHER MEM LOCATION
F984	20	C2		BRA	MEMC2	PRINT LOCATION & CONTENTS
F986	31	3F	BACK	LEAY	-1,Y	POINT TO LAST MEM LOCATION
F988	20	BE		BRA	MEMC2	PRINT LOCATION & CONTENTS

* "S" DISPLAY STACK
 * HEX-ASCII DISPLAY OF CURRENT STACK CONTENTS FROM
 * CURRENT STACK POINTER TO INTERNAL STACK LIMIT.

```
F98A 17 0335 DISSTK LBSR PRTSP PRINT CURRENT STACK POINTER
F98D 1F 32 TFR U,Y
F98F 8E DFC0 LDX #STACK LOAD INTERNAL STACK AS UPPER LIMIT
F992 30 1F LEAX -1,X POINT TO CURRENT STACK
F994 20 05 BRA MDUMP1 ENTER MEMORY DUMP OF STACK CONTENTS
```

* "E" DUMP MEMORY FOR EXAMINE IN HEX AND ASCII
 * AFTER CALLING 'IN2ADR' LOWER ADDRESS IN Y-REG.
 * UPPER ADDRESS IN X-REG.
 * IF HEX ADDRESSES ARE INVALID (V)=1.

```
F996 17 038B MEMDUMP LBSR IN2ADR INPUT ADDRESS BOUNDRIES
F999 29 06 BVS EDPRTN NEW COMMAND IF ILLEGAL HEX
F99B 34 20 MDUMP1 PSHS Y COMPARE LOWER TO UPPER BOUNDS
F99D AC E1 CMPX ,S++ LOWER BOUNDS > UPPER BOUNDS?
F99F 24 01 BCC AJDUMP IF NOT, DUMP HEX AND ASCII
F9A1 39 EDPRTN RTS
```

* ADJUST LOWER AND UPPER ADDRESS LIMITS
 * TO EVEN 16 BYTE BOUNDRIES.

* IF LOWER ADDR = \$4532
 * LOWER BOUNDS WILL BE ADJUSTED TO = \$4530.

* IF UPPER ADDR = \$4567
 * UPPER BOUNDS WILL BE ADJUSTED TO = \$4570.

* ENTER WITH LOWER ADDRESS IN X-REG.
 * -UPPER ADDRESS ON TOP OF STACK.

```
F9A2 1F 10 AJDUMP TFR X,D GET UPPER ADDR IN D-REG
F9A4 C3 0010 ADDD #$10 ADD 16 TO UPPER ADDRESS
F9A7 C4 F0 ANDB #$F0 MASK TO EVEN 16 BYTE BOUNDRY
F9A9 34 06 PSHS A,B SAVE ON STACK AS UPPER DUMP LIMIT
F9AB 1F 20 TFR Y,D $F9A5 GET LOWER ADDRESS IN D-REG
F9AD C4 F0 ANDB #$F0 MASK TO EVEN 16 BYTE BOUNDRY
F9AF 1F 01 TFR D,X PUT IN X-REG AS LOWER DUMP LIMIT
F9B1 AC E4 NXTLIN CMPX ,S COMPARE LOWER TO UPPER LIMIT
F9B3 27 05 BEQ SKPDMP IF EQUAL SKIP HEX-ASCII DUMP
F9B5 17 0427 LBSR INCHEK CHECK FOR INPUT FROM KEYBOARD
F9B8 27 03 BEQ EDUMP IF NONE, CONTINUE WITH DUMP
F9BA 32 62 SKPDMP LEAS 2,S READJUST STACK IF NOT DUMPING
F9BC 39 RTS
```

* PRINT 16 HEX BYTES FOLLOWED BY 16 ASCII CHARACTERS
 * FOR EACH LINE THROUGHOUT ADDRESS LIMITS.

```
F9BD 34 10 EDUMP PSHS X PUSH LOWER ADDR LIMIT ON STACK
F9BF 8E FE83 LDX #MSG5 POINT TO MSG " - "
```

```

F9C2 17 03E8      LBSR  PSTRNG  PRINT MSG
F9C5 AE E4        LDX   ,S      LOAD LOWER ADDR FROM TOP OF STACK
F9C7 17 03AF      LBSR  OUT4H   PRINT THE ADDRESS LBSR OUT2S PRINT 2
SPACES
F9CA C6 10        LDB   #$10   LOAD COUNT OF 16 BYTES TO DUMP
F9CC A6 80        ELOOP  LDA   ,X+   GET FROM MEMORY HEX BYTE TO PRINT
F9CE 17 03B0      LBSR  OUT2H   OUTPUT HEX BYTE AS ASCII
F9D1 17 0418      LBSR  OUT1S   OUTPUT SPACE
F9D4 5A           DECB          $F9D1 DECREMENT BYTE COUNT
F9D5 26 F5        BNE   ELOOP  CONTINUE TIL 16 HEX BYTES PRINTED

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* PRINT 16 ASCII CHARACTERS
* IF NOT PRINTABLE OR NOT VALID
* ASCII PRINT A PERIOD (.)

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```

F9D7 17 0410      LBSR  OUT2S   2 SPACES
F9DA AE E1        LDX   ,S++   GET LOW LIMIT FRM STACK - ADJ STACK
F9DC C6 10        LDB   #$10   SET ASCII CHAR TO PRINT = 16
F9DE A6 80        EDPASC LDA   ,X+   GET CHARACTER FROM MEMORY
F9E0 81 20        CMPA  #$20   IF LESS THAN $20, NON-PRINTABLE?
F9E2 25 04        BCS   PERIOD  IF SO, PRINT PERIOD INSTEAD
F9E4 81 7E        CMPA  #$7E   IS IT VALID ASCII?
F9E6 23 02        BLS   PRASC   IF SO PRINT IT
F9E8 86 2E        PERIOD LDA   #'.'   LOAD A PERIOD (.)
F9EA 17 0401      PRASC  LBSR  OUTCH  PRINT ASCII CHARACTER
F9ED 5A           DECB          DECREMENT COUNT
F9EE 26 EE        BNE   EDPASC
F9F0 20 BF        BRA   NXTLIN

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```
***** "Q" MEMORY TEST *****
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F9F2 6F E2        MEMTST CLR   ,-S    CLEAR BYTE ON STACK
F9F4 6F E2        CLR   ,-S    CLEAR ANOTHER BYTE
F9F6 17 032B      LBSR  IN2ADR  GET BEGIN(Y) & END(X) ADDR. LIMITS
F9F9 34 30        PSHS  X,Y    SAVE ADDRESSES ON STACK
F9FB 29 7B        BVS   ADJSK6  EXIT IF NOT VALID HEX
F9FD AC 62        CMPX  2,S    COMPARE BEGIN TO END ADDR.
F9FF 25 77        BCS   ADJSK6  EXIT IF BEGIN > END ADDR.
FA01 17 03E8      LBSR  OUT1S   OUTPUT SPACE
FA04 1F 20        MEMSET TFR   Y,D    PUT BEGIN ADDR. IN 'D'-ACCUM.
FA06 E3 64        ADDD  4,S    ADD PASS COUNT TO BEGIN ADDR
FA08 34 04        PSHS  B      ADD LS BYTE TO MS BYTE OF BEGIN ADDR
FA0A AB E0        ADDA  ,S+   SAVE THIS DATA BYTE AT BEGIN ADDR
FA0C A7 A0        STA   ,Y+   COMPARE END TO BEGIN ADDR
FA0E 10AC E4      CMPY  ,S    IF BEGIN LOWER, CONTINUE TO SET MEMORY
FA11 25 F1        BCS   MEMSET
FA13 10AE 62      LDY   2,S    RELOAD BEGIN ADDRESS
FA16 1F 20        TEST1 TFR   Y,D    PUT BEGIN ADDR IN 'D'-ACC.
FA18 E3 64        ADDD  4,S    ADD PASS COUNT TO ADDRESS
FA1A 34 02        PSHS  A      ADD MS BYTE TO LS BYTE OF ADDRESS
FA1C EB E0        ADDB  ,S+   EX-OR THIS DATA WITH DATA IN MEMORY LOC.
FA1E E8 A0        EORB  ,Y+   IF (Z) SET, MEMORY BYTE OK
FA20 27 3C        BEQ   GUDPAS
FA22 8E FE83      LDX   #MSG5  POINT TO MSG " - "
FA25 17 0385      LBSR  PSTRNG  PRINT MSG
FA28 30 3F        LEAX  -1,Y   GET ERROR ADDRESS IN X-REG

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FA2A	17	034C		LBSR	OUT4H	OUTPUT IT
FA2D	34	10		PSHS	X	PUSH ERROR ADDR ON STACK
FA2F	8E	FEA1		LDX	#MSG8	POINT TO MSG " =>"
FA32	17	0388		LBSR	PDATA	PRINT MSG
FA35	35	10		PULS	X	POP ERROR ADDR FROM STACK
FA37	17	0147		LBSR	LRA	GET PHYSICAL ADDR FROM LRA
FA3A	17	0350		LBSR	XASCII	OUTPUT EXTENDED 4 BITS OF PHYSICAL ADDR
FA3D	17	0339		LBSR	OUT4H	OUTPUT LS 16 BITS OF PHYSICAL ADDR
FA40	8E	FE87		LDX	#MSG6	POINT TO MSG ", PASS "
FA43	17	0377		LBSR	PDATA	PRINT MSG
FA46	AE	64		LDX	4,S	LOAD PASS COUNT
FA48	17	032E		LBSR	OUT4H	OUTPUT IT
FA4B	8E	FE8F		LDX	#MSG7	POINT TO MSG ", BITS IN ERROR
FA4E	17	036C		LBSR	PDATA	PRINT MSG
FA51	1F	98		TFR	B,A	GET ERROR BYTE INTO A-ACC
FA53	8E	FEA6		LDX	#MSG9	POINT TO MSG "76543210"
FA56	17	033E		LBSR	BIASCI	OUTPUT IN BINARY/ASCII FORMAT
FA59	17	0383		LBSR	INCHEK	CHECK FOR INPUT FROM KEYBOARD \$FA56
FA5C	26	1A		BNE	ADJSK6	IF SO, EXIT MEMORY TEST
FA5E	10AC	E4	GUDPAS	CMPY	,S	COMPARE END ADDR TO BEGIN ADDR
FA61	25	B3		BCS	TEST1	
FA63	86	2B		LDA	#'+	GET "PASS" SYMBOL IF MEMORY PASS OK
FA65	17	0386		LBSR	OUTCH	OUTPUT SYMBOL TO TERMINAL
FA68	17	0374		LBSR	INCHEK	INPUT FROM KEYBOARD?
FA6B	26	0B		BNE	ADJSK6	IF SO, EXIT MEMORY TEST
FA6D	10AE	62		LDY	2,S	LOAD BEGIN ADDRESS
FA70	6C	65		INC	5,S	INCREMENT LS BYTE OF PASS COUNT
FA72	26	90		BNE	MEMSET	IF NOT ZERO, SET NEXT MEMORY BYTE
FA74	6C	64		INC	4,S	INCREMENT MS BYTE OF PASS COUNT
FA76	26	8C		BNE	MEMSET	DONE WITH 65,535 PASSES OF MEMORY?
FA78	32	66	ADJSK6	LEAS	6,S	ADJ STACK POINTER BY 6
FA7A	39			RTS		

***** "B" SET BREAKPOINT *****

FA7B	17	02B1	BRKPNT	LBSR	IN1ADR	GET BREAKPOINT ADDRESS
FA7E	29	1E		BVS	EXITBP	EXIT IF INVALID HEX ADDR.
FA80	8C	DFC0		CMPX	#STACK	ADDRESS ILLEGAL IF >=\$DFC0
FA83	24	1A		BCC	BPERR	IF ERROR PRINT (?), EXIT
FA85	34	10		PSHS	X	\$FA82 PUSH BP ADDRESS ON STACK
FA87	8E	FFFF		LDX	#\$FFFF	LOAD DUMMY ADDR TO TEST BP TABLE
FA8A	8D	55		BSR	BPTEST	TEST BP TABLE FOR FREE SPACE
FA8C	35	10		PULS	X	POP BP ADDRESS FROM STACK
FA8E	27	0F		BEQ	BPERR	(Z) SET, OUT OF BP TABLE SPACE
FA90	A6	84		LDA	,X	GET DATA AT BREAKPOINT ADDRESS
FA92	81	3F		CMPA	#\$3F	IS IT A SWI?
FA94	27	09		BEQ	BPERR	IF SWI ALREADY, INDICATE ERROR
FA96	A7	A0		STA	,Y+	SAVE DATA BYTE IN BP TABLE
FA98	AF	A4		STX	,Y	SAVE BP ADDRESS IN BP TABLE
FA9A	86	3F		LDA	#\$3F	LOAD A SWI (\$3F)
FA9C	A7	84		STA	,X	SAVE SWI AT BREAKPOINT ADDRESS
FA9E	39		EXITBP	RTS		

* INDICATE ERROR SETTING BREAKPOINT

FA9F	17	034A	BPERR	LBSR	OUT1S	OUTPUT SPACE
FAA2	86	3F		LDA	#'?	LOAD (?), INDICATE BREAKPOINT ERROR
FAA4	16	0347		LBRA	OUTCH	PRINT "?"

*** "X" CLEAR OUTSTANDING BREAKPOINTS ***

FAA7	108E	DFE3	XBKPNT	LDY	#BPTBL	POINT TO BREAKPOINT TABLE
FAAB	C6	08		LDB	#8	LOAD BREAKPOINT COUNTER
FAAD	8D	18	XBPLP	BSR	RPLSWI	REMOVE USED ENTRY IN BP TABLE
FAAF	5A			DECB		\$FAAC DECREMENT BP COUNTER
FAB0	26	FB		BNE	XBPLP	END OF BREAKPOINT TABLE?
FAB2	39			RTS		

***** SWI ENTRY POINT *****

FAB3	1F	43	SWIE	TFR	S,U	TRANSFER STACK TO USER POINTER
FAB5	AE	4A		LDX	10,U	LOAD PC FROM STACK INTO X-REG
FAB7	30	1F		LEAX	-1,X	ADJUST ADDR DOWN 1 BYTE.
FAB9	8D	26		BSR	BPTST	FIND BREAKPOINT IN BP TABLE
FABB	27	04		BEQ	REGPR	IF FOUND, REPLACE DATA AT BP ADDR
FABD	AF	4A		STX	10,U	SAVE BREAKPOINT ADDR IN STACK
FABF	8D	06		BSR	RPLSWI	GO REPLACE SWI WITH ORIGINAL DATA
FAC1	17	FDE4	REGPR	LBSR	REGSTR	GO PRINT REGISTERS
FAC4	16	FD9A		LBRA	NEXTCMD	GET NEXT COMMAND
FAC7	AE	21	RPLSWI	LDX	1,Y	LOAD BP ADDRESS FROM BP TABLE
FAC9	8C	DFC0		CMPX	#STACK	COMPARE TO TOP AVAILABLE USER MEMORY
FACC	24	0A		BCC	FFSTBL	GO RESET TABLE ENTRY TO \$FF'S
FACE	A6	84		LDA	,X	GET DATA FROM BP ADDRESS
FAD0	81	3F		CMPA	#\$3F	IS IT SWI?
FAD2	26	04		BNE	FFSTBL	IF NOT, RESET TABLE ENTRY TO \$FF'S
FAD4	A6	A4		LDA	,Y	GET ORIGINAL DATA FROM BP TABLE
FAD6	A7	84		STA	,X	\$FAD3 RESTORE DATA AT BP ADDRESS
FAD8	86	FF	FFSTBL	LDA	#\$FF	LOAD \$FF IN A-ACC
FADA	A7	A0		STA	,Y+	RESET BREAKPOINT TABLE DATA TO \$FF'S
FADC	A7	A0		STA	,Y+	RESET BREAKPOINT TABLE ADDR TO \$FF'S
FADE	A7	A0		STA	,Y+	
FAE0	39			RTS		

** SEARCH BREAKPOINT TABLE FOR MATCH **

FAE1	108E	DFE3	BPTST	LDY	#BPTBL	POINT TO BREAKPOINT TABLE
FAE5	C6	08		LDB	#8	LOAD BREAKPOINT COUNTER
FAE7	A6	A0	FNDBP	LDA	,Y+	LOAD DATA BYTE
FAE9	AC	A1		CMPX	,Y++	COMPARE ADDRESS, IS IT SAME?
FAEB	27	04		BEQ	BPADJ	IF SO, ADJUST POINTER FOR TABLE ENTRY
FAED	5A			DECB		IF NOT, DECREMENT BREAKPOINT COUNTER
FAEE	26	F7		BNE	FNDBP	AND LOOK FOR NEXT POSSIBLE MATCH
FAF0	39			RTS		
FAF1	31	3D	BPADJ	LEAY	-3,Y	MOVE POINTER TO BEGIN OF BP ENTRY
FAF3	39			RTS		

*** "D" DISK BOOT FOR DMAF2 ***

```

FAF4 86 DE DBOOT LDA #$DE
FAF6 B7 F024 STA DRVREG
FAF9 86 FF LDA #$FF
FAFB B7 F014 STA PRIREG $FAF8
FAFE B7 F010 STA CCREG
FB01 B7 F015 STA AAAREG
FB04 B7 F016 STA BBBREG
FB07 7D F010 TST CCREG
FB0A 86 D8 LDA #$D8
FB0C B7 F020 STA COMREG
FB0F 17 0097 LBSR DLY
FB12 B6 F020 DBOOT0 LDA COMREG
FB15 2B FB BMI DBOOT0
FB17 86 09 LDA #$09
FB19 B7 F020 STA COMREG
FB1C 17 008A LBSR DLY

FB1F B6 F020 DISKWT LDA COMREG FETCH DRIVE STATUS
FB22 85 01 BITA #1 TEST BUSY BIT
FB24 26 F9 BNE DISKWT LOOP UNTIL NOT BUSY

FB26 85 10 BITA #$10
FB28 26 CA BNE DBOOT

FB2A 8E C000 LDX #$C000 LOGICAL ADDR. = $C000
FB2D 8D 52 BSR LRA GET 20 BIT PHYSICAL ADDR. OF LOG. ADDR.
FB2F 8A 10 ORA #$10
FB31 B7 F040 STA CCCREG
FB34 1F 10 TFR X,D
FB36 43 COMA
FB37 53 COMB
FB38 FD F000 STD ADDRREG
FB3B 8E FEFF LDX #$FEFF LOAD DMA BYTE COUNT = $100
FB3E BF F002 STX CNTREG STORE IN COUNT REGISTER
FB41 86 FF LDA #$FF LOAD THE CHANNEL REGISTER
FB43 B7 F010 STA CCREG
FB46 86 FE LDA #$FE SET CHANNEL 0
FB48 B7 F014 STA PRIREG
FB4B 86 01 LDA #1 SET SECTOR TO "1"
FB4D B7 F022 STA SECREG ISSUE COMMAND
FB50 86 8C LDA #$8C SET SINGLE SECTOR READ
FB52 B7 F020 STA COMREG ISSUE COMMAND
FB55 8D 52 BSR DLY
    
```

* THE FOLLOWING CODE TESTS THE STATUS OF THE
 * CHANNEL CONTROL REGISTER. IF "D7" IS NOT
 * ZERO THEN IT WILL LOOP WAITING FOR "D7"
 * TO GO TO ZERO. IF AFTER 65,536 TRIES IT
 * IS STILL A ONE THE BOOT OPERATION WILL
 * BE STARTED OVER FROM THE BEGINING.

```

FB57 5F CLR
    
```

```

FB58 34 04      DBOOT1  PSHS  B          $FB55
FB5A 5F          CLR B
FB5B 7D F010    DBOOT2  TST   CCREG
FB5E 2A 0A      BPL   DBOOT3
FB60 5A          DECB
FB61 26 F8      BNE   DBOOT2
FB63 35 04      PULS  B
FB65 5A          DECB
FB66 26 F0      BNE   DBOOT1
FB68 20 8A      BRA   DBOOT
FB6A 35 04      DBOOT3  PULS  B
FB6C B6 F020    LDA   COMREG
FB6F 85 1C      BITA  #$1C
FB71 27 01      BEQ   DBOOT4
FB73 39          RTS

```

```

FB74 C6 DE      DBOOT4  LDB   #$DE
FB76 F7 F024    STB   DRVREG
FB79 8E C000    LDX   #$C000
FB7C AF 4A      STX   10,U
FB7E 1F 34      TFR   U,S          $FB7B
FB80 3B          RTI

```

***** LRA LOAD REAL ADDRESS *****

* THE FOLLOWING CODE LOADS THE 20-BIT
* PHYSICAL ADDRESS OF A MEMORY BYTE
* INTO THE "A" AND "X" REGISTERS. THIS
* ROUTINE IS ENTERED WITH THE LOGICAL
* ADDRESS OF A MEMORY BYTE IN THE "IX"
* REGISTER. EXIT IS MADE WITH THE HIGH-
* ORDER FOUR BITS OF THE 20-BIT PHYSICAL
* ADDRESS IN THE "A" REGISTER, AND THE
* LOW-ORDER 16-BITS OF THE 20-BIT
* PHYSICAL ADDRESS IN THE "IX" REGISTER.
* ALL OTHER REGISTERS ARE PRESERVED.
* THIS ROUTINE IS REQUIRED SINCE THE
* DMAF1 AND DMAF2 DISK CONTROLLERS MUST
* PRESENT PHYSICAL ADDRESSES ON THE
* SYSTEM BUS.

```

FB81 34 36      LRA    PSHS  A,B,X,Y  PUSH REGISTERS ON STACK
FB83 A6 62      LDA    2,S    GET MSB LOGICAL ADDR FRM X REG ON STACK
FB85 44          LSRA
FB86 44          LSRA    ADJ FOR INDEXED INTO
FB87 44          LSRA    CORRESPONDING LOCATION
FB88 44          LSRA    IN LRA TABLE
FB89 108E DFD0   LDY    #LRARAM  LOAD LRA TABLE BASE ADDRESS
FB8D E6 A6      LDB    A,Y    GET PHYSICAL ADDR. DATA FROM LRA TABLE
FB8F 54          LSRB   ADJ. REAL ADDR. TO REFLECT EXTENDED
FB90 54          LSRB   PHYSICAL ADDRESS.
FB91 54          LSRB   EXTENDED MS 4-BITS ARE RETURNED
FB92 54          LSRB   IN THE "A" ACCUMULATOR

```

```

FB93 E7 E4 STB ,S MS 4 BITS IN A ACCUM. STORED ON STACK
FB95 E6 A6 LDB A,Y LOAD REAL ADDRESS DATA FROM LRA TABLE
FB97 53 COMB COMP TO ADJ FOR PHYSICAL ADDR. IN X REG
FB98 58 ASLB ADJ DATA FOR RELOCATION IN X REG
FB99 58 ASLB
FB9A 58 ASLB $FB97
FB9B 58 ASLB
FB9C A6 62 LDA 2,S GET MS BYTE OF LOGICAL ADDR.
FB9E 84 0F ANDA #$0F MASK MS NIBBLE OF LOGICAL ADDRESS
FBA0 A7 62 STA 2,S SAVE IT IN X REG ON STACK
FBA2 EA 62 ORB 2,S SET MS BYTE IN X REG TO ADJ PHY ADDR.

```

* PLUS LS NIBBLE OF LOGICAL ADDRESS

```

FBA4 E7 62 STB 2,S SAVE AS LS 16 BITS OF PHY ADDR IN X REG

```

* ON STACK

```

FBA6 35 36 PULS A,B,X,Y POP REGS. FROM STACK
FBA8 39 RTS

```

* DELAY LOOP

```

FBA9 34 04 DLY PSHS B SAVE CONTENTS OF "B"
FBAB C6 20 LDB #$20 GET LOOP DELAY VALUE
FBAD 5A SUB1 DECB SUBTRACT ONE FROM VALUE
FBAE 26 FD BNE SUB1 LOOP UNTIL ZERO
FBB0 35 04 PULS B RESTORE CONTENTS OF "B"
FBB2 39 RTS

```

***** "U" MINIDISK BOOT *****

```

FBB3 7D E018 MINBOOT TST Comreg
FBB6 7F E014 CLR Drvreg SELECT DRIVE 0

```

* DELAY BEFORE ISSUING RESTORE COMMAND

```

FBB9 C6 03 LDB #3
FBBB 8E 0000 LDX #0
FBBE 30 01 LOOP LEAX 1,X $FBBB
FBC0 8C 0000 CMPX #0
FBC3 26 F9 BNE LOOP
FBC5 5A DECB $FBC2
FBC6 26 F6 BNE LOOP

```

```

FBC8 86 0F LDA #$0F *LOAD HEAD, VERIFY, 20msec/step
FBCA B7 E018 STA Comreg ISSUE RESTORE COMMAND
FBCD 8D 37 BSR DELAY
FBCF F6 E018 LOOP1 LDB Comreg $FBCC
FBD2 C5 01 BITB #1
FBD4 26 F9 BNE LOOP1 LOOP UNTIL THRU
FBD6 86 01 LDA #1
FBD8 B7 E01A STA Secreg SET SECTOR REGISTER TO ONE
FBDB 8D 29 BSR DELAY
FBDD 86 8C LDA #$8C LOAD HEAD, DELAY 10msec,
FBDF B7 E018 STA Comreg AND READ SINGLE RECORD
FBE2 8D 22 BSR DELAY
FBE4 8E C000 LDX #$C000

```

```

FBE7 20 09          BRA    LOOP3

FBE9 C5 02          LOOP2  BITB  #2          $FBE6 DRQ?
FBEB 27 05          BEQ    LOOP3
FBED B6 E01B       LDA    Datreg
FBF0 A7 80          STA    ,X+

FBF2 F6 E018       LOOP3  LDB    Comreg    FETCH STATUS
FBF5 C5 01          BITB  #1          BUSY?
FBF7 26 F0          BNE    LOOP2
FBF9 C5 2C          BITB  #$2C         CRC ERROR OR LOST DATA?
FBFB 27 01          BEQ    LOOP4
FBFD 39             RTS
FBFE 8E C000       LOOP4  LDX    #$C000    $FBFB
FC01 AF 4A          STX    10,U
FC03 1F 34          TFR    U,S
FC05 3B             RTI

```

* DELAY

```

FC06 C6 20          DELAY  LDB    #$20
FC08 5A             LOOP5  DECB
FC09 26 FD          BNE    LOOP5
FC0B 39             RTS

```

***** "L" LOAD MIKBUG TAPE *****

```

FC0C 86 11          LOAD   LDA    #$11          LOAD 'DC1' CASS. READ ON CODE
FC0E 17 01DD        LBSR  OUTCH        OUTPUT IT TO TERMINAL PORT
FC11 7F DFE2        CLR   ECHO         TURN OFF ECHO FLAG
FC14 17 01AD        LOAD1  LBSR  ECHON        INPUT 8 BIT BYTE WITH NO ECHO
FC17 81 53          LOAD2  CMPA  #'S          IS IT AN "S", START CHARACTER ?
FC19 26 F9          BNE    LOAD1        IF NOT, DISCARD AND GET NEXT CHAR.
FC1B 17 01A6        LBSR  ECHON
FC1E 81 39          CMPA  #'9          IS IT A "9" , END OF FILE CHAR ?
FC20 27 3D          BEQ    LOAD21       IF SO, EXIT LOAD
FC22 81 31          CMPA  #'1          IS IT A "1" , FILE LOAD CHAR ?
FC24 26 F1          BNE    LOAD2        IF NOT, LOOK FOR START CHAR.
FC26 17 0117        LBSR  BYTE         INPUT BYTE COUNT
FC29 34 02          PSHS  A           PUSH COUNT ON STACK
FC2B 29 26          BVS   LODERR      (V) C-CODE SET, ILLEGAL HEX
FC2D 17 00FF        LBSR  IN1ADR      INPUT LOAD ADDRESS
FC30 29 21          BVS   LODERR      (V) C-CODE SET, ADDR NOT HEX
FC32 34 10          PSHS  X           PUSH ADDR ON STACK
FC34 E6 E0          LDB   ,S+         LOAD MSB OF ADDR AS CHECKSUM BYTE
FC36 EB E0          ADDB  ,S+         ADD LSB OF ADDR TO CHECKSUM
FC38 EB E4          ADDB  ,S          ADD BYTE COUNT BYTE TO CHECKSUM
FC3A 6A E4          DEC   ,S          $FC37 DECREMENT BYTE COUNT 2 TO BYPASS
FC3C 6A E4          DEC   ,S          ADDRESS BYTES.
FC3E 34 04          LOAD10 PSHS  B          PUSH CHECKSUM ON STACK
FC40 17 00FD        LBSR  BYTE         INPUT DATA BYTE (2 HEX CHAR)
FC43 35 04          PULS  B           POP CHECKSUM FROM STACK
FC45 29 0C          BVS   LODERR      (V) SET, DATA BYTE NOT HEX
FC47 34 02          PSHS  A           PUSH DATA BYTE ON STACK

```

FC49	EB	E0		ADDB	,S+	ADD DATA TO CHECKSUM, AUTO INC STACK
FC4B	6A	E4		DEC	,S	DECREMENT BYTE COUNT 1
FC4D	27	05		BEQ	LOAD16	IF BYTE COUNT ZERO, TEST CHECKSUM
FC4F	A7	80		STA	,X+	SAVE DATA BYTE IN MEMORY
FC51	20	EB		BRA	LOAD10	GET NEXT DATA BYTE
FC53	5F		LODERR	CLRB		ERROR CONDITION, ZERO CHECKSUM
FC54	35	02	LOAD16	PULS	A	ADJUST STACK (REMOVE BYTE COUNT)
FC56	C1	FF		CMPB	#\$FF	CHECKSUM OK?
FC58	27	B2		BEQ	LOAD	IF SO, LOAD NEXT LINE
FC5A	86	3F		LDA	#'?	LOAD (?) ERROR INDICATOR
FC5C	17	018F		LBSR	OUTCH	OUTPUT IT TO TERMINAL
FC5F	73	DFE2	LOAD21	COM	ECHO	TURN ECHO ON
FC62	86	13		LDA	#\$13	\$FC5F LOAD 'DC3' CASS. READ OFF CODE
FC64	16	0187		LBRA	OUTCH	OUTPUT IT

***** "P" PUNCH MIKBUG TAPE *****

FC67	6F	E2	PUNCH	CLR	,-S	CLEAR RESERVED BYTE ON STACK
FC69	17	00B8		LBSR	IN2ADR	GET BEGIN AND END ADDRESS
FC6C	34	30		PSHS	X,Y	SAVE ADDRESSES ON STACK
FC6E	29	4A		BVS	PUNEXT	(V) C-CODE SET, EXIT PUNCH
FC70	AC	62		CMPX	2,S	COMPARE BEGIN TO END ADDR
FC72	25	46		BCS	PUNEXT	IF BEGIN GREATER THAN END, EXIT PUNCH
FC74	30	01		LEAX	1,X	INCREMENT END ADDRESS
FC76	AF	E4		STX	,S	STORE END ADDR ON STACK
FC78	86	12		LDA	#\$12	LOAD 'DC2' PUNCH ON CODE
FC7A	17	0171		LBSR	OUTCH	OUTPUT IT TO TERMINAL
FC7D	EC	E4	PUNCH2	LDD	,S	LOAD END ADDR IN D-ACC
FC7F	A3	62		SUBD	2,S	SUBTRACT BEGIN FROM END
FC81	27	06		BEQ	PUNCH3	SAME, PUNCH 32 BYTES DEFAULT
FC83	1083	0020		CMPD	#\$20	LESS THAN 32 BYTES?
FC87	23	02		BLS	PUNCH4	PUNCH THAT MANY BYTES
FC89	C6	20	PUNCH3	LDB	#\$20	LOAD BYTE COUNT OF 32.
FC8B	E7	64	PUNCH4	STB	4,S	STORE ON STACK AS BYTE COUNT
FC8D	8E	FEEB		LDX	#MSG20	POINT TO MSG "S1"
FC90	17	011A		LBSR	PSTRNG	PRINT MSG
FC93	CB	03		ADDB	#3	ADD 3 BYTES TO BYTE COUNT
FC95	1F	98		TFR	B,A	GET BYTE COUNT IN A-ACC TO PUNCH
FC97	17	00E7		LBSR	OUT2H	OUTPUT BYTE COUNT
FC9A	AE	62		LDX	2,S	LOAD BEGIN ADDRESS
FC9C	17	00DA		LBSR	OUT4H	PUNCH ADDRESS
FC9F	EB	62		ADDB	2,S	ADD ADDR MSB TO CHECKSUM
FCA1	EB	63		ADDB	3,S	ADD ADDR LSB TO CHECKSUM
FCA3	EB	84	PUNCHL	ADDB	,X	ADD DATA BYTE TO CHECKSUM
FCA5	A6	80		LDA	,X+	LOAD DATA BYTE TO PUNCH
FCA7	17	00D7		LBSR	OUT2H	OUTPUT DATA BYTE
FCAA	6A	64		DEC	4,S	DECREMENT BYTE COUNT
FCAC	26	F5		BNE	PUNCHL	NOT DONE, PUNCH NEXT BYTE
FCAE	53			COMB		1's COMPLIMENT CHECKSUM BYTE
FCAF	1F	98		TFR	B,A	GET IT IN A-ACC TO PUNCH
FCB1	17	00CD		LBSR	OUT2H	OUTPUT CHECKSUM BYTE
FCB4	AF	62		STX	2,S	SAVE X-REG IN STACK AS NEW PUNCH ADDR
FCB6	AC	E4		CMPX	,S	COMPARE IT TO END ADDR
FCB8	26	C3		BNE	PUNCH2	\$FCB5 PUNCH NOT DONE, CONT.

FCBA	86	14	PUNEXT	LDA	#\$14	LOAD 'DC4' PUNCH OFF CODE
FCBC	17	012F		LBSR	OUTCH	OUTPUT IT
FCBF	32	65		LEAS	5,S	READJUST STACK POINTER
FCC1	39			RTS		
FCC2	8E	FEAE	PRTSP	LDX	#MSG10	POINT TO MSG "SP="
FCC5	17	00F5		LBSR	PDATA	PRINT MSG
FCC8	1F	31		TFR	U,X	
FCCA	16	00AC		LBRA	OUT4H	
FCCD	8E	FEBA	PRTUS	LDX	#MSG12	POINT TO MSG "US="
FCD0	17	00EA		LBSR	PDATA	PRINT MSG
FCD3	AE	48		LDX	8,U	
FCD5	16	00A1		LBRA	OUT4H	
FCD8	8E	FECC	PRTDP	LDX	#MSG15	POINT TO MSG "DP="
FCDB	17	00DF		LBSR	PDATA	PRINT MSG
FCDE	A6	43		LDA	3,U	
FCE0	16	009E		LBRA	OUT2H	OUTPUT HEX BYTE AS ASCII
FCE3	8E	FEC6	PRTIX	LDX	#MSG14	POINT TO MSG "IX="
FCE6	17	00D4		LBSR	PDATA	PRINT MSG
FCE9	AE	44		LDX	4,U	\$FCE6
FCEB	16	008B		LBRA	OUT4H	
FCEE	8E	FEC0	PRTIY	LDX	#MSG13	POINT TO MSG "IY="
FCF1	17	00C9		LBSR	PDATA	PRINT MSG
FCF4	AE	46		LDX	6,U	
FCF6	16	0080		LBRA	OUT4H	
FCF9	8E	FEB4	PRTPC	LDX	#MSG11	POINT TO MSG "PC="
FCFC	17	00BE		LBSR	PDATA	PRINT MSG
FCFF	AE	4A		LDX	10,U	
FD01	20	76		BRA	OUT4H	
FD03	8E	FED2	PRTA	LDX	#MSG16	POINT TO MSG "A="
FD06	17	00B4		LBSR	PDATA	PRINT MSG
FD09	A6	41		LDA	1,U	
FD0B	20	74		BRA	OUT2H	OUTPUT HEX BYTE AS ASCII
FD0D	8E	FED7	PRTB	LDX	#MSG17	POINT TO MSG "B="
FD10	17	00AA		LBSR	PDATA	PRINT MSG
FD13	A6	42		LDA	2,U	
FD15	20	6A		BRA	OUT2H	OUTPUT HEX BYTE AS ASCII
FD17	8E	FEDC	PRTCC	LDX	#MSG18	POINT TO MSG "CC:"
FD1A	17	00A0		LBSR	PDATA	PRINT MSG
FD1D	A6	C4		LDA	,U	
FD1F	8E	FEE3		LDX	#MSG19	POINT TO MSG "EFHINZVC"
FD22	20	73		BRA	BIASCI	OUTPUT IN BINARY/ASCII FORMAT

* THE FOLLOWING ROUTINE LOOPS WAITING FOR THE
 * OPERATOR TO INPUT TWO VALID HEX ADDRESSES.
 * THE FIRST ADDRESS INPUT IS RETURNED IN "IY".
 * THE SECOND IS RETURNED IN "IX". THE "V" BIT
 * IN THE C-CODE REG. IS SET IF AN INVALID HEX
 * ADDRESS IS INPUT.

FD24	8D	09	IN2ADR	BSR	IN1ADR	GET FIRST ADDRESS
FD26	29	4E		BVS	NOTHEX	EXIT IF NOT VALID HEX
FD28	1F	12		TFR	X,Y	SAVE FIRST ADDR. IN "IY"


```

FD2A 86 2D          LDA  #'-
FD2C 17 00BF        LBSR OUTCH   PRINT " - "

```

```

* THE FOLLOWING ROUTINE LOOPS WAITING FOR THE
* OPERATOR TO INPUT ONE VALID HEX ADDRESS. THE
* ADDRESS IS RETURNED IN THE "X" REGISTER.

```

```

FD2F 8D 0F          IN1ADR BSR   BYTE   INPUT BYTE (2 HEX CHAR)
FD31 29 43          BVS   NOTHEX  EXIT IF NOT VALID HEX
FD33 1F 01          TFR   D,X
FD35 8D 09          BSR   BYTE   INPUT BYTE (2 HEX CHAR)
FD37 29 3D          BVS   NOTHEX
FD39 34 10          PSHS  X
FD3B A7 61          STA  1,S
FD3D 35 10          PULS  X
FD3F 39            RTS

```

```

***** INPUT BYTE (2 HEX CHAR.) *****

```

```

FD40 8D 11          BYTE  BSR   INHEX   GET HEX LEFT
FD42 29 32          BVS   NOTHEX  EXIT IF NOT VALID HEX
FD44 48             ASLA
FD45 48             ASLA
FD46 48             ASLA   SHIFT INTO LEFT NIBBLE
FD47 48             ASLA
FD48 1F 89          TFR   A,B   PUT HEXL IN "B"
FD4A 8D 07          BSR   INHEX   GET HEX RIGHT
FD4C 29 28          BVS   NOTHEX  EXIT IF NOT VALID HEX
FD4E 34 04          PSHS  B   PUSH HEXL ON STACK
FD50 AB E0          ADDA  ,S+  ADD HEXL TO HEXR AND ADJ. STK
FD52 39            RTS   RETURN WITH HEX L&R IN "A"

```

```

FD53 8D 6F          INHEX BSR   ECHON   INPUT ASCII CHAR.
FD55 81 30          CMPA  #'0   IS IT > OR = "0" ?
FD57 25 1D          BCS   NOTHEX  IF LESS IT AIN'T HEX
FD59 81 39          CMPA  #'9   IS IT < OR = "9" ?
FD5B 22 03          BHI   INHEXA  IF > MAYBE IT'S ALPHA
FD5D 80 30          SUBA  #$30  ASCII ADJ. NUMERIC
FD5F 39            RTS

```

```

FD60 81 41          INHEXA CMPA  #'A   IS IT > OR = "A"
FD62 25 12          BCS   NOTHEX  IF LESS IT AIN'T HEX
FD64 81 46          CMPA  #'F   IS IT < OR = "F" ?
FD66 22 03          BHI   INHEXL  IF > IT AIN'T HEX
FD68 80 37          SUBA  #$37  ASCII ADJ. ALPHA
FD6A 39            RTS

```

```

FD6B 81 61          INHEXL CMPA  #'a   IS IT > OR = "a"
FD6D 25 07          BCS   NOTHEX  IF LESS IT AIN'T HEX
FD6F 81 66          CMPA  #'f   IS IT < "f"
FD71 22 03          BHI   NOTHEX  IF > IT AIN'T HEX
FD73 80 57          SUBA  #$57  ADJUST TO LOWER CASE

```

```

FD75 39          RTS

FD76 1A 02      NOTHEX ORCC #2      SET (V) FLAG IN C-CODES REGISTER
FD78 39          RTS

FD79 34 10      OUT4H  PSHS  X      PUSH X-REG. ON THE STACK
FD7B 35 02          PULS  A      POP MS BYTE OF X-REG INTO A-ACC.
FD7D 8D 02          BSR   OUTHL   OUTPUT HEX LEFT
FD7F 35 02          PULS  A      POP LS BYTE OF X-REG INTO A-ACC.
                FD81  OUTHL  EQU   *
FD81 34 02      OUT2H  PSHS  A      SAVE IT BACK ON STACK
FD83 44          LSRA          CONVERT UPPER HEX NIBBLE TO ASCII
FD84 44          LSRA
FD85 44          LSRA
FD86 44          LSRA
FD87 8D 04          BSR   XASCII  PRINT HEX NIBBLE AS ASCII
FD89 35 02      OUTHR  PULS  A      CONVERT LOWER HEX NIBBLE TO ASCII
FD8B 84 0F          ANDA  #$0F     STRIP LEFT NIBBLE
FD8D 8B 30      XASCII  ADDA  #$30   ASCII ADJ
FD8F 81 39          CMPA  #$39     IS IT < OR = "9" ?
FD91 2F 02          BLE  OUTC      IF LESS, OUTPUT IT
FD93 8B 07          ADDA  #7       IF > MAKE ASCII LETTER
FD95 20 57      OUTC   BRA    OUTCH  OUTPUT CHAR

```

```

* BINARY / ASCII --- THIS ROUTINE
* OUTPUTS A BYTE IN ENHANCED
* BINARY FORMAT. THE ENHANCEMENT
* IS DONE BY SUBSTITUTING ASCII
* LETTERS FOR THE ONES IN THE BYTE.
* THE ASCII ENHANCEMENT LETTERS
* ARE OBTAINED FROM THE STRING
* POINTED TO BY THE INDEX REG. "X".

```

```

FD97 34 02      BIASCI  PSHS  A      SAVE "A" ON STACK
FD99 C6 08          LDB   #8       PRESET LOOP# TO BITS PER BYTE
FD9B A6 80      OUTBA  LDA    ,X+    GET LETTER FROM STRING
FD9D 68 E4          ASL   ,S       TEST BYTE FOR "1" IN B7
FD9F 25 02          BCS  PRTBA    IF ONE PRINT LETTER
FDA1 86 2D          LDA  #'-      IF ZERO PRINT "-"
FDA3 8D 49      PRTBA  BSR   OUTCH   PRINT IT
FDA5 8D 45      BSR   OUT1S   PRINT SPACE
FDA7 5A          DECB          SUB 1 FROM #BITS YET TO PRINT
FDA8 26 F1          BNE  OUTBA
FDAA 35 02          PULS  A
FDAC 39          RTS

```

```

* PRINT STRING PRECEDED BY A CR & LF.

```

```

FDAD 8D 02      PSTRNG  BSR   PCRLF   PRINT CR/LF
FDAF 20 0C      BRA    PDATA   PRINT STRING POINTED TO BY IX

```

```

* PCRLF

```

```

FDB1 34 10      PCRLF  PSHS  X      SAVE IX
FDB3 8E FE75    LDX   #MSG2+1  POINT TO MSG CR/LF + 3 NULS
FDB6 8D 05      BSR   PDATA  PRINT MSG
FDB8 35 10      PULS  X      RESTORE IX
FDBA 39        RTS
FDBB 8D 31      PRINT  BSR   OUTCH

```

* PDATA

```

FDBD A6 80      PDATA  LDA    ,X+    GET 1st CHAR. TO PRINT
FDBF 81 04      CMPA  #4      IS IT EOT?
FDC1 26 F8      BNE   PRINT  IF NOT EOT PRINT IT
FDC3 39        RTS

```

```

FDC4 7D DFE2    ECHON  TST   ECHO   IS ECHO REQUIRED ?
FDC7 27 06      BEQ   INCH   ECHO NOT REQ. IF CLEAR

```

* INCHE

* ---GETS CHARACTER FROM TERMINAL AND
* ECHOS SAME. THE CHARACTER IS RETURNED
* IN THE "A" ACCUMULATOR WITH THE PARITY
* BIT MASKED OFF. ALL OTHER REGISTERS
* ARE PRESERVED.

```

FDC9 8D 04      INCHE  BSR   INCH   GET CHAR FROM TERMINAL
FDCB 84 7F      ANDA  #$7F   STRIP PARITY FROM CHAR.
FDCD 20 1F      BRA   OUTCH  ECHO CHAR TO TERMINAL

```

* INCH

* GET CHARACTER FROM TERMINAL. RETURN
* CHARACTER IN "A" ACCUMULATOR AND PRESERVE
* ALL OTHER REGISTERS. THE INPUT CHARACTER
* IS 8 BITS AND IS NOT ECHOED.

```

FDCF 34 10      INCH  PSHS  X      SAVE IX
FDD1 BE DFE0    LDX   CPORT  POINT TO TERMINAL PORT
FDD4 A6 84      GETSTA LDA   ,X      FETCH PORT STATUS
FDD6 85 01      BITA  #1      TEST READY BIT, RDRF ?
FDD8 27 FA      BEQ   GETSTA  IF NOT RDY, THEN TRY AGAIN
FDDA A6 01      LDA   1,X     FETCH CHAR
FDDC 35 10      PULS  X      RESTORE IX
FDDE 39        RTS

```

* INCHEK

* CHECK FOR A CHARACTER AVAILABLE FROM
* THE TERMINAL. THE SERIAL PORT IS CHECKED
* FOR READ READY. ALL REGISTERS ARE
* PRESERVED, AND THE "Z" BIT WILL BE

* CLEAR IF A CHARACTER CAN BE READ.

```

FDDF 34 02      INCHEK  PSHS  A          SAVE A ACCUM.
FDE1 A6 9F DFE0      LDA    [CPORT]  FETCH PORT STATUS
FDE5 85 01          BITA   #1        TEST READY BIT, RDRF ?
FDE7 35 02          PULS   A          RESTORE A ACCUM.
FDE9 39          RTS

FDEA 8D 00      OUT2S   BSR    OUT1S     OUTPUT 2 SPACES
FDEC 86 20      OUT1S   LDA    #$20     OUTPUT 1 SPACE

```

* OUTCH

* OUTPUT CHARACTER TO TERMINAL.

* THE CHAR. TO BE OUTPUT IS

* PASSED IN THE A REGISTER.

* ALL REGISTERS ARE PRESERVED.

```

FDEE 34 12      OUTCH   PSHS  A,X        SAVE A ACCUM AND IX
FDF0 BE DFE0      LDX    CPORT  GET ADDR. OF TERMINAL
FDF3 A6 84      FETSTA  LDA    ,X        FETCH PORT STATUS
FDF5 85 02          BITA   #2        TEST TDRE, OK TO XMIT ?
FDF7 27 FA      BEQ    FETSTA  IF NOT LOOP UNTIL RDY
FDF9 35 02          PULS   A          GET CHAR. FOR XMIT
FDFB A7 01      STA    1,X      XMIT CHAR.
FDFD 35 10      PULS   X          RESTORE IX
FDFE 39          RTS

```

```

FE00 BE DFE0      ACINIZ  LDX    CPORT  POINT TO CONTROL PORT ADDRESS
FE03 86 03          LDA    #3        RESET ACIA PORT CODE
FE05 A7 84          STA    ,X        STORE IN CONTROL REGISTER
FE07 86 11          LDA    #$11     SET 8 DATA, 2 STOP AN 0 PARITY
FE09 A7 84          STA    ,X        STORE IN CONTROL REGISTER
FE0B 6D 01          TST    1,X      ANYTHING IN DATA REGISTER?
FE0D 86 FF          LDA    #$FF     TURN ON ECHO FLAG
FE0F B7 DFE2      STA    ECHO
FE12 39          RTS

```

* MONITOR KEYBOARD COMMAND JUMP TABLE

```

FE13 01      FE13  JMPTAB  EQU    *
FE13 01          FCB    1          " ^A " $F91D
FE14 F923          FDB    ALTRA
FE16 02          FCB    2          " ^B " $F90F
FE17 F915          FDB    ALTRB
FE19 03          FCB    3          " ^C " $F92B
FE1A F931          FDB    ALTRCC
FE1C 04          FCB    4          " ^D " $F901
FE1D F907          FDB    ALTRDP

```

FE1F 10	FCB	\$10	" ^P "	\$F8C9
FE20 F8CF	FDB	ALTRPC		
FE22 15	FCB	\$15	" ^U "	\$F8D7
FE23 F8DD	FDB	ALTRU		
FE25 18	FCB	\$18	" ^X "	\$F8F3
FE26 F8F9	FDB	ALTRX		
FE28 19	FCB	\$19	" ^Y "	\$F8E5
FE29 F8EB	FDB	ALTRY		

FE2B 42	FCC	'B'		
FE2C FA7B	FDB	BRKPNT	*\$FA78	
FE2E 44	FCC	'D'		
FE2F FAF4	FDB	DBOOT	*\$FAF1	
FE31 45	FCC	'E'		
FE32 F996	FDB	MEMDUMP	*\$F990	
FE34 47	FCC	'G'		
FE35 F8A5	FDB	GO	*\$F89F	
FE37 4C	FCC	'L'		
FE38 FC0C	FDB	LOAD	*\$FC09	
FE3A 4D	FCC	'M'		
FE3B F941	FDB	MEMCHG	*\$F93B	
FE3D 50	FCC	'P'		
FE3E FC67	FDB	PUNCH	*\$FC64	
FE40 51	FCC	'Q'		
FE41 F9F2	FDB	MEMTST	*\$F9EF	
FE43 52	FCC	'R'		
FE44 F8A8	FDB	REGSTR	*\$F8A2	
FE46 53	FCC	'S'		
FE47 F98A	FDB	DISSTK	*\$F984	
FE49 55	FCC	'U'		
FE4A FBB3	FDB	MINBOOT	*\$FBB0	
FE4C 58	FCC	'X'		
FE4D FAA7	FDB	XBKPNT	*\$FAA4	

FE4F TABEND EQU *

* ** 6809 VECTOR ADDRESSES **

* FOLLOWING ARE THE ADDRESSES OF THE VECTOR ROUTINES
 * FOR THE 6809 PROCESSOR. DURING INITIALIZATION THEY
 * ARE RELOCATED TO RAM FROM \$DFC0 TO \$DFCF. THEY ARE
 * RELOCATED TO RAM SO THAT THE USER MAY REVECTOR TO
 * HIS OWN ROUTINES IF HE SO DESIRES.

FE4F FAB3	RAMVEC	FDB	SWIE	USER-V
FE51 F8A7		FDB	RTI	SWI3-V
FE53 F8A7		FDB	RTI	SWI2-V
FE55 F8A7		FDB	RTI	FIRQ-V
FE57 F8A7		FDB	RTI	IRQ-V
FE59 FAB3		FDB	SWIE	SWI-V
FE5B FFFF		FDB	\$\$\$\$	SVC-VO
FE5D FFFF		FDB	\$\$\$\$	SVC-VL

* PRINTABLE MESSAGE STRINGS

```

FE5F 00 00 00 0D MSG1 FCB $0,$0,$0,$D,$A,$0,$0,$0 * 0, CR/LF, 0
FE63 0A 00 00 00
FE67 53 2D 42 55 FCC 'S-BUG 1.8 - '
FE6B 47 20 31 2E
FE6F 38 20 2D 20
FE73 04 FCB 4
FE74 4B 0D 0A 00 MSG2 FCB 'K,$D,$A,$0,$0,$0,4 K, * CR/LF + 3 NULS
FE78 00 00 04
FE7B 3E MSG3 FCC '>'
FE7C 04 FCB 4
FE7D 57 48 41 54 MSG4 FCC 'WHAT?'
FE81 3F
FE82 04 FCB 4
FE83 20 2D 20 MSG5 FCC ' - '
FE86 04 FCB 4
FE87 2C 20 50 41 MSG6 FCC ', PASS '
FE8B 53 53 20
FE8E 04 FCB 4
FE8F 2C 20 42 49 MSG7 FCC ', BITS IN ERROR: '
FE93 54 53 20 49
FE97 4E 20 45 52
FE9B 52 4F 52 3A
FE9F 20
FEA0 04 FCB 4
FEA1 20 3D 3E 20 MSG8 FCC ' => '
FEA5 04 FCB 4
FEA6 37 36 35 34 MSG9 FCC '76543210'
FEAA 33 32 31 30
FEAE 20 20 53 50 MSG10 FCC ' SP='
FEB2 3D
FEB3 04 FCB 4
FEB4 20 20 50 43 MSG11 FCC ' PC='
FEB8 3D
FEB9 04 FCB 4
FEBA 20 20 55 53 MSG12 FCC ' US='
FEBE 3D
FEBF 04 FCB 4
FEC0 20 20 49 59 MSG13 FCC ' IY='
FEC4 3D
FEC5 04 FCB 4
FEC6 20 20 49 58 MSG14 FCC ' IX='
FECA 3D
FECB 04 FCB 4
FECC 20 20 44 50 MSG15 FCC ' DP='
FED0 3D
FED1 04 FCB 4
FED2 20 20 41 3D MSG16 FCC ' A='
FED6 04 FCB 4
FED7 20 20 42 3D MSG17 FCC ' B='
FEDB 04 FCB 4
FEDC 20 20 43 43 MSG18 FCC ' CC: '
FEE0 3A 20

```

```

FEE2 04          FCB      4
FEE3 45 46 48 49 MSG19   FCC      'EFHINZVC'
FEE7 4E 5A 56 43
FEEB 53 31      MSG20   FCC      'S1'
FEED 04          FCB      4

```

* MESSAGE EXPANSION AREA

```

EEEE FF FF FF FF          FCB      $FF,$FF,$FF,$FF,$FF,$FF,$FF,$FF
FEF2 FF FF FF FF
FEF6 FF FF FF FF          FCB      $FF,$FF,$FF,$FF,$FF,$FF,$FF
FEFA FF FF FF

```

* POWER UP/ RESET/ NMI ENTRY POINT

```

FF00          ORG      $FF00

```

```

FF00 8E      FFF0      START   LDX      #IC11      POINT TO DAT RAM IC11
FF03 86      0F          LDA      #$F        GET COMPLIMENT OF ZERO

```

* INITIALIZE DAT RAM --- LOADS \$F-\$0 IN LOCATIONS \$0-\$F
* OF DAT RAM, THUS STORING COMPLEMENT OF MSB OF ADDRESS
* IN THE DAT RAM. THE COMPLEMENT IS REQUIRED BECAUSE THE
* OUTPUT OF IC11, A 74S189, IS THE INVERSE OF THE DATA
* STORED IN IT.

```

FF05 A7      80          DATLP   STA      ,X+      STORE & POINT TO NEXT RAM LOCATION
FF07 4A          DECA          GET COMP. VALUE FOR NEXT LOCATION
FF08 26      FB          BNE      DATLP     ALL 16 LOCATIONS INITIALIZED ?

```

* NOTE: IX NOW CONTAINS \$0000, DAT RAM IS NO LONGER
* ADDRESSED, AND LOGICAL ADDRESSES NOW EQUAL
* PHYSICAL ADDRESSES.

```

FF0A 86      F0          LDA      #$F0
FF0C A7      84          STA      ,X        STORE $F0 AT $FFFF
FF0E 8E      D0A0       LDX      #$D0A0    ASSUME RAM TO BE AT $D000-$DFFF
FF11 108E 55AA       LDY      #TSTPAT   LOAD TEST DATA PATTERN INTO "Y"
FF15 EE      84          TSTRAM  LDU      ,X        SAVE DATA FROM TEST LOCATION
FF17 10AF 84          STY      ,X        STORE TEST PATTERN AT $D0A0
FF1A 10AC 84          CMPY     ,X        IS THERE RAM AT THIS LOCATION ?
FF1D 27      0B          BEQ      CNVADR    IF MATCH THERE'S RAM, SO SKIP
FF1F 30      89 F000    LEAX    -$1000,X  ELSE POINT 4K LOWER
FF23 8C      F0A0       CMPX    #$F0A0    DECREMENTED PAST ZERO YET ?
FF26 26      ED          BNE      TSTRAM   IF NOT CONTINUE TESTING FOR RAM
FF28 20      D6          BRA      START    ELSE START ALL OVER AGAIN

```

* THE FOLLOWING CODE STORES THE COMPLEMENT OF
* THE MS CHARACTER OF THE FOUR CHARACTER HEX
* ADDRESS OF THE FIRST 4K BLOCK OF RAM LOCATED

* BY THE ROUTINE "TSTRAM" INTO THE DAT RAM. IT
 * IS STORED IN RAM IN THE LOCATION THAT IS
 * ADDRESSED WHEN THE PROCESSOR ADDRESS IS \$D---,
 * THUS IF THE FIRST 4K BLOCK OF RAM IS FOUND
 * WHEN TESTING LOCATION \$70A0, MEANING THERE
 * IS NO RAM PHYSICALLY ADDRESSED IN THE RANGE
 * \$8000-\$DFFF, THEN THE COMPLEMENT OF THE
 * "7" IN THE \$70A0 WILL BE STORED IN
 * THE DAT RAM. THUS WHEN THE PROCESSOR OUTPUTS
 * AN ADDRESS OF \$D---, THE DAT RAM WILL RESPOND
 * BY RECOMPLEMENTING THE "7" AND OUTPUTTING THE
 * 7 ONTO THE A12-A15 ADDRESS LINES. THUS THE
 * RAM THAT IS PHYSICALLY ADDRESSED AT \$7---
 * WILL RESPOND AND APPEAR TO THE 6809 THAT IT
 * IS AT \$D--- SINCE THAT IS THE ADDRESS THE
 * 6809 WILL BE OUTPUTTING WHEN THAT 4K BLOCK
 * OF RAM RESPONDS.

```

FF2A EF 84 CNVADR STU ,X RESTORE DATA AT TEST LOCATION
FF2C 1F 10 TFR X,D PUT ADDR. OF PRESENT 4K BLOCK IN D
FF2E 43 COMA COMPLEMENT MSB OF THAT ADDRESS
FF2F 44 LSRA PUT MS 4 BITS OF ADDRESS IN
FF30 44 LSRA LOCATION D0-D3 TO ALLOW STORING
FF31 44 LSRA IT IN THE DYNAMIC ADDRESS
FF32 44 LSRA TRANSLATION RAM.
FF33 B7 FFFD STA $FFFD STORE XLATION FACTOR IN DAT "D"

FF36 10CE DFC0 LDS #STACK INITIALIZE STACK POINTER
    
```

* THE FOLLOWING CHECKS TO FIND THE REAL PHYSICAL ADDRESSES
 * OF ALL 4K BLKS OF RAM IN THE SYSTEM. WHEN EACH 4K BLK
 * OF RAM IS LOCATED, THE COMPLEMENT OF IT'S REAL ADDRESS
 * IS THEN STORED IN A "LOGICAL" TO "REAL" ADDRESS XLATION
 * TABLE THAT IS BUILT FROM \$DFD0 TO \$DFDF. FOR EXAMPLE IF
 * THE SYSTEM HAS RAM THAT IS PHYSICALLY LOCATED (WIRED TO
 * RESPOND) AT THE HEX LOCATIONS \$0--- THRU \$F---....

```

* 0 1 2 3 4 5 6 7 8 9 A B C D E F
* 4K 4K 4K 4K 4K 4K 4K 4K -- 4K 4K 4K 4K -- -- --
    
```

* ...FOR A TOTAL OF 48K OF RAM, THEN THE TRANSLATION TABLE
 * CREATED FROM \$DFD0 TO \$DFDF WILL CONSIST OF THE FOLLOWING....

```

* 0 1 2 3 4 5 6 7 8 9 A B C D E F
* 0F 0E 0D 0C 0B 0A 09 08 06 05 00 00 04 03 F1 F0
    
```

* HERE WE SEE THE LOGICAL ADDRESSES OF MEMORY FROM \$0000-\$7FFF
 * HAVE NOT BEEN SELECTED FOR RELOCATION SO THAT THEIR PHYSICAL
 * ADDRESS WILL = THEIR LOGICAL ADDRESS; HOWEVER, THE 4K BLOCK
 * PHYSICALLY AT \$9000 WILL HAVE ITS ADDRESS TRANSLATED SO THAT
 * IT WILL LOGICALLY RESPOND AT \$8000. LIKewise \$A,\$B, AND \$C000

* WILL BE TRANSLATED TO RESPOND TO \$9000,\$C000, AND \$D000
 * RESPECTIVELY. THE USER SYSTEM WILL LOGICALLY APPEAR TO HAVE
 * MEMORY ADDRESSED AS FOLLOWS....

* 0 1 2 3 4 5 6 7 8 9 A B C D E F
 * 4K 4K 4K 4K 4K 4K 4K 4K 4K 4K -- -- 4K 4K -- --

```

FF3A 108E DFD0          LDY    #LRARAM   POINT TO LOGICAL/REAL ADDR. TABLE
FF3E A7 2D             STA    13,Y      STORE $D--- XLATION FACTOR AT $DFDD
FF40 6F 2E             CLR    14,Y      CLEAR $DFDE
FF42 86 F0             LDA    #$F0      DESTINED FOR IC8 AN MEM EXPANSION ?
FF44 A7 2F             STA    15,Y      STORE AT $DFDF
FF46 86 0C             LDA    #$0C      PRESET NUMBER OF BYTES TO CLEAR
FF48 6F A6             CLRLRT CLR    A,Y   CLEAR $DFDC THRU $DFD0
FF4A 4A                DECA                SUB. 1 FROM BYTES LEFT TO CLEAR
FF4B 2A FB             BPL    CLRLRT     CONTINUE IF NOT DONE CLEARING
FF4D 30 89 F000        FNDRAM LEAX   -$1000,X  POINT TO NEXT LOWER 4K OF RAM
FF51 8C F0A0           CMPX   #$F0A0    TEST FOR DECREMENT PAST ZERO
FF54 27 22             BEQ    FINTAB    SKIP IF FINISHED
FF56 EE 84             LDU    ,X        SAVE DATA AT CURRENT TEST LOCATION
FF58 108E 55AA         LDY    #TSTPAT   LOAD TEST DATA PATTERN INTO Y REG.
FF5C 10AF 84           STY    ,X        STORE TEST PATT. INTO RAM TEST LOC.
FF5F 10AC 84           CMPY   ,X        VERIFY RAM AT TEST LOCATION
FF62 26 E9             BNE    FNDRAM    IF NO RAM GO LOOK 4K LOWER
FF64 EF 84             STU    ,X        ELSE RESTORE DATA TO TEST LOCATION
FF66 108E DFD0         LDY    #LRARAM   POINT TO LOGICAL/REAL ADDR. TABLE
FF6A 1F 10             TFR    X,D      PUT ADDR. OF PRESENT 4K BLOCK IN D
FF6C 44                LSRA                PUT MS 4 BITS OF ADDR. IN LOC. D0-D3
FF6D 44                LSRA                TO ALLOW STORING IT IN THE DAT RAM.
FF6E 44                LSRA
FF6F 44                LSRA
FF70 1F 89             TFR    A,B      SAVE OFFSET INTO LRARAM TABLE
FF72 88 0F             EORA   #$0F     INVERT MSB OF ADDR. OF CURRENT 4K BLK
FF74 A7 A5             STA    B,Y      SAVE TRANSLATION FACTOR IN LRARAM TABLE
FF76 20 D5             BRA    FNDRAM    GO TRANSLATE ADDR. OF NEXT 4K BLK
FF78 86 F1             FINTAB LDA    #$F1  DESTINED FOR IC8 AND MEM EXPANSION ?
FF7A 108E DFD0         LDY    #LRARAM   POINT TO LRARAM TABLE
FF7E A7 2E             STA    14,Y     STORE $F1 AT $DFCE
    
```

* THE FOLLOWING CHECKS TO SEE IF THERE IS A 4K BLK OF
 * RAM LOCATED AT \$C000-\$CFFF. IF NONE THERE IT LOCATES
 * THE NEXT LOWER 4K BLK AN XLATES ITS ADDR SO IT
 * LOGICALLY RESPONDS TO THE ADDRESS \$C---.

```

FF80 86 0C             LDA    #$0C      PRESET NUMBER HEX "C"
FF82 E6 A6             FINDC  LDB    A,Y   GET ENTRY FROM LRARAM TABLE
FF84 26 05             BNE    FOUNDC    BRANCH IF RAM THIS PHYSICAL ADDR.
FF86 4A                DECA                ELSE POINT 4K LOWER
FF87 2A F9             BPL    FINDC     GO TRY AGAIN
FF89 20 14             BRA    XFERTF
FF8B 6F A6             FOUNDC CLR    A,Y   CLR XLATION FACTOR OF 4K BLOCK FOUND
FF8D E7 2C             STB    $C,Y     GIVE IT XLATION FACTOR MOVING IT TO $C---
    
```

* THE FOLLOWING CODE ADJUSTS THE TRANSLATION
 * FACTORS SUCH THAT ALL REMAINING RAM WILL
 * RESPOND TO A CONTIGUOUS BLOCK OF LOGICAL
 * ADDRESSES FROM \$0000 AND UP....

FF8F	4F			CLRA		START AT ZERO
FF90	1F	21		TFR	Y,X	START POINTER "X" START OF "LRARAM"
TABLE.						
FF92	E6	A6	COMPRS	LDB	A,Y	GET ENTRY FROM "LRARAM" TABLE
FF94	27	04		BEQ	PNTNXT	IF IT'S ZERO SKIP
FF96	6F	A6		CLR	A,Y	ELSE ERASE FROM TABLE
FF98	E7	80		STB	,X+	AND ENTER ABOVE LAST ENTRY- BUMP
FF9A	4C		PNTNXT	INCA		GET OFFSET TO NEXT ENTRY
FF9B	81	0C		CMPA	#\$0C	LAST ENTRY YET ?
FF9D	2D	F3		BLT	COMPRS	

* THE FOLLOWING CODE TRANSFER THE TRANSLATION
 * FACTORS FROM THE LRARAM TABLE TO IC11 ON
 * THE MP-09 CPU CARD.

FF9F	8E	FFF0	XFERTF	LDX	#IC11	POINT TO DAT RAM IC11
FFA2	C6	10		LDB	#\$10	GET NO. OF BYTES TO MOVE
FFA4	A6	A0	FETCH	LDA	,Y+	GET BYTE AND POINT TO NEXT
FFA6	A7	80		STA	,X+	POKE XLATION FACTOR IN IC11
FFA8	5A			DECB		SUB 1 FROM BYTES TO MOVE
FFA9	26	F9		BNE	FETCH	CONTINUE UNTIL 16 MOVED
FFAB	53			COMB		SET "B" NON-ZERO
FFAC	F7	DFE2		STB	ECHO	TURN ON ECHO FLAG
FFAF	16	F862		LBRA	MONITOR	INITIALIZATION IS COMPLETE

FFB2	6E	9F DFC0	V1	JMP	[STACK]
FFB6	6E	9F DFC4	V2	JMP	[SWI2]
FFBA	6E	9F DFC6	V3	JMP	[FIRQ]
FFBE	6E	9F DFC8	V4	JMP	[IRQ]
FFC2	6E	9F DFCA	V5	JMP	[SWI]

* SWI3 ENTRY POINT

FFC6	1F	43	SWI3E	TFR	S,U	
FFC8	AE	4A		LDX	10,U	*\$FFC8
FFCA	E6	80		LDB	,X+	
FFCC	AF	4A		STX	10,U	
FFCE	4F			CLRA		
FFCF	58			ASLB		
FFD0	49			ROLA		
FFD1	BE	DFCC		LDX	SVCVO	
FFD4	8C	FFFF		CMPX	#\$FFFF	
FFD7	27	0F		BEQ	SWI3Z	
FFD9	30	8B		LEAX	D,X	
FFDB	BC	DFCE		CMPX	SVCVL	
FFDE	22	08		BHI	SWI3Z	
FFE0	34	10		PSHS	X	
FFE2	EC	C4		LDD	,U	

FFE4	AE	44		LDX	4,U
FFE6	6E	F1		JMP	[,S++]
FFE8	37	1F	SWI3Z	PULU	A,B,X,CC,DP
FFEA	EE	42		LDU	2,U
FFEC	6E	9F	DFC2	JMP	[SWI3]

* 6809 VECTORS

FFF0	FFB2	FDB	V1	USER-V
FFF2	FFC6	FDB	SWI3E	SWI3-V
FFF4	FFB6	FDB	V2	SWI2-V
FFF6	FFBA	FDB	V3	FIRQ-V
FFF8	FFBE	FDB	V4	IRQ-V
FFFA	FFC2	FDB	V5	SWI-V
FFFC	FFB2	FDB	V1	NMI-V
FFFE	FF00	FDB	START	RESTART-V
		END		

SYMBOL TABLE :

AAAREG	F015	ACIAS	E004	ACINIZ	FE00	ADDREG	F000	ADJSK6	FA78
AJDUMP	F9A2	ALTAD	F930	ALTBD	F922	ALTCCD	F940	ALTRDP	F914
ALTPCD	F8DC	ALTRA	F923	ALTRB	F915	ALTRCC	F931	ALTRDP	F907
ALTRPC	F8CF	ALTRU	F8DD	ALTRX	F8F9	ALTRY	F8EB	ALTUD	F8EA
ALTXD	F906	ALTYD	F8F8	BACK	F986	BBBREG	F016	BIASCI	FD97
BPADJ	FAF1	BPERR	FA9F	BPTBL	DFE3	BPTST	FAE1	BRKPNT	FA7B
BYTE	FD40	CCCREG	F040	CCREG	F010	CHANGE	F974	CHRTN	F973
CLRLRT	FF48	CLRSTK	F82F	CNTREG	F002	CNVADR	FF2A	COMPRS	FF92
COMREG	F020	CPORT	DFE0	Comreg	E018	DATLP	FF05	DBOOT	FAF4
DBOOT0	FB12	DBOOT1	FB58	DBOOT2	FB5B	DBOOT3	FB6A	DBOOT4	FB74
DELAY	FC06	DISKWT	FB1F	DISSTK	F98A	DLY	FBA9	DRVREG	F024
Datreg	E01B	Drvreg	E014	ECHO	DFE2	ECHON	FDC4	EDPASC	F9DE
EDPRTN	F9A1	EDUMP	F9BD	ELOOP	F9CC	EXITBP	FA9E	FETCH	FFA4
FETSTA	FDF3	FFSTBL	FAD8	FINDC	FF82	FINTAB	FF78	FIRQ	DFC6
FLEX	0005	FNDBP	FAE7	FNDRAM	FF4D	FNDREL	F84E	FORWRD	F982
FOUNDC	FF8B	GETSTA	FDD4	GO	F8A5	GUDPAS	FA5E	IC11	FFF0
IN1ADR	FD2F	IN2ADR	FD24	INCH	FDCF	INCHE	FDC9	INCHEK	FDDF
INHEX	FD53	INHEXA	FD60	INHEXL	FD6B	IRQ	DFC8	JMPCMD	F8A1
JMPTAB	FE13	LOAD	FC0C	LOAD1	FC14	LOAD10	FC3E	LOAD16	FC54
LOAD2	FC17	LOAD21	FC5F	LODERR	FC53	LOOP	FBBE	LOOP1	FBCF
LOOP2	FBE9	LOOP3	FBF2	LOOP4	FBFE	LOOP5	FC08	LOOPA	F81D
LRA	FB81	LRARAM	DFD0	MDUMP1	F99B	MEMC2	F948	MEMCHG	F941
MEMDUM	F996	MEMSET	FA04	MEMTST	F9F2	MINBOO	FBB3	MONITO	F814
MSG1	FE5F	MSG10	FEAE	MSG11	FEB4	MSG12	FEBA	MSG13	FEC0
MSG14	FEC6	MSG15	FECC	MSG16	FED2	MSG17	FED7	MSG18	FEDC
MSG19	FEE3	MSG2	FE74	MSG20	FEEB	MSG3	FE7B	MSG4	FE7D
MSG5	FE83	MSG6	FE87	MSG7	FE8F	MSG8	FEA1	MSG9	FEA6
NEXTCM	F861	NOTHEX	FD76	NXTCH0	F88B	NXTCHR	F88E	NXTLIN	F9B1
OUT1S	FDEC	OUT2H	FD81	OUT2S	FDEA	OUT4H	FD79	OUTBA	FD9B
OUTC	FD95	OUTCH	FDEE	OUTH1	FD81	OUTH2	FD89	PCRLF	FDB1
PDATA	FDBD	PERIOD	F9E8	PNTNXT	FF9A	PRASC	F9EA	PRINT	FDBB
PRIREG	F014	PRTA	FD03	PRTB	FD0D	PRTBA	FDA3	PRTCC	FD17
PRTCMD	F87F	PRTDP	FCD8	PRTIX	FCE3	PRTIY	FCEE	PRTPC	FCF9
PRTSP	FCC2	PRTUS	FCCD	PSTRNG	FDAD	PUNCH	FC67	PUNCH2	FC7D
PUNCH3	FC89	PUNCH4	FC8B	PUNCHL	FCA3	PUNEXT	FCBA	RAMVEC	FE4F
REGPR	FAC1	REGSTR	F8A8	RELPA	F855	RPLSWI	FAC7	RTI	F8A7
SECREG	F022	SKPDMP	F9BA	STACK	DFC0	START	FF00	SUB1	FBAD
SVCVL	DFCE	SVCVO	DFCC	SWI	DFCA	SWI2	DFC4	SWI3	DFC2
SWI3E	FFC6	SWI3Z	FFE8	SWIE	FAB3	Secreg	E01A	TABEND	FE4F
TEST1	FA16	TSTPAT	55AA	TSTRAM	FF15	V1	FFB2	V2	FFB6
V3	FFBA	V4	FFBE	V5	FFC2	XASCII	FD8D	XBKPNT	FAA7
XBPLP	FAAD	XFERTF	FF9F						