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\ Write a simple Application just using 35 Forth Words - set IO bits, start a counter  -- ExMark -  Juergen Pintaske Oct. 2016
\ There is a Word for SOS as well, but dependent on the hardware you can hear the SOS as some sounds (or not) just try
\ VFXTESTAPP - A Demo running on the PC. Set up a folder c:\VFXTESTAPP . Store this file VFXTESTAPP.f into this folder
\ ( INCLUDE c:\VFXTESTAPP\VFXTESTAPP.f ) copy the text in brackets into the VFX window, and hit <cr>  to run the demo.
\ VFX reads in the file, VFX compiles new words where needed. SOS should be heard, then a simple "GUI" of few lines shows.
\ and the 4 out bits are counted up. <cr> stops this and answers ok. Now set bits, e.g. with PWL or PWL <cr> or the others.
\ or try NAME <cr>, type SOS <cr>, or COUNTER <cr>; <cr> to get back into command mode; or 400 SCOUNTER <cr> where 400 sets speed
\ Try the very basic debugger with ???? <cr>.
\ Desription: The implementation of a virtual MicroBox,  which consists of a Micro, PWM LED, 3 Switches, 4 OUT LEDs, 4 IN LEDs
\ Here some functionality implemented in SW: no chip, no LEDs, no resistors, no PCB, no soldering  - an Application on PC only
\ The "GUI", the Graphic User Interface implemented using two very simple words - Page to clear screen, <cr> go to next line.
\ LINE1 shows the funtions represented, and below LINE3 the 1bit PWM, 3bits SWITCHES, 4bits OUT, 4bits IN, 4bits A - 16 bits
\ Further down find MBV2, it prints the 16 Bits underneath this GUI. All lines are resent whenever the 16 bits are updated.
\ LINE1 to LINE4 define words to explain the names of the single bits and the control words. LINE4 not used. Modify to show.
\ This has been intentionally written just using simple words and constructs, so anybody can use it as startig point.
\ And as with all Forth programs, this application can be easily modified and extended - and all of this interactively.
\ BIN/HEX 0000-0 0001-1 0011-2 0011-3 0100-4 0101-5 0110-6 0111-7 1000-8 1001-9 1010-A 1011-B 1100-C 1101-D 1110-E 1111-F
HEX \ From now on all of the numbers are understood as hexadecimal. The LINES n print a small GUI, very basic, with PAGE and CR
: LINE1 ." \ VFXTESTAPP - bit change ie. PWH / PWL <cr>, try COUNTER, 400 SCOUNTER, SOS, ???? plus <cr>  ExMark Oct2016" CR ;
: LINE2 ." \ PWHL T3HL T2HL T1HL O3HL O2HL O1HL O0HL I3HL I2HL I1HL I0HL A3Hl A2HL A1HL A0HL h/l ???? " CR ;
: LINE3 ." \ PWM  T3___T2___T1   O3___O2___O1___O0   I3___I2___I1___I0   A3___A2___A1___A0  " CR ;
: LINE4 ."    X    t    t    t    o    o    o    o    i    i    i    i    a    a    a    a  "  CR ;  \ display after START?
: TEST  PAGE LINE1 LINE2 LINE3  LINE4  ( LINE5 ) CR ;  \ display lines of our  GUI Graphic User Interface,  LINE5 not used
Variable PWM    ( 0 or 1                                  )      \ not used for now, as combined in Variable PSWI
Variable SWI    ( Switches SW3 SW2 SW1    0 0 0           )      \ not used for now, as combined in Variable PSWI
Variable PSWI   ( PSWI X t t t  4 bits PWM and 3 Switches  )  \ combines the bit for PWM and the 3 bits for the 3 switches
Variable OUTP   ( OUTP 3 2 1 0  7 6 5 4 of the 8 bits      )  \ the 4 "OUTPUT LEDs" of the MicroBox
Variable IN     ( IN   3 2 1 0  3 2 1 0 of the 8 Bits      )  \ 4 Input bits that can be set e.g. for AND OR XOR INVERT
Variable ANI    ( ANI  3 2 1 0  4 more bits for test       )  \ either as simulated external ANALOG - or free for anything
Variable HOU    ( OUT as hexadecimal number 0 to F         )      \ to be implemented, just showing the 4 OUT bits in hexadecimal
Variable ALL    ( PWM SWI OUT INP ANI                      )      \ To be done, combining it all into one 16 bit Variable
: disbit4  DUP $8 AND IF ." 1" ELSE ." 0" THEN  ;   \ test a bit, here the topmost bit3 of the 4. If 1 then display 1, else 0
: ds       Disbit4 1 LSHIFT ;                       \ display a bit, shift the 4 bits left by one, so bit 2 is the topmost and so on
: dssp     ds Space Space space space ;             \ combine a bit with 4 Spaces, to be a block for display
: 4dssp    dssp dssp dssp disbit4  drop ;           \ now combine all 4 bits of the Variable nibble, DROP cleans up the stack
: DV       3 spaces PSWI @ 4dssp  4 spaces OUTP @ 4dssp 4 spaces IN @ 4dssp  4 spaces  ANI @ 4dssp  ;  \ combine 4x 4 = 16 bits
: SPACES   ( u -- ) 0 ?DO SPACE LOOP ;              \ define SPACES, often included in the Forth word set already
: MBV2     PAGE LINE1 LINE2 LINE3 LINE4 DV CR ;     \ MBV2 updates the “SCREEN”, first the explaining lines, then the 16 Bits
: COUNTER  Begin outp @ 1+ outp !     300 ms mbv2 key? until ; \ run a counter program, see OUT bits change, type counter <cr>
: SCOUNTER Begin dup outp @ 1+ outp !     ms mbv2 key? until ; \ the same with programmable speed, for example 400 scounter <cr>
: SOS 07 emit 100 ms 07 emit 100 ms 07 emit 600 ms 07 emit 300 ms 07 emit 300 ms 07 emit 600 ms 07 emit 100 ms 07 emit 100 ms 07 emit ;
: LINE5  ." PSWI OUT  IN   ANI  - R0  R1   - Stack contents                                  "  CR ; \ description of ???? display
: ????   3 spaces PSWI @ . OUTP @ . IN @ . ANI @ . 4 spaces >R >R >R >R >R >R >R >R R> DUP . R> DUP . R> DUP . R> DUP . R> DUP . R> DUP
.  R> DUP . R> DUP . ;  \ ???? displays PSWI OUTP IN ANI and DSTACK 8 levels. Enter FFFF, sets lowest one visible as bottom, so 7 left
: ???   PSWI @ . OUTP @ . IN @ . ANI @ . base @ >r hex .S r> base ! ; \ Debug 2 - prints 4 variables + Data + Stack differently

\ More details at http://wiki.forth-ev.de/doku.php/en:projects:a-start-with-forth:start
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\ Preset Variables:
0 PWM  !         \      not used for now
0 SWI  !         \      not used for now
9 PSWI !    \  Set this combined variable to 9 = 1001  this will show the PWM LED ON and T1 ON
0 OUTP !    \  All bits LOW 0000
3 IN   !    \  The IN variable set to 3  0011 - prepared to try AND OR XOR INVERT
F ANI  !    \  Set to F, so all bits HIGH, free for any use, e.g. program an extra counter, or for other tests
F HOU  !         \      not used for now
FFFF ALL  !      \      ALL will be the combined 16 Bit Vector PWSI OUT IN ANI  later , was commented out here for now

\ Control Words ( from left to right as shown in LINE2 )
: PWH   PSWI @  $8 OR   PSWI !  MBV2 ; \ Get the variable onto stack, set bit 3 using OR, and store it back, now update the Display
: T3H   PSWI @  $4 OR   PSWI !  MBV2 ; \ Get the variable onto stack, set bit 2, and store it back, see above
: T2H   PSWI @  $2 OR   PSWI !  MBV2 ; \ And the same for setting all of the other bits
: T1H   PSWI @  $1 OR   PSWI !  MBV2 ;
: O3H   OUTP @  $8 OR   OUTP !  MBV2 ;  \ x x x x    1 0 0 0
: O2H   OUTP @  $4 OR   OUTP !  MBV2 ;  \            0 1 0 0
: O1H   OUTP @  $2 OR   OUTP !  MBV2 ;  \            0 0 1 0
: O0H   OUTP @  $1 OR   OUTP !  MBV2 ;  \            0 0 0 1
: I3H   IN   @  $8 OR   IN   !  MBV2 ;
: I2H   IN   @  $4 OR   IN   !  MBV2 ;
: I1H   IN   @  $2 OR   IN   !  MBV2 ;
: I0H   IN   @  $1 OR   IN   !  MBV2 ;
: A3H   ANI  @  $8 OR   ANI  !  MBV2 ;
: A2H   ANI  @  $4 OR   ANI  !  MBV2 ;
: A1H   ANI  @  $2 OR   ANI  !  MBV2 ;
: A0H   ANI  @  $1 OR   ANI  !  MBV2 ;  \ here end the words that Set Bits HIGH - the next ones set the same bits LOW using AND
: PWL   PSWI @  $7 AND  PSWI !  MBV2 ;  \ x x x x    0 1 1 1
: T3L   PSWI @  $B AND  PSWI !  MBV2 ;  \            1 0 1 1
: T2L   PSWI @  $D AND  PSWI !  MBV2 ;  \            1 1 0 1
: T1L   PSWI @  $E AND  PSWI !  MBV2 ;  \            1 1 1 0
: O3L   OUTP @  $7 AND  OUTP !  MBV2 ;
: O2L   OUTP @  $B AND  OUTP !  MBV2 ;
: O1L   OUTP @  $D AND  OUTP !  MBV2 ;
: O0L   OUTP @  $E AND  OUTP !  MBV2 ;
: I3L   IN   @  $7 AND  IN   !  MBV2 ;
: I2L   IN   @  $B AND  IN   !  MBV2 ;
: I1L   IN   @  $D AND  IN   !  MBV2 ;
: I0L   IN   @  $E AND  IN   !  MBV2 ;
: A3L   ANI  @  $7 AND  ANI  !  MBV2 ;
: A2L   ANI  @  $B AND  ANI  !  MBV2 ;
: A1L   ANI  @  $D AND  ANI  !  MBV2 ;
: A0L   ANI  @  $E AND  ANI  !  MBV2 ;

\ Set I1 and/or I0 of the INPUTs, then call AND01, OR01, XOR01, INVERT0 and see the result of the logic result in OUT0
: AND01    IN @  DUP 1 RSHIFT AND 01 AND  OUTP !  MBV2  ;   \ Do an AND of IN bit0 and bit1, 00=>1 01=>0 10=>0 11=>1
: OR01     IN @  DUP 1 RSHIFT OR  01 AND  OUTP !  MBV2  ;   \ Do an OR  of IN bit0 and bit1, 00=>0 01=>1 10=>1 11=>1
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: XOR01    IN @  DUP 1 RSHIFT XOR 01 AND  OUTP !  MBV2  ;   \ Do an XOR of IN bit0 and bit1, 00=>0 01=>1 10=>1 11=>0
: INVERT0  IN @  INVERT           01 AND  OUTP !  MBV2  ;   \ Do an INV of IN bit0,           0=>1  1=>0
\ Forth Words used - remember: Any Forth Word consists of a character sequence plus a space (not allowed in Words is Space )
\  0 INCLUDE   INCLUDE loads and starts a file in VFX; set up c:\VFXTESTAPP, store file there, type INCLUDE c:\VFXTESTAPP\VFXTESTAPP.f
\  1 HEX       Mostly VFX recognizes numbers as decimal or HEX. If in DECIMAL mode any Hex Number will give an error. Careful!
\  2 \         \ and a Space after it tells Forth, that the rest of the line is for documentation, so is ignored by VFX.
\  3 :         : starts new Forth Word definition, is terminated by ;  see Number 6. Example  : Bell 07 EMIT ; sends a sound.
\  4 ."        ." and a space  starts a string of characters to be sent to the screen, the string is terminated by "
\  5 CR        CR defines a word that places the cursor to the beginning of the next line
\  6 ;         ; ends the definition started by :  see number 3
\  7 TEST      TEST is the name of a new word defined just to display the GUI - the Graphical User Interface
\  8 Variable  Variables = named memory locations. VARIABLE xx defines, nn xx ! sets,  xx @ . prints. Remember: NAME and contents
\  9 DUP       DUP takes the value on top of the stack and puts the same value on top as NEW TOS - Top of Stack
\ 10 $n        $n - the $ ensures that VFX takes the number following as hexadecimal number
\ 11 AND       AND is a logical operator. works on the two top numbers on the stack, on a bitwise basis, only leaves result
\ 12 IF        IF   is not zero do A  -  ELSE do B  -  THEN continue
\ 13 ELSE
\ 14 THEN
\ 15 LSHIFT    LSHIFT does a bitwise shift of the value on stack, expects the number of shifts to be done on stack - 1 LSHIFT
\ 16 SPACE     SPACE sends a space to the screen
\ 17 DROP      DROP does the opposite to DUP; DROP takes the TOS and deletes what was there, all values move up one position
\ 18 DV        DV is a word that combines the 4x 4 bits of the variables for the screen, 16 Bit wide.
\ 19 @         @ stands for me for AT, for example with Variables - xx puts address of xx onto the stack, xx @ gets the value of it
\ 20 ?DO       ?DO will start a DO  word word LOOP, expects the number of loops on stack. ?DO checks if number on stack is 0.
\ 21 LOOP      Goes back to ?DO until 0, then continues
\ 22 PAGE      PAGE clears the screen, takes the cursor to the top left position and prints ok
\ 23 BEGIN     BEGIN starts a loop of words which ends with UNTIL. UNTIL expects a flag on stack; not 0 then to BEGIN else continue
\ 24 1+        1+ is put on stack, adds one to the number below and replaces it. Same function as 1 + as 2 words.
\ 25 !         ! is the opposite function to @, and stores the number on stack at a location on stack, e.g. 55 xx ! at Variable xx
\ 26 MS        MS stands  1 Millisecond delay in software. Careful which base  you are in - 256 and 100 the same Dec / HEX
\ 27 KEY?      Key? Checks, if a key has been pushed as this generates a flag. BEGIN xxxxxxxx KEY? UNTIL - flag stops the loop
\ 28 UNTIL     UNTIL end the BEGIN … UNTIL loop, exit if flag true.
\ 29 EMIT      (07 for Bell ) to get audible output from the PC  - ( : ) BELL 07 BEL ( ; )sends the bell signal to the speaker
\ 30 .S        .S is a non-destructive display of the stack,  all of the items there
\ 31 .         . is similar to .S, prints out the top item only and as well consumes it; an easy way to get rid of the top stack item
\ 32 >R        >R takes an item from DSTACK and moves to the RSTACK;
\ 33 R>        R> does the opposite: take item from RSTACK move it to the top of DSTACK
\ 34 ( and )   These 2 brackets are used to put explanations within the code, and this is ignored by Forth, similar to \
\  ------ it seems this covers all of the words needed for this little sandbox application
\
\ This application VFXTESTAPP has not been programmed optimally  - but this was not the target -  beginner's code for beginners
\ Links  to further information: see WORD file and PDF version of this text
\
: Name  ." Hello Forth World " ;
Page CR Name   1000 ms
sos      \ send  SOS      and then start the counter
counter  \ start COUNTER
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\ The Forth Machine:  Data stream coming in on the left, THE STACK, Return Stack, Variables in memory, other memory, route to screen.
\                     Digital_In and Digital_Out are for later, the same applies to Memory
\ The Forth Machine looks very complicated - but people actually use a similar model every day at the desk, work coming in, execute, results out
\
\    DIGITAL_IN                        TOP_OF_STACK   TOP_OF_RS                 x7       DIGITAL_OUT
\   ( for later )                      DS-1           RS-1                      x6      ( for later )
\                                      DS-2           RS-2                      x5
\                                      DS-3           RS-3                      x4
\                                      DS-4           RS-4           PSWI       x3
\                                      DS-5           RS-5           OUTP       x2
\                                      DS-6           RS-6           IN         x1
\    Token8 T7 T6 T5 T4 T3 T2 T1 T0    FFFF (-7)      FFFF           ANI        x0       Hello Forth World
\
\    Terminal_Input_Buffer_Contents    DATA STACK     RETURN_STACK   VARIABLES   MEMORY   TO_SCREEN                          ExMark October 2016
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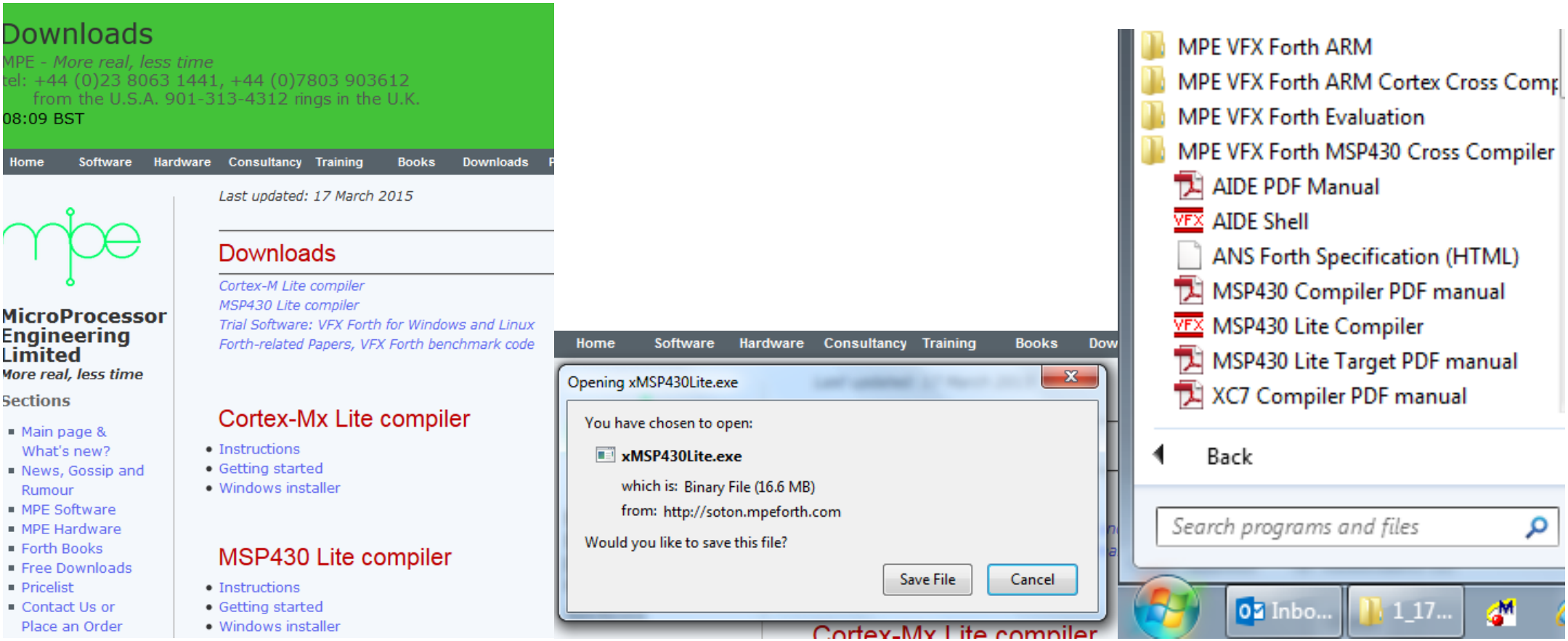
MPE_VFX_LITE – download, installation and test



Go to www.mpeforth.com and have a look around. Have a look at the Press section and see what is new.
This website is in the state of transition, it has been updated recently.

Open the tab downloads http://www.mpeforth.com/arena.htm. The link we want is the MSP430 Lite compiler and the link Windows installer.
I suggest you create a new folder MPEFORTH first.
Download into this folder and execute xMSP430lite.exe.
From the files there there are look at: AIDE Manual and start AIDE Shell

In the Utilities window you start ForthEd2 and Forth Console.
Resort the windows and you will have the same display as further down:
The AIDE Window with the 4 other windows :

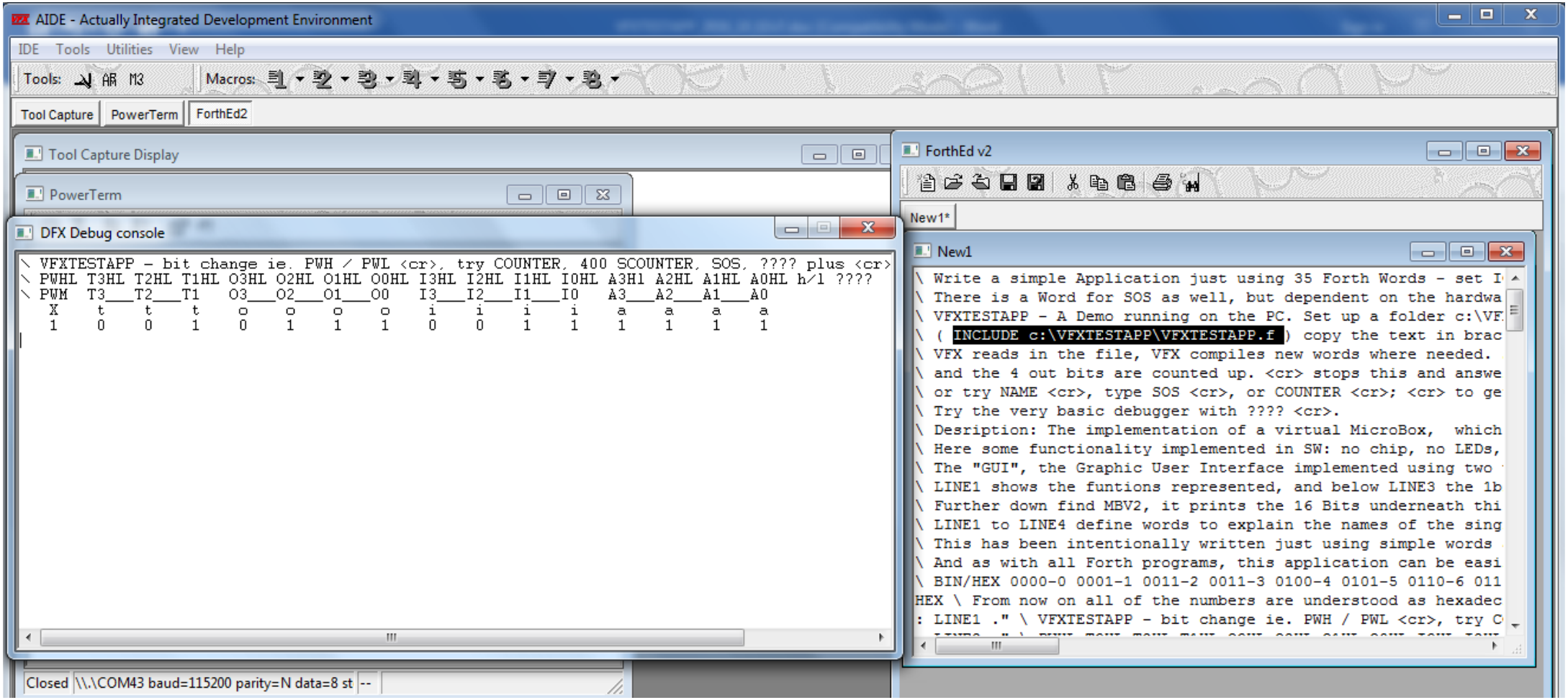
Power Term – not neeed for now, so switch it off in Utilities.

Tool Capture Display: this for later so can be disabled as well.

ForthEd2 our very basic ASCII editor.

And most importantly the **Forth Console**, this shows the VFX Forth software, here running VFXTESTAPP; and you can see part of the file in ForthEd2.
There will be a download location to be defined. For now it is http://wiki.forth-ev.de/doku.php/en:projects:a-start-with-forth:start

More explanations in the text of the application.



You can as well download a smaller size version of the AIDE Manual from the Forth-eV location if you wish – enjoy A Start in Forth