Dear Jim, February 23, 1977

I have submitted this to the *Kim-1 User Notes* but thought that it might deserve more widespread distribution. People with other 6502 or 6800 systems might find it useful if they are going to interface to the SWTP GT6144. I therefore submit it for your consideration also.

Yours truly,

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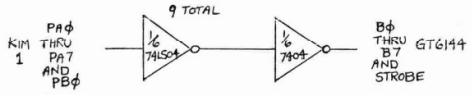
I RECENTLY ADDED THE SOUTHWEST TECHNICAL GRAPHICS BOARD TO MY KIM-1. THERE IS NOT MUCH RESOLUTION (60X96) BUT IT IS RELATIVELY CHEAP ($100) AND GIVES A NICE ROCK STEADY DISPLAY WITH NO FLICKERING OF WHITE FLASHES ON ENTRY OF KEY INFORMATION. YOU QUICKLY COME TO REALIZE THAT GOOD RESOLUTION TAKES LOTS OF MEMORY. I'M ATTEMPTING PRIMARILY TO USE ONLY THAT CONTAINED IN THE BASIC KIM-1.

THE KIT SHOULD NOT PROVIDE ANY PROBLEMS TO SOMEONE WITH SOME KIT BUILDING EXPERIENCE. SOCKETS ARE NOT PROVIDED AND IT TURNS OUT THAT WHILE I USED SOME, IT WOULDN'T HAVE BEEN NECESSARY. I INITIALLY HOOKED THE INPUT DIRECTLY TO THE KIM OUTPUT PORTS. IT WORKED, BUT I LATER REALIZED THAT SOME OF THESE INPUTS REPRESENTED 2 OR 3 TTL LOADS SO I ADDED BUFFERS AS SHOWN IN THE FIGURE BELOW.



I USED PORT A TO OUTPUT INFORMATION AND PB0 TO OUTPUT THE STROBE.

ONE PROBLEM I HAD WAS THAT I DIDN'T REALIZE FOR A WHILE THAT EVERY TIME I RESET THE KIM THE GRAPHICS BOARD WENT INTO A DISABLE GRAPHICS MODE. IT HAS TO BE SENT A CERTAIN CODE TO ENABLE IT AGAIN. I HAVE DONE THIS IN THE INITILIZATION ROUTINE BUT IT CAN BE DONE BY GROUNDING A CERTAIN PIN ON THE BOARD.

THERE IS NO R.F. GENERATOR ON THE BOARD. I WENT DIRECTLY INTO THE BASE OF THE VIDEO DRIVER ON A CHEAP T.V. SET THROUGH AN ELECTROLYTIC (150 MFD) CAPACITOR. THE BRIGHTNESS HAS TO BE ADJUSTED WHEN GOING FROM BLACK ON WHITE TO WHITE ON BLACK BUT OTHERWISE IT SEEMS TO WORK O.K.

THE T.V. SET DOES HAVE A TRANFORMER IN IT TO ISOLATE FROM THE A.C. LINE!

I'M WORKING ON A NUMBER OF BASIC (ELEMENTARY) ROUTINES TO BE USED IN GAMES ETC. WITH THE BOARD. SOME ARE INCLUDED IN THE T.V. SKETCH PROGRAM WHICH FOLLOWS. THIS PROGRAM ALLOWS YOU TO SKETCH THINGS ON THE T.V. USING THE SQUARE OF BUTTONS SURROUNDING THE "5" ON THE KIM KEYBOARD. EACH KEY MAKES THE LINE GO VERTICALLY, HORIZONTALLY OR DIAGONALLY IN THE DIRECTION INDICATED BY THE LOCATION OF THAT KEY. KEY "5" IS A FLIP-FLOP FOR SWITCHING FROM WRITE TO NO-WRITE MODE. A BLINKING CURSOR ALLOWS YOU TO KNOW WHERE YOU ARE WHEN NOT WRITING. KEY "E" IS FOR NORMAL WHITE ON BLACK WHILE KEY "F" WILL SWITCH YOU TO A BLACK ON WHITE MODE. KEY "B" WILL BLANK THE SCREEN WITH THE CURSOR REMAINING IN THE SAME SPOT.

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                ***** T.V. SKETCH PROGRAM *****

0200            D8          CLD
  01        A9 60           LDA #$60        ; INITILIZE SPEED
  03        85 EA           STA 00EA
  05        A9 00           LDA #$00        ; INITILIZE BLINK FLAG
  07        85 E9           STA 00E9
  09     20 E5 02           JSR INIT        ; INITILIZE GRAPHICS
  0C     20 F8 02           JSR BLNK        ; BLANK SCREEN
  0F     20 AD 02   CURS    JSR SPON        ; START OF CURSOR
  12     20 26 03   RETN    JSR DELA        ; DELAY
  15     20 A0 1F   KEYD    JSR KEYIN       ; IS A KEY DOWN?
  18        D0 08           BNE WHAT        ; YES, FIND OUT WHICH
  1A     20 A9 02           JSR SPOF        ; TURN OFF SPOT
  1D     20 26 03           JSR DELA
  20        D0 ED           BNE CURS        ; UNCOND. JUMP
  22     20 6A 1F   WHAT    JSR GETKEY
  25        C9 0B           CMP #$0B        ; IS IT A "B"?
  27        F0 1D           BEQ BLKS        ; YES, BLANK SCREEN
  29        C9 05           CMP #$05        ; IS IT A "5"?
  2B        F0 2A           BEQ MODE        ; YES, CHANGE MODE
  2D        C9 0E           CMP #$0E        ; IS IT AN "E"?
  2F        F0 33           BEQ NORM        ; YES, NORMAL SCREEN
  31        C9 0F           CMP #$0F        ; IS IT A "F"?
  33        F0 36           BEQ INVR        ; YES, INVERTED SCREEN
  35     20 72 02           JSR MOVE        ; DETERMINE MOVE
  38        A5 E9           LDA 00E9        ; BLINK OR DRAW?
  3A        D0 05           BNE DRAW        ; DRAW
  3C     20 0F 03           JSR BLIN        ; BLINK
  3F        50 D1           BVC RETN        ; UNCOND. JUMP
  41     20 12 03   DRAW    JSR CONT        ; CONTINUOUS LINE
  44        50 CC           BVC RETN        ; UNCOND. JUMP
  46        A5 EE   BLKS    LDA 00EE        ; BLANK SCREEN
  48           48           PHA             ; SAVE VERT. AND
  49        A5 ED           LDA 00ED          HORIZ. POSITION
  4B           48           PHA
  4C     20 F8 02           JSR BLNK        ; BLANK SCREEN
  4F           68           PLA             ; RESTORE VERT.
  50        85 ED           STA 00ED          HORIZ. POSITION
  52           68           PLA
  53        85 EE           STA 00EE
  55        50 BB           BVC RETN        ; UNCOND. JUMP
  57        A5 E9   MODE    LDA 00E9        ; CHANGE DRAW-NO DRAW
  59        49 FF           EOR #$FF          MODE
  5B        85 E9           STA 00E9
  5D     20 40 1F   WAIT    JSR KEY IN      ; WAIT FOR KEY RELEASE
  60        D0 FB           BNE WAIT
  62        F0 AE           BEQ RETN
  64        A9 F1   NORM    LDA #$F1        ; SET NORMAL SCREEN
  66     20 D8 02           JSR STRO          SCREEN
  69        D0 A7           BNE RETN        ; UNCOND. JUMP
  6B        A9 F0   INV     LDA #$F0        ; SET INVERTED
  6D     20 D8 02           JSR STRO          SCREEN
  70        D0 A0           BNE RETN        ; UNCOND. JUMP
                ***** MOVKEY SUBROUTINE *****
0272        C9 00           CMP #$00        ; DETERMINE WHICH KEY
  74        F0 1C           BEQ DNLT          IS PRESSED AND
  76        C9 01           CMP #$01            MAKE NECESSARY
  78        F0 2C           BEQ DOWN              CHANGES TO 00ED AND
  7A        C9 02           CMP #$02              00EE
  7C        F0 19           BEQ DNRT
  7E        C9 06           CMP #$06
  80        F0 17           BEQ RITE
  82        C9 0A           CMP #$0A
  84        F0 16           BEQ RTUP
  86        C9 09           CMP #$09
  88        F0 14           BEQ STUP
  8A        C9 08           CMP #$08
  8C        F0 13           BEQ LTUP
  8E        C9 04           CMP #$04
  90        F0 02           BEQ LEFT
  92        E6 EC   DNLT    INC 00EC        ; DOWN-LEFT ENTRY
  94        C6 EB   LEFT    DEC 00EB        ; LEFT ENTRY
  96           60           RTS
  97        E6 EC   DNRT    INC 00EC        ; DOWN-RIGHT ENTRY
  99        E6 EB   RITE    INC 00EB        ; RIGHT ENTRY
  9B           60           RTS
  9C        E6 EB   RTUP    INC 00EB        ; RIGHT-UP ENTRY
  9E        C6 EC   STUP    DEC 00EC        ; STRAIGHT UP ENTRY
  A0           60           RTS
  A1        C6 EB   LTUP    DEC 00EB        ; LEFT-UP ENTRY
  A3        C6 EC           DEC 00EC
  A5           60           RTS
  A6        E6 EC   DOWN    INC 00EC        ; DOWN ENTRY
  A8           60           RTS
                ***** SPOT ON - OFF SUBROUTINE *****
02A9        A9 00   SPOF    LDA #$00        ; SPOT OFF ENTRY
  AB        F0 02           BEQ TSTH        ; UNCOND. JUMP
  AD        A9 40   SPON    LDA #$40        ; SPOT ON ENTRY
  AF           48   TSTH    PHA             ; TEST HOR. FOR OFF SCREEN
  B0        A5 ED           LDA 00ED        ; GET HORIZ. LOCATION
  B2        30 08           BMI SETP        ; IF NEG. SET TO $3F
  B4        C9 40           CMP #$40        ; IF >=40 SET TO $00
  B6        90 08           BCC RETN        ; IF NOT RETURN
  B8        A9 00           LDA #$00        ; LEFT HAND SIDE
  BA        F0 02           BEQ NEWH        ; UNCOND. JUMP
  BC        A9 3F   SETR    LDA #$3F        ; RIGHT HAND SIDE
  BE        85 ED   NEWH    STA 00ED        ; UPDATE HORIZ. POS.
  C0           68   RETN    PLA             ; 00 OR 40
  C1        05 ED           ORA 00ED        ; COMBINE WITH 00ED
  C3     20 D8 02           JSR STRO        ; STROBE IN HORIZ.
  C6        A5 EE   VERT    LDA 00EE        ; VERTICAL ENTRY
  C8        30 08           BMI SETB        ; IF NEG. SET TO 5F
  CA        C9 0A           CMP #$60        ; IF >=60 SET TO 00
  CC        90 08           BCC VMSK          IF NOT, DON'T CHANGE
  CE        A9 00           LDA #$00        ; TOP OF SCREEN
  D0        F0 02           BEQ NEWV        ; UNCOND. JUMP
  D2        A9 5F   SETB    LDA #$5F        ; BOTTOM OF SCREEN
  D4        85 EE   NEWV    STA 00EE        ; UPDATE VERTICAL
  D6        09 80   VMSK    ORA #$80        ; PUT IN VERT. BIT
  D8     8D 00 17   STRO    STA PAD         ; STROBE STARTS HERE
  DB     EE 02 17           INC PBD         ; PB0 TO 0 (NOTE* PB1 TO 1)
  DE     EA EA EA           NOP'S           ; FOR DELAY
  E1     CE 02 17           DEC PBD         ; PB0 BACK HIGH
  E4           60           RTS
                ***** INITILIZATION SUBROUTINE *****
02E5        A9 FF   INIT    LDA #$FF        ; A REGISTER TO OUTPUTS
  E7     8D 01 17           STA PADD
  EA        A9 01           LDA #$01        ; PB0 TO OUTPUT
  EC     8D 03 17           STA PBDD
  EF     8D 02 17           STA PBD         ; STROBE HIGH
  F2        A9 F1           LDA #$F1        ; GRAPHICS ENABLE
  F4     20 D8 02           JSR STRO
  F7           60           RTS
                ***** BLANK SCREEN SUBROUTINE *****
02F8     20 E5 02   BLNK    JSR INIT        ; INITILIZE
  FB        A9 3F           LDA #$3F
  FD        85 ED           STA 00ED        ; START AT BOTTOM RIGHT
  FF        A9 5F           LDA #$5F          OF SCREEN
0301        85 EE           STA 00EE
  03     20 A9 02   MORE    JSR SPOF        ; TURN OFF SPOTS
  06        C6 EE           DEC 00EE        ; MORE IN VERT LINE?
  08        10 F9           BPL MORE        ; YES
  0A        C6 ED           DEC 00ED        ; MORE HORIZ. LINES?
  0C        10 F5           BPL MORE        ; YES
  0E           60           RTS
                ***** BLINK A SPOT SUBROUTIE *****
030F     20 A9 02   BLIN    JSR SPOF        ; BLINK ENTRY
  12        A5 ED   CONT    LDA 00EB        ; CONTINUOUS LINE ENTRY
  14        85 ED           STA 00ED
  16        A5 EC           LDA 00EC        ; UPDATE LOCATION
  18        85 EE           STA 00EE          00EB TO 00ED
  1A     20 AD 02           JSR SPON          00EC TO 00EE
  1D        A5 ED           LDA 00ED
  1F        85 EB           STA 00EB        ; THIS IS NECESSARY TO
  21        A5 EE           LDA 00EE          CAUSE WRAP-AROUND
  23        85 EC           STA 00EC
  25           60           RTS
                ***** DELAY SUBROUTINE *****
0326        A5 EA   DELA    LDA 00EA        ; 00EA CONTROLS TIMING
  28     8D 07 17           STA 1707        ; START TIMER
  2B     AD 07 17   HOLD    LDA 1707        ; TIME UP?
  2E        F0 FB           BEQ HOLD        ; NO
  30           60           RTS
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