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KIM-1

APPLICATION PROGRAMS (CT1)

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COMPUMART, INC.
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OPERATING INSTRUCTIONS FOR

LOADING FROM CASSETTE INTO KIM-1 MEMORY

1. Set Location $F1 = ØØ
2. Set Locations $17F9 = Block I.D. (HEX). See Colum 1 of Table A.
   $17FA = $ØØ
   $17FB = $1C
3. Address Mode, set address to $1873
4. To save time, position Cassette Tape just in front of desired block. This in NOT a REQUIREMENT!
5. Depress GO-Display will blank!
6. Start Tape
7. Successful load will cause disply of ØØØØ XX (XX = Don't Care)
8. Parity fail will cause display of FFFF XX. Rewind tape, Check Volume setting on Cassette Recorder; Too Low or Too High will cause Load Failure. Also Dirty Head!! Also Magnetized Head!
9. If, after a reasonable time, the display still remains blank, KIM was not able to recognize the I.D. of the Block (s) Just Load. Recover as in 8.
10. If, still unable to read, it is suggested you record a test program or two on a blank tape using you KIM and Recorder. If This can be read O.K. then we must suspect the original tape. Contact us! If your KIM cannot read a tape it wrote, also contact us - write or phone!

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TABLE A

CT1 APPLICATION TAPE

Block I.D.	Program Name	Remark
01	Pulse Generator	Uses Timer interrupt
02	KIM Adder	
03	Clock	Uses Timer interrupt
04	Drill	Uses TTY
05	Display Scroll	Uses Timer interrupt

Note: Programs using the timer interrupt need the connection pin A-15 (on the application connector) to pin E-4 (on the expansion connector) to be installed. This connects PB7 of the 6530-03 to IRQ.

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PULSE GENERATOR

Version:	7/28/76
Locations loaded:	$044 - $07F
Additional location used	$043
Starting location:	$044

On starting,this program will output a train of pulses to PA0 (Application connector pin 14). The timer is used to generate interrupts at fixed time intervals and for each interrupt a pulse is output.

The time interval between pulses is controlled by the constant in location $066. This constant is the number of micro seconds (in hex) between pulses. The minimum value possible is $2A (42 microseconds). The current value set in the program is $2B (43 micro seconds).

The pulse can be changed from negative to positive by changing the contents of location $05B from one to zero.

A square wave of minimun half period 42 microseconds can be produced (instead of pulses) by entering NOP's ($EA) in location $07A, $07B and $07C.

```
*-
>0.
.MAL.
0001                ; PROGRAM: PULSE GENERATOR  (USING TIMER INTERRUPT)
0002                ;
0003                ; MINIMUM PULSE SPACING:- 42US (ACCURACY +/-1US)
0004                ; PULSE POLARITY:- NEGATIVE (POSITIVE BY CHANGING
0005                ; ($5B) FROM $01 TO $00)
0006                ; PULSE OUTPUT CHANGED TO SQUARE WAVE OF 42US HALF
0007                ; PERIOD (MIN) BY ENTERING NOP ($EA)
0008                ; AT $7A,$7B,$7C
0009                ;
0010                ; PULSE SPACING IN US; ENTER AS HEX AT 066: MIN
0011                ; VALUE 42US: MAX VALUE 256 US
0012                ;
0013                ; RESET (TO ENSURE ALL PORTS SET TO INPUT)
0014                ;
0015                ; $43 RESERVED FOR PROGRAM
0016                 =$44
0017               START
0018 0044 78        SEI 1 TO I. DISABLE IRQ
0019 0045 D8        CLD 0 TO D. SET BINARY
0020 0046 A977      LDA #$77 SET IRQ VECTOR
0021 0048 8DFE17    STA $17FE
0022 004B A900      LDA #0
0023 004D 8DFF17    STA $17FF
0024 0050 A900      LDA #0 SET NMI VECTOR
0025 0052 8DFA17    STA $17FA
0026 0055 A91C      LDA #$1C
0027 0057 8DFB17    STA $17FB
0028 005A A901      LDA #1 SET PAD-0 TO 1
0029 005C 8D0017    STA $1700
0030 005F A901      LDA #1 PADD-0 TO OUTPUT
0031 0061 8D0117    STA $1701
0032 0064 38        SEC 1 TO C. SET CARRY
0033 0065 A92E      LDA #$2E TIME INTERVAL ( > $2A)
0034 0067 E924      SBC #$24
0035 0069 8543      STA $43
0036 006B A543      LDA $43 SET TIMER
0037 006D 8D0C17    STA $170C
0038 0070 A2FF      LDX #$FF SET S TO $FF
0039 0072 9A        TXS
0040 0073 58        CLI 0 TO I
0041 0074 4C7400    JMP * WAIT
0042               ;
0043               ; IRQ
0044               ;
0045 0077 EE0017    INC $1700 TOGGLE PAD-0
0046 007A EE0017    INC $1700 TOGGLE PAD-0
0047 007D 4C6B00    JMP $6B (SET TIMER)
0048               $
```

```
.MAO.
:
:0C004473D3A9773DFE17A9003DFF17C6AE
:10005DA9003DFA17A91C3DFE17A9013D0017A90702
:1C006001BD011733A92BE9243543A5403D0C17053F
:10007DA2FF9A534C7400EE0017EE0017406B000694
:0000042004
.
```

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KIM ADDER

Version:	7/6/76
Locations loaded:	$200 - $27F
Additional locations used:	$002 - $005
Starting location:	$200

This uses KIM as a simple six digit adding machine suitable for checkbook balancing. Three words of memory ($2 - $4) are used to store a six digit total. On starting, the display and the total are cleared to zero. Decimal digits entered on the KIM keyboard are shifted into the display. The letter keys A - D act as function keys: -

A - Add display to total. Display total

B - Subtract display from total. Display total

C - Clear display to zero

D - Clear display and total to zero

Location $5 is used as a flag to control whether the display is to be cleared before shifting a digit into it.

```
>O.
.MALSO.
0001                    ; K I N  A D D E R
0002                    ; 7/6/76
0003                    ;
0004                    ; STARTING ADDRESS $200
0005                    ; HEX KEY INPUT:
0006                    ; 0 - 9  :SHIFT INTO DISPLAY
0007                    ; A :ADD DISPLAY TO TOTAL
0008                    ; B :SUBTRACT DISPLAY FROM TOTAL
0009                    ; C :CLEAR DISPLAY
0010                    ; D :CLEAR DISPLAY & TOTAL
0011                    ;
0012                    ; K I N  M O N I T O R  L I N K S
0013                    ;
0014                    INIT1 =$1E3C
0015                    SCANDS =$1F1F
0016                    GETKEY =$1F6A
0017                    ;
0018                    ; V A R I A B L E S
0019                    INH =$F9
0020                    KEY =5
0021                    TOT =2
0022                    ;
0023                    ; P R O G R A M
0024                    ;
0025                     =$200
0026 0200 A900      CLT LDA #0 CLEAR TOTAL
0027 0202 8502       STA TOT
0028 0204 8503       STA TOT+1
0029 0206 8504       STA TOT+2
0030                    ;
0031 0208 A900      CLK LDA #0 CLEAR KEY
0032 020A 8505       STA KEY
0033                    ;
0034 020C A900      CLD LDA #0 CLEAR DISPLAY
0035 020E 85F9       STA INH
0036 0210 85FA       STA INH+1
0037 0212 85FB       STA INH+2
0038                    ;
0039 0214 A505      SHD LDA KEY SHIFT KEY INTO DISPLAY
0040 0216 2A         ROL A
0041 0217 2A         ROL A
0042 0218 2A         ROL A
0043 0219 2A         ROL A
0044 021A A004       LDY #4
0045 021C 2A        SHD2 ROL A
0046 021D 26F9       ROL INH
0047 021F 26FA       ROL INH+1
0048 0221 26FB       ROL INH+2
0049 0223 88         DEY
0050 0224 D0F6       BNE SHD2
0051                    ;
```

```
0052 0226 D8       CKB CLD CLEAR KEYBOARD
0053 0227 20C01E   CKB2 JSR INIT1
0054               ;
0055 022A 201F1F   IKB JSR SCAN0S INPUT FROM KEYBOARD
0056 022D D0F3      BNE CKB2
0057 022F 201F1F   IKB2 JSR SCAN0S
0058 0232 F0FB      BEQ IKB2
0059 0234 201F1F    JSR SCAN0S
0060 0237 F0F6      BEQ IKB2
0061 0239 206A1F    JSR GETKEY
0062 023C C900      CMP #$0
0063 023E F008      BEQ CLK IF 00 CLEAR DISPLAY
0064 0240 C90D      CMP #$D
0065 0242 F0B0      BEQ CLT IF 0D CLEAR TOTAL
0066 0244 A605      LDX KEY
0067 0246 8505      STA KEY
0068 0248 C90A      CMP #0A
0069 024A 300F      BMI DGT IF DECIMAL DIGIT
0070 024C F8        SED
0071 024D A200      LDX #0
0072 024F A000      LDY #0
0073 0251 C90A      CMP #0A
0074 0253 F00D      BEQ ADD IF 0A ADD
0075 0255 C90B      CMP #0B
0076 0257 F013      BEQ SUB IF 0B SUB
0077 0259 D0D3      BNE CKB
0078               ;
0079 025B 8A       DGT TXA
0080 025C C90A      CMP #0A
0081 025E 10AC      BPL CLD IF NOT  DECIMAL DIGIT LAST TIME
0082 0260 30B2      BMI SHD
0083               ;
0084 0262 18       ADD CLC
0085 0263 B502     ADD2 LDA TOT,X
0086 0265 75F9      ADC INH,X
0087 0267 9502      STA TOT,X
0088 0269 95F9      STA INH,X
0089 026B E8        INX
0090 026C 38        DEY
0091 026D D0F4      BNE ADD2
0092 026F F0B5      BEQ CKB
0093               ;
0094 0271 38       SUB SEC
0095 0272 B502     SUB2 LDA TOT,X
0096 0274 F5F9      SBC INH,X
0097 0276 9502      STA TOT,X
0098 0278 95F9      STA INH,X
0099 027A E8        INX
0100 027B 38        DEY
0101 027C D0F4      BNE SUB2
0102 027E F0A6      BEQ CKB
0103               ;
0104               .
```

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```
ADD  Ø262     ADD2 Ø263     CKB  Ø226     CKB2 Ø227
CLD  Ø2ØC     CLK  Ø2Ø8     CLT  Ø2ØØ     DGT  Ø25B
GETK 1F6A     IKB  Ø22A     IKB2 Ø22F     INH  ØØF9
INIT 1E3C     KEY  ØØØ5     SCAN 1F1F     SHD  Ø214
SHD2 Ø21C     SUB  Ø271     SUB2 Ø272     TOT  ØØØ2

P
;10Ø2ØØA9ØØ85Ø285Ø385Ø4A9ØØ85Ø5A9ØØ85F9Ø5AD
;10Ø21Ø85FA85FBA5Ø52A2A2A2AAØØ42A26F926Ø686
;10Ø22ØFA26FB88DØF6D8203C1E2Ø1F1FDØF82ØØ833
;10Ø23Ø1F1FFØFB2Ø1F1FFØF62Ø6A1FC9ØCFØC8Ø7E5
;10Ø24ØC9ØDFØBCA6Ø585Ø5C9ØA3ØØFF8A2ØØAØØ755
;10Ø25ØØ3C9ØAFØØDC9ØBFØ18DØCB3AC9ØA1ØAØØ7C5
;10Ø26Ø3ØB218B5Ø275F995Ø295F9E888DØF4FØØ9DA
;10Ø27ØB538B5Ø2F5F995Ø295F9E888DØF4FØA6ØBØ3
;ØØØØØ8ØØØ8
.
```

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CLOCK

Version:	7/14/76
Locations loaded:	$004 - $070
Additional locations used:	$000 - $003
Starting location:	$007

This will display the time of day (HR, MIN, SEC) on the KIM display. Before starting, the initial time must be set in locations $001 (HR), $002 (MIN) and $003 (SEC). The KIM monitor should be used to set up these three locations and the time should be expressed in the 12 hour system. Upon starting at location $007, the initial time will be displayed and then updated each second.

The program uses the timer to generate an interrupt at 1/4 second intervals. Location $00 is used to count four of these interrupts after which the time is updated by one second.

The speed of the clock is controlled by the constant in location $016. By reducing the current value ($F4) of this constant (to, say,$10) the clock can be made to run very fast for checking purposes.

```
*ALSO.
0001                    ; C L O C K
0002                    ; 7/14/76
0003                    ;
0004                    ; STARTING ADDRESS:- 307
0005                    ; SET TIME (HOUR,MIN,SEC) INTO LOCATIONS 1,2&3
0006                    ; THEN START. KIM WILL DISPLAY THE TIME
0007                    ;
0008                    ; K I M  M O N I T O R  L I N K S
0009                    ;
0010                    CONVD =$1F43
0011                    ;
0012                    ; V A R I A B L E S
0013                    ;
0014                    IRQ =$17FE
0015                    PADD =$1741
0016                    INH =$F9
0017                    CNT =0
0018                    HR =1
0019                    MN =2
0020                    SC =3
0021                    ;
0022                    ; P R O G R A M
0023                    ;
0024                     =$04
0025                    HRMX
0026 0004 17             .$17 HOUR LIMIT
0027 0005 40             .$40 MINUTE LIMIT
0028 0006 40             .$40 SECOND LIMIT
0029                    ;
0030                    ; START. SET UP IRQ & 1/4 SEC COUNTER
0031                    ;
0032 0007 A915          STRT LDA #INT
0033 0009 8DFE17         STA IRQ
0034 000C A900           LDA #0
0035 000E 8DFF17         STA IRQ+1
0036 0011 A903           LDA #$03
0037 0013 8500           STA CNT
0038                    ;
0039                    ; INTERRUPT TO HERE EVERY 1/4 SECOND
0040                    ;
0041 0015 A9F4          INT LDA #244
0042 0017 8D0F17         STA $170F
0043 001A 0600           ASL CNT
0044 001C 9013           BCC INT6
0045                    ;
0046                    ; INCREMENT TIME BY 1 SECOND
0047                    ;
0048 001E A200           LDX #0
0049 0020 A900           LDA #0
0050 0022 F8             SED
0051 0023 7500          INT2 ADC HR-1,X
0052 0025 9500           STA HR-1,X
0053 0027 7500           ADC HRMX-1,X
0054 0029 9007           BCC INT4
```

```
0055 002B 9500      STA HR-1,X
0056 002D CA        DEX
0057 002E D0F3      BNE INT2
0058 0030 E601      INC HR
0059                ;
0060 0032 A910    INT4 LDA #$10
0061 0034 8500      STA CNT
0062 0036 A2FF    INT6 LDX #$FF
0063 0038 9A        TXS
0064 0039 D8        CLD
0065 003A 58        CLI
0066                ;
0067                ; DISPLAY TIME
0068                ;
0069 003B A501    DPLY LDA HR
0070 003D 85FB      STA INH+2
0071 003F A502      LDA MI
0072 0041 85FA      STA INH+1
0073 0043 A500      LDA SC
0074 0045 85F9      STA INH
0075 0047 A97F      LDA #$7F
0076 0049 8D4117    STA PADD
0077 004C A209      LDX #9
0078 004E A003      LDY #3
0079 0050 B9F900  DPL2 LDA INH-1,Y
0080 0053 4A        LSR A
0081 0054 4A        LSR A
0082 0055 4A        LSR A
0083 0056 4A        LSR A
0084 0057 D003      BNE DPL4
0085 0059 C003      CPY #3
0086 005B D004      BNE DPL4
0087 005D E8        INX
0088 005E E8        INX
0089 005F D003      BNE DPL5
0090 0061 204A1F  DPL4 JSR CONVD
0091 0064 B9F900  DPL5 LDA INH-1,Y
0092 0067 290F      AND #$F
0093 0069 204A1F    JSR CONVD
0094 006C 88        DEY
0095 006D D0E1      BNE DPL2
0096 006F F0CA      BEQ DPLY
0097                $
```

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CNT	ØØØØ	CONV	1F43	DPL2	ØØ5E	DPL4	ØØ61
DPL5	ØØ64	DPLY	ØØ3B	HR	ØØØ1	HRMK	ØØØ4
INH	ØØF9	INT	ØØ15	INT2	ØØ23	INT4	ØØ32
INT6	ØØ36	IRQ	17FE	MN	ØØØ2	PADD	1741
SC	ØØØ3	STRT	ØØØ7				

```
P
;ØCØØØ4874Ø4ØA9158DFE17A9ØØ8DFFØ5AC
;1ØØØ1Ø17A9Ø385ØCA9F48DØF17Ø6ØØ9Ø18A2Ø3Ø51Ø
;1ØØØ2ØA9ØØF875ØØ95ØØ75Ø39ØØ795ØØCADØF3Ø7EC
;1ØØØ3ØE6Ø1A91Ø85ØØA2FF9AD858A5Ø1557EA5Ø39B
;1ØØØ4ØØ285FAA5Ø385F9A97F8D4117A2Ø9AØØ3Ø752
;1ØØØ5ØB9F8ØØ4A4A4A4ADØØ5CØØ3DØØ4E8E8DØØ848
;1ØØØ6ØØ32Ø481FB9F8ØØ29ØF2Ø481F88DØE1FØØ693
;Ø1ØØ7ØCAØ13B
;ØØØØØ8ØØØ8
```

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DRILL

Locations Loaded:	$06C - $0EE (Main program) $100 - $1B2 (Subroutines)
Additional locations used:	$001 - $00C (Variables) $200 - $3FF (Text buffer) $1780 on (Response buffer)
Starting location:	$17D To enter text of questions $18E To list text of questions $070 To run drill

This program will drill a student by typing out a series of questions on the teletype. After each question the program waits for the student to type in a response. If the response matches the correct answer, stored in the KIM memory,the next question will be typed out. Otherwise the program will type out a response and wait for the student to try again. After two incorrect tries by the student the program types out the correct answer. Two points are scored for the correct answer on the first try, and one point for the correct answer on the second try. Otherwise no points are scored.

At the end of the list of questions, control is returned to the KIM monitor which displays the contents of location 1, the students score. Hit return and the monitor will display the contents of location 2, the maximum possible score.

Before running the drill, it is necessary to enter the text of the questions and answer into the text buffer. Start at location $17D to do this. The system will type a prompt character "?" to indicate it is ready to accept a string.

A string is any sequence of characters terminated by a common or a carriage return. After each string the program will type a prompt to indicate it is ready to accept the next string. Text input is terminated by entering a string of a single character (dollar sign).

Strings should be entered in the following order.

I$ General Instruction
e.g. "Name The Capitals of the Following States"

R1$ Response to first incorrect response
e.g. "Try Again"

R2$ Response to second incorrect response
e.g. "The Correct Answer Is:"

Q$ Question
e.g. "New York"

A$ Answer
e.g. "Albany"

Repeat for all question and answer paid.

$ Terminator to end text input.

When entering any string, typing a back arrow will erase any part of the string already entered.

Start at $18E if it is desired to list all strings entered.

Start at $070 to run drill.

```
MALSO.
0001                ; D R I L L
0002                ; 7/10/76
0003                ;
0004                ; STARTING ADDRESSES:
0005                ; $17D TO ENTER DATA:- IS,R1S,R2S,(QS,AS)*,S
0006                ; $18E TO LIST DATA
0007                ; $270 TO RUN DRILL
0008                ;
0009                ; AT END OF DRILL, KIM PRINTS (LOC 1) STUDENT SCORE
0010                ; PRESS RETURN AND KIM PRINTS (LOC 2) MAXIMUM SCORE
0011                ;
0012                ; K I M  M O N I T O R  L I N K S
0013                ;
0014                START =$1C4F
0015                GETCH =$1E5A
0016                OUTSP =$1E9E
0017                OUTCH =$1EA0
0018                INCPT =$1F63
0019                ;
0020                ; V A R I A B L E S
0021                ;
0022                S =1 STUDENT SCORE
0023                U =2 MAXIMUM SCORE
0024                T =3 NUMBER OF INCORRECT TRIES AT QUESTION
0025                TEMP =4
0026                QP =5 QS POINTER (QUESTION)
0027                AP =7 AS POINTER (CORRECT ANSWER)
0028                R1P =9 R1S POINTER (RESPONSE TO 1ST ERROR)
0029                R2P =11 R2S POINTER (RESPONSE TO 2ND ERROR)
0030                P =$FA
0031                ;
0032                ; B U F F E R  P O I N T E R S
0033                ;
0034                 =$60
0035 0060 FF01     IP .$1FF. IS POINTER (GENERAL INSTRUCTION)
0036 0062 8017     BP .$178. BS POINTER (STUDENT'S ANSWER)
0037                ;
0038                ; M A I N  P R O G R A M
0039                ;
0040 0070 A900     DRILL LDA #0
0041 0072 8502      STA U
0042 0074 8501      STA S
0043 0076 A260      LDX #IP
0044 0078 205101    JSR PRNC
0045 007B 8509      STA R1P
0046 007D 860A      STX R1P+1
0047 007F A209      LDX #R1P
0048 0081 206301    JSR SKIP
0049 0084 850B      STA R2P
0050 0086 860C      STX R2P+1
0051 0088 204701    JSR CRLF
0052                ;
0053 008B A20B      LDX #R2P
0054 008D 206301   OE JSR SKIP
```

```
0055 0090 8505      STA OP
0056 0092 8606      STX OP+1
0057 0094 A001      LDY #1
0058 0096 B105      LDA (OP),Y
0059 0098 C924      CMP #$24 "$"
0060 009A F048      BEQ EXIT
0061 009C A900      LDA #0
0062 009E 8503     02 STA T
0063 00A0 A205      LDX #OP
0064 00A2 205101    JSR PRNO
0065 00A5 8507      STA AP
0066 00A7 8603      STX AP+1
0067 00A9 A26E     03 LDX #3P
0068 00AB 200001    JSR INPO
0069 00AE 203101    JSR OPAB
0070 00B1 F01B      BEQ 06
0071 00B3 A503      LDA T
0072 00B5 D009      BNE 05
0073 00B7 A209      LDX #P1P
0074 00B9 205401    JSR PRNT
0075 00BC E603      INC T
0076 00BE D0E9      BNE 03 JMP
0077                ;
0078 00C0 A20B     05 LDX #R2P
0079 00C2 205401    JSR PRNT
0080 00C5 A207      LDX #AP
0081 00C7 205401    JSR PRNT
0082 00CA A902      LDA #2
0083 00CC D0D6      BNE 02 JMP
0084                ;
0085 00CE F8       06 SED
0086 00CF 18        CLC
0087 00D0 A902      LDA #2
0088 00D2 6502      ADC U
0089 00D4 8502      STA U
0090 00D6 A902      LDA #2
0091 00D8 6501      ADC S
0092 00DA 38        SEC
0093 00DB E503      SBC T
0094 00DD 8501      STA S
0095 00DF D8        CLD
0096 00E0 A207      LDX #AP
0097 00E2 D0A9      BNE 02 JMP
0098                ;
0099 00E4 A901     EXIT LDA #S
0100 00E6 85FA      STA P
0101 00E8 A900      LDA #0
0102 00EA 85F8      STA P+1
0103 00EC 4C4F10    JMP START
0104                ;
0105                ; S U B R O U T I N E S
0106                ;
0107                 =$100
0108 0100 A93F     INPO LDA #$3F "?"
```

```
0109 0102 20A01E   JSR OUTCH
0110 0105 209E1E   JSR OUTSP
0111 0108 8604     INPT STX TEMP
0112 010A A604     INP0 LDX TEMP
0113 010C 207201   JSR STRP
0114 010F 20631F   INP2 JSR INCP
0115 0112 205A1E   INP3 JSR GETCH
0116 0115 F0FB      BEQ INP3 IF NULL
0117 0117 C90A      CMP #$0A
0118 0119 F0F7      BEQ INP3 IF LF
0119 011B C95F      CMP #$5F
0120 011D F0EB      BEQ INP0 IF BACK ARROW
0121 011F C92C      CMP #$2C ","
0122 0121 F003      BEQ INP4
0123 0123 C90D      CMP #$0D CR
0124 0125 D005      BNE INP5
0125 0127 204C01    JSR LF
0126 012A A900     INP4 LDA #0
0127 012C 81FA     INP5 STA (P,X)
0128 012E D0DF      BNE INP2
0129 0130 60        RTS
0130                ;
0131 0131 A207     CPAE LDX #AP
0132 0133 207201    JSR STRP
0133 0136 A000      LDY #0
0134 0138 20631F   CPA2 JSR INCP
0135 013B C8        INY
0136 013C A1FA      LDA (P,X)
0137 013E D16E      CMP (BP),Y
0138 0140 D004      BNE CPA4
0139 0142 C900      CMP #0
0140 0144 D0F2      BNE CPA2
0141 0146 60       CPA4 RTS
0142                ;
0143 0147 A90D     CRLF LDA #$0D CR
0144 0149 20A01E    JSR OUTCH
0145 014C A90A     LF LDA #$0A LF
0146 014E 4CA01E    JMP OUTCH
0147                ;
0148 0151 204701   PRNC JSR CRLF
0149 0154 207201   PRNT JSR STRP
0150 0157 20631F   PRN2 JSR INCP
0151 015A A1FA      LDA (P,X)
0152 015C F00F      BEQ SKP4
0153 015E 20A01E    JSR OUTCH
0154 0161 F0F4      BEQ PRN2 JMP
0155                ;
0156 0163 207201   SKIP JSR STRP
0157 0166 20631F   SKP2 JSR INCP
0158 0169 A1FA      LDA (P,X)
0159 016B D0F9      BNE SKP2
0160 016D A5FA     SKP4 LDA P
0161 016F A6FB      LDX P+1
0162 0171 60        RTS
```

```
0163                ;
0164 0172 B500      STRP LDA 0,X
0165 0174 85FA       STA P
0166 0176 B501       LDA 1,X
0167 0178 85FB       STA P+1
0168 017A A200       LDX #0
0169 017C 60         RTS
0170                ;
0171 017D A56C      TXT LDA IP
0172 017F A66D       LDX IP+1
0173 0181 20AC01     JSR CKN1
0174 0184 200001    TXT2 JSR INPQ
0175 0187 20A801     JSR CKND
0176 018A D0F8       BNE TXT2
0177 018C F00F       BEQ VER4 JMP
0178                ;
0179 018E A56C      VER LDA IP
0180 0190 A66D       LDX IP+1
0181 0192 20AC01     JSR CKN1
0182 0195 200101    VER2 JSR PRNQ
0183 0193 20A801     JSR CKND
0184 019B D0F8       BNE VER2
0185 019D 4C4F1C    VER4 JMP START
0186                ;
0187 01A8 A001      CKND LDY #1
0188 01A2 B105       LDA (IP),Y
0189 01A4 C924       CMP #$24 "S"
0190 01A6 F00A       BEQ CKN2
0191 01A8 A5FA       LDA P
0192 01AA A6FB       LDX P+1
0193 01AC 85C5      CKN1 STA QP
0194 01AE 86C6        STX QP+1
0195 01B0 A2C5        LDX #QP
0196 01B2 60        CKN2 RTS
0197                ;
```

```
AP    ØØØ7    BP    ØØ6E    CKM1  Ø1AC    CKM2  Ø1B2
CKMD  Ø1AØ    CPA2  Ø138    CPA4  Ø146    CPAB  Ø131
CRLF  Ø147    DPIL  ØØ7Ø    EXIT  ØØE4    GETC  1E5A
INCP  1F63    INPØ  Ø1ØA    INP2  Ø1ØF    INP3  Ø112
INP4  Ø12A    INP5  Ø12C    INPQ  Ø1ØØ    INPT  Ø1Ø3
IP    ØØ6C    LF    Ø14C    OUTC  1EAØ    OUTS  1E9E
P     ØØFA    PRN2  Ø157    PRNC  Ø151    PRNT  Ø154
Q2    ØØ9E    Q3    ØØA9    Q5    ØØCØ    Q6    ØØCE
QP    ØØØ5    QZ    ØØ6D    R1P   ØØØ9    R2P   ØØØB
S     ØØØ1    SKIP  Ø163    SKP2  Ø166    SKP4  Ø16D
STAR  1C4F    STRP  Ø172    T     ØØØ3    TEMP  ØØØ4
TKT   Ø17D    TKT2  Ø184    U     ØØØ2    VEP   Ø18E
VEP2  Ø195    VEP4  Ø19D
P
;Ø4ØØ6CFFØ18Ø17Ø2Ø7
;1ØØØ7ØA9ØØ35Ø285Ø1A26Ø2Ø51Ø135Ø936ØAA2Ø576
;1ØØØ8ØØ92Ø63Ø185ØB36ØC2Ø47Ø1A2ØB2Ø63Ø1Ø3D3
;1ØØØ9ØØ35Ø556Ø6AØØ1B1Ø5C924FØ45A9ØØ35ØØ3Ø663
;1ØØØAØA2Ø52Ø51Ø135Ø736Ø3A26E2ØØØØ12Ø31Ø465
;1ØØØBØØ1FØ1BA5Ø3DØØ9A2Ø92Ø54Ø1E6Ø3DØE9Ø73F
;1ØØØCØA2ØB2Ø54Ø1A2Ø72Ø54Ø1A9Ø2DØDØF313Ø663
;1ØØØDØA9Ø265Ø285Ø2A9Ø265Ø135E5Ø335Ø1D8Ø635
;ØFØØEØA2Ø7DØA9A9Ø135FAA9ØØ85FB4C4F1ØØ31A
;1ØØ1ØØA93F2ØAØ1E2Ø9E1E36Ø4A6Ø42Ø72Ø12ØØ49A
;1ØØ11Ø631F2Ø5A1EFØFBC9ØAFØF7C95FFØEBC9Ø9AC
;1ØØ12Ø2CFØØ7C9ØDDØØ52Ø4CØ1A9ØØ31FADØDFØ73F
;1ØØ13Ø6ØA2Ø72Ø72Ø1AØØØØ631FC3A1FAD16EØ6Ø1
;1ØØ14ØDØ24C9ØØDØF26ØA9ØD2ØAØ1EA9ØA4CAØØ743
;1ØØ15Ø1E2Ø47Ø12Ø72Ø12Ø631FA1FAFØØF2ØAØØ576
;1ØØ16Ø1EFØF42Ø72Ø12Ø631FA1FADØF9A5FAA6Ø951
;1ØØ17ØFB6ØB5ØØ85FAB5Ø185FBA2ØØ6ØA56ØA6Ø3FF
;1ØØ18Ø6D2ØAØØ12ØØØ12ØAØØ1DØF8FØØFA56ØØ635
;1ØØ19ØA66D2ØAØØ12Ø51Ø12ØAØØ1DØF34C4F1ØØ633
;1ØØ1AØAØØ1B1Ø5C924FØØAA5FAA6FB85Ø8536Ø6Ø845
;Ø3Ø1BØA2Ø56ØØ1BB
;ØØØØ15ØØ15
.
```

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DISPLAY SCROLL

Locations loaded:	$006 - $07A
Additional locations used:	$000 - $003 (Variables)
	$200 on (Text buffer)
Starting location:	$021

This will display characters from a buffer starting at location $200 on the KIM display. At fixed intervals, governed by a timer interrupt, the display will be shifted left, introducing one extra character from the buffer on the right. The end of the buffer is to be designated by the character $01 which, when detected, will cause the display program to recycle from the beginning. Before starting, characters to be displayed must be entered in consecutive locations, starting at $200, using the KIM monitor. The last character entered must be the terminating $01.

Each character to be displayed is represented by one eight bit word in the buffer. Of these eight bits, the seven bits 0 thru 6 control elements A thru G (in that order) of the seven element LED. When a bit is one, the corresponding element is turned on, otherwise it is turned off. The eighth bit (bit 7) is not output and so may be set to one for convenience. A table of the hexadecimal digits represented in this fashion appears in the KIM monitor listing, starting at location $1FE7. The labeling of the LED elements (A thru G) is included on the KIM schematic (wall size).

```
MAL.
0001                ; D I S P L A Y  S C R O L L
0002                ; 3/3/76
0003                ; STARTING ADDRESS:- $21
0004                ; LOC 0 DETERMINES WHICH DIGIT IS ON
0005                ; LOC 1 COMPARISON TO TELL WHEN LEFT MOST DIGIT IS ON
0006                ; LOC 2 INTERRUPT FLAG (=1 AFTER INTERRUPT)
0007                ; LOC 3 DETERMINES HOW LONG EACH 6 CHARS ON DISPLAY
0008                ;
0009                ; V A R I A B L E S
0010                ;
0011                SAD =$1740
0012                PADD =$1741
0013                SBD =$1742
0014                PBDD =$1743
0015                IRQL =$17FE
0016                BUF =$0200
0017                BUFF =MAIN+1
0018                ;
0019                ; I N T E R R U P T  R O U T I N E
0020                 =6
0021 0006 A500      ISUB LDA 0
0022 0008 C501       CMP 1
0023 000A F00E       BEQ DIGCHA
0024 000C 18         CLC
0025 000D 69FE       ADC #$FE
0026 000F 8500       STA 0
0027 0011 E602      INC INC 2
0028 0013 A900       LDA #0
0029 0015 8D0617     STA $1706 ;TIMER DIV BY 64 NOT ENABLE
0030 0018 58         CLI
0031 0019 40         RTI
0032                ;
0033 001A A912      DIGCHA LDA #$12
0034 001C 8500       STA 0
0035 001E 4C1100     JMP INC
0036                ;
0037                ; M A I N  P R O G R A M
0038                ;
0039 0021 A906       LDA #ISUB ;STARTING LOCATION
0040 0023 8DFE17     STA IRQL
0041 0026 A900      INIT LDA #0
0042 0028 8DFF17     STA IRQL+1
0043 002B 8503       STA 3
0044 002D 8546       STA BUFF
0045 002F A205       LDX #5
0046 0031 A97F       LDA #$7F
0047 0033 8D4117     STA PADD
0048 0036 A93F       LDA #$3F
0049 0038 8D4317     STA PBDD
0050 003B A912       LDA #$12
0051 003D 8500       STA 0
0052 003F A903       LDA #3
0053 0041 8501       STA 1
0054 0043 D8         CLD
```

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```
0044 58            CLI
                  MAIN
0045 BD0002        LDA BUF,X
0048 C901          CMP #1
004A F0DA          BEQ INIT
004C 8D4017        STA SAD ;SETS UP CHARACTER
004F A920          LDA #$20
0051 8D0E17        STA $170E ;TIMER DIV BY 64 W/ENABLE
0054 A900          LDA #0
0056 8502          STA 2
0058 A500          LDA 0
005A 8D4217        STA SBD ;TURNS ON DIGIT
005D A900         WAIT LDA #0
005F C502          CMP 2
0061 F0FA          BEQ WAIT
0063 E000          CPX #0
0065 D010          BNE CONT
0067 A503          LDA 3
0069 C931          CMP #$31
006B D006          BNE REST
006D E646          INC BUFP
006F A9FF          LDA #$FF
0071 8503          STA 3
                  REST
0073 A206          LDX #6
0075 E603          INC 3
                  CONT
0077 CA            DEX
0078 4C4500        JMP MAIN
                  S

.MASC.

   BUF  0200    BUFP 0046    CONT 0077    DIGC 001A
   INC  0011    INIT 0026    IRQL 17FE    ISUB 0006
   MAIN 0045    PADD 1741    PBDD 1743    REST 0073
   SAD  1740    SBD  1742    WAIT 005D
P
;0A0006A500C501F00E1869FE85047D
;100010 0CE602A9008D06175840A91285004C11049C
;10002000A9068DFE17A9008DFF1785038546A206C2
;10003005A97F8D4117A93F8D4317A9128500A9060A
;100040098501D858BD0002C901F0DA8D4017A906EF
;100050208D0E17A9008502A5008D4217A900C5055B
;10006002F0FAE000D010A503C931D006E646A90869
;0B0070FF8503A206E603CA4C450004EE
;0000080008
```