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ON THE COVER: Pictured is the new Z-100 Personal Computer, Model 150. See page 5 for further details.

I/O Port Baud Rate Programmer

Rick Swenton
19 Allen Street
Bristol, CT 06010

Back in October of 1983 I had performed Pat Swayne's 4MHz modifications which appeared in REMark issues 34 and 38. Having been impressed with the new operating speed of my H89A, I decided to try operating the H19 terminal portion at 19200 baud. These two factors when combined produced an outstanding increase in operating speed. Some programs such as basic sorting routines that output listings to the console now run at lightning speed! Of course, the Heath documentation does not guarantee that the H-19 will operate at 19200 baud without dropping characters, I decided to try it anyway. My system seems to work fine at 4MHz and 19200 baud. I was using CONFIGUR to change the baud rate of the computer and then switching the H-19 portion offline and entering "Escape rM" on the keyboard, and then going online again. I did not want to change the settings of the switches on the CPU and Terminal circuit boards for the reasons Pat Swayne mentioned in his 4MHz article - to keep the hardware compatible with obsolete systems which you cannot (or may not want to) modify.

Now the problems. Some programs send a master reset to the terminal (Escape z) for many reasons. (It's probably the easiest way to erase the 25th line.) This will reset the baud rate to that chosen by the dip switch on the terminal logic board. If your CPU is running at 19200 baud and an Escape z is sent to the terminal, you can no longer communicate with the CPU unless you switch the terminal offline and type "Escape rM", then switch back online. This escape sequence will restore the terminal baud rate to 19200. What you need is a utility program to conveniently set the baud rate of both the CPU and terminal, so that you can run at the standard 9600 baud when you wish, and then switch to 19200 baud for those long text editing sessions which used to seem to take forever to page back and forth. There is a good reason for running a slow terminal. Try listing a program in MBASIC with the console running at 19200 baud and you will find that it is hard to stop the listing at the right time to view the desired line numbers. At this baud

```

;
; SETBAUD.ASM I/O PORT BAUD RATE PROGRAMMER
; BY RICK SWENTON 18-OCT-83
;
; THIS PROGRAM WILL CHANGE THE BAUD RATE OF ANY OF THE FOUR
; H-89 SERIAL I/O PORTS BY PROGRAMMING THE NECESSARY
; INFORMATION INTO THE 8250 ASYNCHRONOUS COMMUNICATIONS ELEMENT
; FOR THE SELECTED PORT. IF THE CONSOLE PORT IS BEING CHANGED,
; THE PROGRAM WILL ALSO SEND THE CORRESPONDING ESCAPE SEQUENCE
; TO THE H-19 TERMINAL. THE PROGRAM IS MENU DRIVEN AND WILL
; PROMPT THE OPERATOR FOR TWO SELECTIONS:
;
; 1 - THE DESIRED PORT 2 - THE DESIRED BAUD RATE
;
;
;
;
ESC EQU 27 ;ESCAPE
CR EQU 13 ;CARRIAGE RETURN
LF EQU 10 ;LINE FEED
;
CRT EQU 00E8H ;CONSOLE PORT
B110 EQU 0417H ;BAUD RATE DIVISOR FOR 110 BAUD
;
;
;
; BDOS SYSTEM CALLS
;
BDOS EQU 5 ;BDOS JUMP VECTOR
PSTRF EQU 9 ;PRINT STRING FUNCTION
RCONF EQU 1 ;READ CONSOLE CHARACTER FUNCTION
TPA EQU 100H ;TRANSIENT PROGRAM AREA STARTING ADDRESS
;
;
;
; ASEG ;REQUIRED FOR M80 MACRO ASSEMBLER
; ORG TPA
;
START: DI ;DISABLE INTERRUPTS
;
; SAVE OLD STACK AND SET UP NEW ONE
;
LXI H,0 ;CLEAR H,L
DAD SP ;GET STACK POINTER
SHLD OLDSP ;SAVE IT
LXI SP,STACK ;SET UP NEW STACK
;
SENDEV: LXI D,DEVMS ;D,E POINT TO DEVICE SELECTION MESSAGE
CALL OUTS ;PRINT MESSAGE
CALL INC ;GET THE SELECTION FROM THE OPERATOR
SUI '1' ;SUBTRACT ASCII BIAS
JC SENDEV ;BAD ENTRY
CPI '4'-'1'+1 ;GREATER THAN 4?
JNC SENDEV ;BAD ENTRY
MOV B,A ;TEMP STORAGE
LXI H,BPT ;POINT TO START OF BASE PORT TABLE
LXI D,0 ;CLEAR D,E
MOV E,A ;STORE A IN E
DAD D ;RAISE H,L BY A
MOV A,M ;GET PORT VALUE FROM THE TABLE
STA BPTM ;SAVE IT
LXI H,DMEST-9 ;POINT TO START OF DEV MESSAGE TABLE-9
LXI D,9

```

rate, they whiz right by you! You need the ability to change baud rates at will. Heath provides a program to set the baud rate of the printer. It is called SETLP.COM. This program allows the operator to change the baud rate of the printer port by typing a console command. This would be great to change the baud rate of the console port with one major exception: you need to change the terminal baud rate to match the new CPU baud rate. So I decided to write a program which can change the baud rate of the console port of the CPU as well as the terminal in one operation. While I was writing the program, it became evident that it would be easy to include the option of changing the baud rates of any of the four serial I/O ports and only update the terminal baud rate if the operator has selected the option to do so.

About the Program - SETBAUD.ASM

This program is written in 8080 assembly language using the standard format recognized by the CP/M Assembler (ASM.COM) and Microsoft's Macro-80 Assembler (M80.COM) and others. It uses system calls to the CP/M operating system to print messages to the console terminal, read input from the console keyboard, and send the Escape sequence to the terminal to update its baud rate if required. It can update any of the four serial I/O ports of the H89 computer: Console - 350Q (0E8H), Printer - 340Q (0E0H), TTY - 320Q (0D0H), and Modem - 330Q (0D8H). If the operator selects to modify the baud rate of the console, the appropriate Escape sequence is sent to the terminal to modify the baud rate of the terminal before the baud rate of the CPU is modified.

I have used comment statements extensively in the program to help others to understand its operation. The first part of the program saves the stack pointer and sets up a new stack so that we can return directly to CP/M after execution without re-booting. Then we print the menu of selections and prompt the operator to enter the selections. The dialogue between the computer and operator looks like this:

I/O Port Baud Rate Programmer Version 1.0
by Rick Swenton 18-Oct-83

Which I/O Device do you wish to set?

1 - CONSOLE	2 - PRINTER
PORT 0E8H	PORT 0E0H
3 - TTY	4 - MODEM
PORT 0D0H	PORT 0D8H

(Operator now makes selection:)

1

```

MOV    A,B           ;GET THE SELECTION
INR    A
;
FINDEV: DAD    D           ;RAISE H,L BY 9
DCR    A           ;DECREMENT A
JNZ    FINDEV       ;LOOP UNTIL DEVICE MESSAGE FOUND
SHLD   DMESTM       ;SAVE DEV MESSAGE LOCATION
;
SENDB: LXI    D,BAUDM     ;D,E POINT TO BAUD RATE SELECTION MESSAGE
CALL   OUTS         ;PRINT MESSAHE
CALL   INC          ;GET THE SELECTION FROM THE OPERATOR
SUI    'A'         ;SUBTRACT ASCII BIAS
JC     SENDB        ;BAD ENTRY
CPI    'I'-'A'+1    ;GREATER THAN I?
JNC    SENDB
MOV    B,A         ;TEMP STORAGE
INR    A
LXI    H,BRDVT-2   ;POINT TO BAUD RATE DIVISOR TABLE-2
;
FINDD: INX    H           ;RAISE H,L TWICE
INX    H
DCR    A           ;DECREMENT A
JNZ    FINDD        ;LOOP UNTIL A=0 THEN DIVISOR FOUND
MOV    E,M         ;GET THE BAUD RATE DIVISOR FROM
INX    H           ;MEMORY AND PLACE IN
MOV    D,M         ;REGISTERS D,E
XCHG                   ;SWAP H,L - D,E
SHLD   BRDVTM      ;SAVE BAUD RATE DIVISOR
LXI    H,ESEQT-4   ;SET H,L TO ESCAPE SEQUENCE TABLE-4
LXI    D,4
MOV    A,B         ;GET SELECTION
INR    A           ;INCREMENT
;
FINDE: DAD    D           ;RAISE H,L BY 4
DCR    A           ;DECREMENT A
JNZ    FINDE        ;LOOP UNTIL ESCAPE SEQUENCE FOUND
SHLD   H,BMESTM    ;SAVE LOC OF ESCAPE SEQUENCE
LXI    H,BMEST-6   ;SET H,L TO BAUD RATE MESSAGE TABLE-6
LXI    D,6
MOV    A,B         ;GET SELECTION
INR    A           ;INCREMENT A
;
FINDP: DAD    D           ;RAISE H,L BY 8
DCR    A           ;DECREMENT A
JNZ    FINDP        ;LOOP UNTIL PRINT MESSAGE FOUND
SHLD   BMESTM      ;SAVE LOCATION OF MESSAGE
;
;
SETUP: CALL   CRLF     ;NEW LINE
LHLD   DMESTM       ;GET LOC OF DEVICE MESSAGE
XCHG                   ;SWAP H,L - D,E
CALL   OUTS         ;PRINT IT
LXI    D,BMESS      ;POINT TO BAUD RATE MESSAGE
CALL   OUTS         ;PRINT THE MESSAGE
LHLD   BMESTM       ;GET LOC OF BAUD RATE MESSAGE
XCHG                   ;SWAP H,L - D,E
CALL   OUTS         ;FINISH THE MESSAGE BY PRINTING NEW BAUD RATE
LHLD   ESEQTM       ;GET LOC OF ESCAPE SEQUENCE
XCHG                   ;SWAP H,L - D,E
LHLD   BRDVTM       ;GET BAUD RATE DIVISOR INTO H,L
LDA    BPTM         ;GET THE BASE PORT VALUE INTO A
CPI    CRT          ;SEE IF THE BASE PORT IS CONSOLE
CZ     OUTS         ;SEND H-19 ESCAPE SEQUENCE IF CONSOLE
LXI    H,200H       ;PLACE TIMING CONSTANT IN H,L
CALL   DELAY        ;AND WAIT FOR THE DUST TO SETTLE
LHLD   BRDVTM       ;GET BAUD RATE DIVISOR
LDA    BPTM         ;GET THE BASE PORT VALUE INTO A
CALL   INITACE      ;UPDATE THE ACE
CALL   CRLF         ;NEW LINE
EI                      ;ENABLE INTERRUPTS
LHLD   OLDSP        ;GET THE OLD STACK POINTER
SPHL                   ;RESTORE IT
RET                      ;DONE, RETURN TO CCP
;
;
CONSOLE INPUT/OUTPUT ROUTINES PERFORMED
THROUGH CP/M SYSTEM CALLS
;
;
READ A CHARACTER FROM THE CONSOLE

```

Select the new Baud Rate:

A - 110 D - 1200 G - 4800
 B - 300 E - 2400 H - 9600
 C - 600 F - 3600 I - 19200

(Operator now makes selection:)

I

Console Baud Rate now set to 19200

The program printed all of the above dialogue at the old baud rate. Then the program determined which baud rate and port were selected and sent "Escape rM" to the terminal. It then called the INITACE subroutine to initialize the port. The H89 and H89A use an Asynchronous Communications Element IC to do the parallel to serial conversion. The INITACE subroutine is very similar to the routines used in Heath's SETLP.COM and the BIOS for CP/M to program or reprogram the ACE. I have increased a delay so that the program would run at both 2 and 4 MHz without any changes. After the ACE is programmed, the program will return to the CP/M operating system by restoring the old stack and returning to the Console Command Processor.

There is one precaution when typing this program. There are several "look-up" tables at the end of the program which have a fixed number of bytes in the tables. These have the labels:

DMEST (Device Message Table)
 BMEST(Baud rate Message Table)
 BRDVT(Baud Rate Divisor Message Table)
 ESEQT(Escape Sequence Message Table)
 BPT(Base Port Table)

These tables MUST be typed exactly as shown or the program will run improperly or not at all.

This program can be modified for specialized applications. However, it will not run on the Heath H-8 computer because of the different port assignments and the different IC's used. (I believe the H-8 uses the 8251 instead of the 8250 IC. The differences are drastic.)

To copy this program on disk, you need a text editor. Type the program carefully and name the program: SETBAUD.ASM. Then invoke the CP/M Assembler by typing: ASM SETBAUD.abc where "a" is the disk drive which has the source file (SETBAUD.ASM), "b" is the disk drive where the assembler will save the .HEX file, and "c" is the disk drive where the assembler will save the Print Listing (use a "Z" here to suppress the Print Listing). After assembly, use the LOAD.COM program to convert the .HEX file into a .COM file. Type: LOAD n:SETBAUD where "n" is

```

;
; INC:  PUSH  H           ;SAVE THE ENVIRONMENT
;       PUSH  D
;       PUSH  B
;       MVI  C,RCONF    ;CP/M FUNCTION NUMBER IN C
;       CALL  BDOS      ;BDOS RETURNS THE CONSOLE CHAR IN A
;       POP  B
;       POP  D
;       POP  H           ;RESTORE THE ENVIRONMENT
;       RET
;
;
; SEND CARRIAGE RETURN AND TWO LINEFEEDS TO THE CONSOLE
;
; CRLF: LXI  D,CRLF     ;SET D,E TO CR,LF,LF MESSAGE
;
;
; PRINT A CHARACTER STRING ON THE CONSOLE
;
; PRE-REQUISITE: D,E HAS THE LOCATION OF THE STRING
;
; OUTS: PUSH  H           ;SAVE THE ENVIRONMENT
;       PUSH  D
;       PUSH  B
;       MVI  C,PSTRF    ;CP/M FUNCTION NUMBER IN C
;       CALL  BDOS      ;BDOS PRINTS THE STRING UNTIL '$'
;       POP  B
;       POP  D
;       POP  H           ;RESTORE THE ENVIRONMENT
;       RET
;
;
; INITACE - INITIALIZE AN 8250 ACE
;
; PREREQUISITES: H,L CONTAINS THE BAUD RATE DIVISOR WORD
;                A CONTAINS THE BASE PORT
;
; INITACE:MOV  B,A       ;SAVE BASE PORT VALUE IN B
;          XCHG          ;SAVE BAUD RATE DIVISOR IN D,E
;          LXI  H,OUTACE+1 ;SET H,L TO LOCATION TO PLACE PORT VAL
;          MVI  A,3       ;SET BAUD RATE ACCESS BIT ON BASE+3 PORT
;          ADD  B         ;GET ACTUAL PORT
;          MOV  C,A       ;SAVE IN C FOR LATER
;          MOV  M,A       ;AND MODIFY THE PORT VALUE WHICH
;                          ;FOLLOWS THE OUT INSTRUCTION
;          MVI  A,083H    ;SET DIVISOR LATCH ACCESS BIT
;          CALL OUTACE    ;SEND IT TO THE ACE
;          INR  M         ;RAISE THE BASE PORT VALUE BY ONE
;                          ;TO MODIFY THE MODEM CONTROL REGISTER
;          MVI  A,00FH    ;AND SET DSR & CTS HIGH FOR DIABLO
;          CALL OUTACE    ;AND OTHER PRINTERS WHICH REQUIRE THEM
;          MOV  M,B       ;SET PORT TO LEAST SIG BYTE
;          MOV  A,E       ;
;          CALL OUTACE    ;SEND IT TO THE ACE
;          MOV  A,D       ;SET PORT TO MOST SIG BYTE
;          ANI  00FH      ;AND TURN OFF CONTROL FLAGS
;          INR  M         ;INCREMENT THE PORT NUMBER
;          CALL OUTACE    ;SEND IT TO THE ACE
;          MOV  M,C       ;RESET PORT TO DIVISOR LATCH ACCESS
;          CPI  B110 SHR 8 ;IF SET FOR GREATER THAN 110 BAUD
;          MVI  A,3       ;THEN SET NO PARITY, 8 BIT WORDS, 1 STOP BIT
;          JC  ACE1       ;IF 110 THEN JUMP TO ACE1
;          ORI  4         ;IF NOT 110 THEN SET TWO STOP BITS
;          CALL OUTACE    ;SEND IT TO THE ACE
;          DCR  M         ;NOW SET PORT FOR INTERRUPT CONTROL
;          DCR  M         ;BY DECREMENTING THE PORT NUMBER TWICE
;          XRA  A         ;DISABLE ALL DEVICE INTERRUPTS
;          CALL OUTACE    ;DISABLE INTERRUPTS
;
;
; DELAY FOR APPROXIMATELY FOUR CHARACTER TIMES
; (DELAY WILL BE TWO CHARACTER TIMES IF RUNNING AT 4 MHZ)
;
;
;          XCHG          ;PUT BAUD RATE DIVISOR IN H,L
;          DELAY: DAD  H   ;MULTIPLY BY 32 TO GET DELAY
;          DAD  H
;          DAD  H
;          DAD  H
;          DAD  H
;          DAD  H
;
;
; LOOP:  DCX  H           ;DECREMENT THE COUNT

```

the disk drive which has the file SET-BAUD.HEX. The loader will create the file: SETBAUD.COM on specified disk drive. SETBAUD.COM can now be run like any other .COM file.

Have fun!



About the Author:

Rick Swenton is an Equipment Service Representative with Eastman Kodak Company in Hartford, Ct. His work centers around Computer Output Microfilm and Computerized Microfilm Retrieval Systems. His first computer was a home built 8080 system with over 8K of machine code entered through an EPROM Programmer. He will NEVER do that again! That's why he bought the H891. Rick is also Amateur Radio operator W4ILMV.

BAUD RATE ESCAPE SEQUENCE TABLE FOR H-19

IF THE OPERATOR HAS SELECTED TO MODIFY THE BAUD RATE OF THE CONSOLE, THEN ONE OF THE FOLLOWING ESCAPE SEQUENCES WILL BE SENT TO THE H-19 TERMINAL THERE MUST BE FOUR ASCII CHARACTERS IN EACH MESSAGE

```
ESEQT: DB     ESC,'rA$'      ;110 BAUD
        DB     ESC,'rC$'      ;300 BAUD
        DB     ESC,'rD$'      ;600 BAUD
        DB     ESC,'rE$'      ;1200 BAUD
        DB     ESC,'rH$'      ;2400 BAUD
        DB     ESC,'rI$'      ;3600 BAUD
        DB     ESC,'rJ$'      ;4800 BAUD
        DB     ESC,'rL$'      ;9600 BAUD
        DB     ESC,'rM$'      ;19200 BAUD
```

I/O BASE PORT ASSIGNMENT TABLE

```
BPT:   DB     0E8H           ;CONSOLE PORT 350Q
        DB     0E0H           ;PRINTER PORT 340Q
        DB     0D0H           ;TTY PORT 320Q
        DB     0D8H           ;MODEM PORT 330Q
```

SIGN-ON MESSAGE

THIS MESSAGE IS PRINTED AT THE CONSOLE TO PROMPT THE OPERATOR TO SELECT THE DESIRED I/O DEVICE TO BE MODIFIED

```
DEVM:  DB     ESC,'EI/O Port Baud Rate Programmer Version 1.0',CR,LF
        DB     ' by Rick Swenton 18-OCT-83',CR,LF,LF
        DB     'Which I/O Device do you wish to set?',CR,LF,LF
        DB     '1 - CONSOLE 2 - PRINTER 3 - TTY 4 - MODEM'
        DB     CR,LF
        DB     ' PORT 0E8H PORT 0E0H PORT 0D0H PORT 0D8H'
        DB     CR,LF,LF,7,'$'
```

```
MOV     A,L           ;GET THE LEAST SIG BYTE
ORA     H             ;OR IN MOST SIG BYTE
JNZ     LOOP         ;LOOP BACK IF NON-ZERO RESULT
RET
```

SELF-MODIFYING OUT INSTRUCTION USED BY INITACE

```
OUTACE: OUT     000H           ;THE PORT VALUE IS ALTERED
        RET             ;BY PLACING THE VALUE IN
                        ;LOCATION OUTACE+1
```

FIRST PART OF CONFIRMATION MESSAGE
SELECTED DEVICE MESSAGE TABLE

ONE OF THESE MESSAGES ARE SENT TO THE CONSOLE TO CONFIRM THE SELECTED I/O DEVICE THERE MUST BE NINE ASCII CHARACTERS IN EACH MESSAGE LEADING CHARACTERS ARE ASCII NULS TRAILING CHARACTER IS ASCII SPACE

```
DMEST:  DB     'Console $'
        DB     'Printer $'
        DB     0,0,0,0,'TTY $'
        DB     0,0,'Modem $'
```

SECOND PART OF CONFIRMATION MESSAGE

```
BMESS:  DB     'Baud Rate now set to $'
```

THIRD PART OF CONFIRMATION MESSAGE
BAUD RATE MESSAGE TABLE

ONE OF THESE MESSAGES ARE SENT TO THE CONSOLE FOLLOWING THE ABOVE PRINT MESSAGE TO CONFIRM THE BAUD RATE SELECTION THERE MUST BE SIX ASCII CHARACTERS IN EACH MESSAGE INCLUDING TRAILING SPACES

```
BMEST:  DB     '110 $'
        DB     '300 $'
        DB     '600 $'
        DB     '1200 $'
        DB     '2400 $'
        DB     '3600 $'
        DB     '4800 $'
        DB     '9600 $'
        DB     '19200$'
```

BAUD RATE DIVISOR TABLE FOR 8250 ACE

```
BRDVT:  DW     0417H           ;110 BAUD
        DW     0180H           ;300 BAUD
        DW     00C0H           ;600 BAUD
        DW     0060H           ;1200 BAUD
        DW     0030H           ;2400 BAUD
        DW     0024H           ;3600 BAUD
        DW     0018H           ;4800 BAUD
        DW     000CH           ;9600 BAUD
        DW     0006H           ;19200 BAUD
```

BAUD RATE PRINT MESSAGE

```

THIS MESSAGE IS PRINTED AT THE CONSOLE TO PROMPT
THE OPERATOR TO SELECT THE DESIRED BAUD RATE

BAUDM: DB      CR,LF,LF,'Select the new Baud Rate: ',CR,LF,LF
        DB      'A - 110              D - 1200          G - 4800',CR,LF
        DB      'B - 300              E - 2400          H - 9600',CR,LF
        DB      'C - 600              F - 3600          I - 19200',CR,LF
        DB      CR,LF,LF,LF,7,'$'

CRLFT: DB      CR,LF,LF,'$'

        DS      15                      ;SET UP 16 BYTE LOCAL STACK
STACK:  DS      1

        DS      2                      ;OLD STACK POINTER SAVED HERE
OLDSP:  DS      2

        STORAGE LOACTIONS

BPTM:   DS      1                      ;BASE PORT VALUE (BYTE)
DMESTM: DS      2                      ;DEVICE MESSAGE TABLE POINTER (WORD)
BRDVTM: DS      2                      ;BAUD RATE DIVISOR TABLE POINTER (WORD)
ESEQTM: DS      2                      ;ESCAPE SEQUENCE TABLE POINTER (WORD)
BMESTM: DS      2                      ;BAUD RATE MESSAGE TABLE POINTER (WORD)

        END      START
    
```

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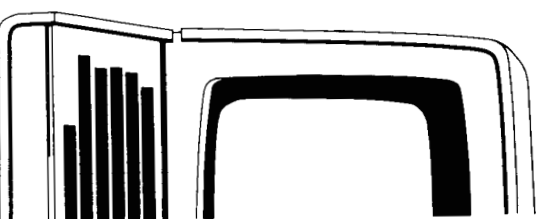
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