INTRODUCTION

This Application Note provides the hardware circuit and software modifications required to use an IBM PC or PC compatible keyboard with the Megatel Quark family of single board computers. The software modifications described apply to Megatel releases of CP/M 2.21 and 2.22 only. Further, the Note does not apply to IBM PC look alike keyboards with RS-232C interfaces, which can be connected directly to the Quark's Full Duplex Serial Port.

SOFTWARE MODIFICATIONS

The code changes listed below permit the use of an IBM PC keyboard that is connected to a Quark. The original code was taken from BYTE magazine (May 1983, page 402). Some changes and additions have been made to the original code to further enhance the routine.

Each key on the IBM PC keyboard generates both a make and break scan code. For example key 1 (esc) produces a scan code 01 (when depressed) and code 81(hex) on break (when released). Break codes are formed by adding 80(hex) to the make codes.

The code changes include some Z80 instructions. These instructions are coded by defining bytes and are followed by a comment line stating the Z80 instruction. For example:

```
DB $81,7*8+a+IBI
; RES 7,a
```

To make the modifications to the operating system, a blank formatted disk, and a "SYSGENed" disk with an operating system and the following files are needed:

- QSYSGEN.COM
- DDT6.COM
- QBIOS.ASM
- ASM.COM
- a text editor or word processor

HARDWARE DESCRIPTION

This implementation of the IBM PC keyboard connection utilizes the Full Duplex Serial Port on the Quark. As such, an external clock synchronization circuit is required. This circuit appears in Figure 1. Values for R1, R2 and C2 should be chosen to set the period of oscillator U1 to double the period of the keyboard clock (suggested values are shown). Figure 1 also shows the jumper connection required on the Quark.

```
R1 = 4.7 kΩ
R2 = 4.7 kΩ
C1 = 0.02 µF
```

FIGURE 1. Clock Synchronizer Circuit and Quark Jumper Connection
The following code must replace the existing code in the QBIOS.ASM. The routines that must be changed are CONIN, CONST, and WBOOT.

The following code will replace the CONIN: and CONST: routines.

; I.B.M. P.C. KEYBOARD CONVERSION FROM BYTE

; ACIA EQUATES
STREG EQU 78H ; ACIA STATUS REGISTER
RDREG EQU 79H ; ACIA RECEIVE DATA REGISTER */

 ; CONSOLE STATUS CHECK
CONST:
LDA SAVECHAR
ORA A
JZ CONST1
MVI A,0FFH
ORA A
RET

CONST1:
IN STREG
ANI 1
RZ
; NO CHARACTER TYPED
PUSH H
PUSH D
PUSH B
CALL KYBRD
; GET CHARACTER
POP B
POP D
POP H
JMP CONST

; CONSOLE INPUT ROUTINE
CONIN:
CALL CONST
JZ CONIN
LDA SAVECHAR
PUSH H
LXI H,SAVECHAR
MVI M,0
POP H
RET

; MAIN ROUTINE TO CONVERT I.B.M. KEY BOARD CODE TO ASCII CODE

; KYBRD:
CALL KEYR
MOV C,A
ORA A
RZ
DB 0CBH,7*8+A+80H
; RES 7,A
LXI H,TAB1-1
MVI D,0
MOV E,A
DAD D
MOV A,M
MOV E, A
LXI H, SHIFT ;ALT KEY?
CPI 83H
MVI B, 80H
JZ SHF
CPI 82H ;CNTRL KEY?
MVI B, 40H
JZ SHF
CPI 81H ;LEFT SHIFT KEY?
MVI B, 2
JZ SHF
CPI 80H ;RIGHT SHIFT KEY
MVI B, 4
JZ SHF
DB 0CBH, 7*8+C+40H
BIT 7, C
JNZ RET3
CPI 84H ;NUMLOCK KEY?
MVI B, 20H
JZ SHFL
CPI 85H ;CAPSLOCKS KEY?
MVI B, 1
JZ SHFL
;
;PROCESS NON SHIFT KEYS
;
CPI 1BH
JC SPEC
CPI 7BH
JNC OTHER
CPI 61H
JC OTHER
MOV A, M
DB 0CBH, 0*8+A+40H
BIT 0, A
JZ KYBRD1
ANI 6
MOV A, E
JZ KYBRD2
JMP RET0

KYBRD1:
ANI 6
MOV A, E
JZ RET0

KYBRD2:
DB 0CBH, 5*8+A+80H
;
RES 5, A
JMP RET0

OTHER:
MOV A, M
ANI 6
MOV A, E
JZ RET0
CPI 60H
JZ OTH2
CPI 5AH
JNC OTH1
LXI H, TAB2+1
SBI  27H
JC   RET0
MVI  D,0
MOV  E,A
DAD  D
MOV  A,M
JMP  RET0

OTH1:
DB   0CBH,5*8+A+0C0H
;   SETB 5,A
JMP  RET0

OTH2:
MVI  A,7EH
RET0:
MVI  C,0
LXI  H,SHIFT
DB   0CBH,6*8+M+40H
;   BIT 6,M
JZ   RET1
ANI  1FH

RET1:
DB   0CBH,7*8+M+40H
;   BIT 7,M
STA  SAVECHAR
RZ   DB   0CBH,7*8+A+0C0H
;   SETB 7,A
STA  SAVECHAR
RET

;PROCESS SHIFT KEYS
;
SHF:
DB   0CBH,7*8+C+40H
;   BIT 7,C
SHF1:
MOV  A,B
JNZ  SHFOFF
ORA  M
SHF2:
MOV  M,A
RET3:
XRA  A
RET

SHFOFF:
CMA
ANA  M
JMP  SHF2

SHFL:
MOV  A,B
ANA  M
JMP  SHF1
; PROCESS FUNCTION AND CURSOR PAD

; SPEC:
CPI   11H
MOV A,M
JC SPEC0
DB $CBH,5*8+A+40H
BIT 5,A
JZ SPEC0
ANI 6
MOV A,E
JNZ SPEC2
JMP SPEC1

SPEC0:
ANI 6
MOV A,E
JZ SPEC2

SPEC1:
DB $CBH,5*8+A+0C0H
SETB 5,A

SPEC2:
DB $CBH,6*8+M+40H
BIT 6,M
JZ SPEC3
DB $CBH,6*8+A+0C0H
SETB 6,A
JMP SPEC5

SPEC3:
CPI $EH
JC SPEC5
CPI 1AH
JNC SPEC5
PUSH H
PUSH D
LXI H,TAB3
MVI D,0
SUI $EH
MOV E,A
DAD D
MOV A,M
POP D
POP H

SPEC5:
MOV E,A
MOV A,C
MVI C,0FEH
CPI $EH
JZ SPEC4
CPI $FH
JZ SPEC4
CPI 1CH
JZ SPEC4
INR C

SPEC4:
MOV A,E
JMP RET1
The following must be added to the beginning of the WBOOT routine. The purpose of this code is to reset the control flag in the shift byte.

```
LDA SHIFT
ANI 21H
STA SHIFT
```

The following procedure should be executed: Place the disk with the required files in drive A and the blank disk in drive B. Make all of the above changes to the QBIOS.ASM. Now enter the following instructions (the instructions in bold face are entered by the operator, RET means a return is entered):

```
AD>ASM QBIOS.AAZ
AD>QSYSGEN
Megatel Quark Floppy Sysgen VER 2.22
SOURCE DRIVE NAME (OR RETURN TO SKIP) A
SOURCE ON A, THEN TYPE RETURN RET
FUNCTION COMPLETE
DESTINATION DRIVE NAME (OR RETURN TO REBOOT) RET
```
The disk in drive B: will now have an operating system that is compatible with the other operating system but will allow input from an IBM PC keyboard. This disk should be used to boot up an operating system after an IBM PC keyboard has been connected.

Please note that the above code is not completely free of bugs. For example, key strokes may be lost if there is a disk access at the same time as keyboard input.

Megatel recommends that the keyboard interrupt routine be enabled at all times. The disk routine should be changed to selectively disable unwanted interrupts instead of disabling all interrupts.

Finally, the ALT key when used in conjunction with two or more keys may cause incorrect interpretations from the keyboard.