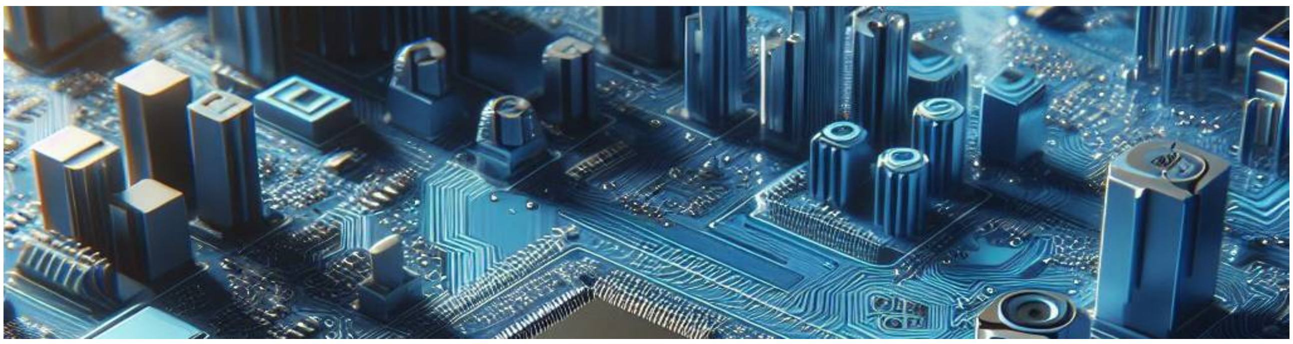
eForth Windows

Reference manual

version 1.1 - 21 novembre 2024



Author

- Marc PETREMANN petremann@arduino-forth.com

Table des matières

Author **1**
forth **17**
! n addr -- 17
# d1 -- d2 17
#! -- 17
#> n -- addr len 17
#FS r -- 17
#s n1 -- n=0 18
#tib -- n 18
' exec: <space>name -- xt 18
'tib -- addr 18
(local) a n -- 18
* n1 n2 -- n3 18
*/ n1 n2 n3 -- n4 18
*/MOD n1 n2 n3 -- n4 n5 18
+ n1 n2 -- n3 19
+! n addr -- 19
+loop n -- 19
+to n --- <valname> 19
, x -- 19
- n1 n2 -- n1-n2 19
-rot n1 n2 n3 -- n3 n1 n2 20
. n -- 20
." -- <string> 20
.s -- 20
/ n1 n2 -- n3 20
/mod n1 n2 -- n3 n4 20
0< x1 --- fl 21
0<> n -- fl 21
0= x -- fl 21
1+ n -- n+1 21
1- n -- n-1 21
1/F r -- r' 21
2! d addr -- 21
2* n -- n*2 21
2/ n -- n/2 21
2@ addr -- d 22
2drop n1 n2 n3 n4 -- n1 n2 22
2dup n1 n2 -- n1 n2 n1 n2 22
3dup n1 n2 n3 -- n1 n2 n3 n1 n2 n3 22
4* n -- n*4 22
4/ n -- n/4 22
: comp: -- <word> | exec: -- 22
:noname -- cfa-addr 22

; --........23
< n1 n2 -- fl........24
<# n --........24
<= n1 n2 -- fl........24
<> x1 x2 -- fl........24
= n1 n2 -- fl........24
> x1 x2 -- fl........24
>= x1 x2 -- fl........24
>body cfa -- pfa........25
>flags xt -- flags........25
>in -- addr........25
>link cfa -- cfa2........25
>link& cfa -- lfa........25
>name cfa -- nfa len........25
>name-length cfa -- n........25
>r S: n -- R: n........25
? addr -- c........26
?do n1 n2 --........26
?dup n -- n | n n........26
@ addr -- n........26
abort --........26
abort" comp: --........26
abs n -- n'........27
accept addr n -- n........27
afliteral r:r --........27
aft --........27
again --........27
align --........27
aligned addr1 -- addr2........27
allot n --........28
also --........28
AND n1 n2 --- n3........28
ansi --........28
argc -- n........28
ARSHIFT x1 u -- x2........28
asm --........28
assert fl --........28
at-xy x y --........28
base -- addr........29
begin --........29
bg color[0..255] --........29
BIN mode -- mode'........29
BINARY --........29
bl -- 32........29
blank addr len --........30
block n -- addr........30
block-fid -- n........30
block-id -- n........30

buffer   n - addr....30
bye   --....30
c!   c addr --....30
c,   c --....30
c@   addr -- c....30
CASE   --....30
cat   -- <path>....31
catch   cfa -- fl....31
cell   -- 8....31
cell+   n -- n'....31
cell/   n -- n'....31
cells   n -- n'....31
char   -- <string>....31
CLOSE-FILE   fileid -- ior....31
cmove   c-addr1 c-addr2 u --....32
code   -- <:name>....32
constant   comp: n -- <name> | exec: -- n....32
context   -- addr....32
copy   from to --....32
cp   -- "src" "dst"....32
cr   --....32
CREATE   comp: -- <name> | exec: -- addr....32
CREATE-FILE   a n mode -- fh ior....33
current   -- cfa....33
DECIMAL   --....33
default-key   -- c....33
default-key?   -- fl....33
default-type   addr len --....33
defer   -- <vec-name>....33
DEFINED?   -- <word>....33
definitions   --....34
depth   -- n....34
do   n1 n2 --....34
DOES>   comp: -- | exec: -- addr....34
drop   n --....34
dump   a n --....34
dump-file   addr len addr2 len2 --....35
dup   n -- n n....35
echo   -- addr....35
editor   --....35
else   --....36
emit   x --....36
empty-buffers   --....36
ENDCASE   --....36
ENDOF   --....37
erase   addr len --....37
evaluate   addr len --....37
EXECUTE   xt --....37

exit   --........37
extract   n base -- n c........37
F*   r1 r2 -- r3........38
F**   r_val r_exp -- r........38
F+   r1 r2 -- r3........38
F-   r1 r2 -- r3........38
f.   r --........38
f.s   --........38
F/   r1 r2 -- r3........38
F0<   r -- fl........39
F0=   r -- fl........39
f<   r1 r2 -- fl........39
f<=   r1 r2 -- fl........39
f<>   r1 r2 -- fl........39
f=   r1 r2 -- fl........39
f>   r1 r2 -- fl........39
f>=   r1 r2 -- fl........40
F>S   r -- n........40
FABS   r1 -- r1'........40
FATAN2   r-tan -- r-rad........40
fconstant   comp: r -- <name> | exec: -- r........40
FCOS   r1 -- r2........40
fdepth   -- n........41
FDROP   r1 --........41
FDUP   r1 -- r1 r1........41
FEXP   ln-r -- r........41
fg   color[0..255] --........41
file-exists?   addr len --........41
FILE-POSITION   fileid -- ud ior........41
FILE-SIZE   fileid -- ud ior........41
fill   addr len c --........41
FIND   addr len -- xt | 0........41
fliteral   r:r --........42
FLN   r -- ln-r........42
FLOOR   r1 -- r2........42
flush   --........42
FLUSH-FILE   fileid –- ior........42
FMAX   r1 r2 -- r1|r2........42
FMIN   r1 r2 -- r1|r2........42
FNEGATE   r1 -- r1'........42
FNIP   r1 r2 -- r2........42
for   n --........43
forget   -- <name>........43
forth   --........43
forth-builtins   -- cfa........43
FOVER   r1 r2 -- r1 r2 r1........43
fp0   -- addr........43
FP@   -- addr........43

FSIN r1 -- r2....................43
FSINCOS r1 -- rcos rsin....................44
fsqrt r1 -- r2....................44
FSWAP r1 r2 -- r1 r2....................44
fvariable comp: -- <name> | exec: -- addr....................44
graphics --....................44
here -- addr....................44
HEX --....................45
hld -- addr....................45
hold c --....................45
i -- n....................45
if fl --....................45
immediate --....................45
include -- <:name>....................46
included addr len --....................46
included? addr len -- f....................46
internalized --....................46
internals --....................46
invert x1 -- x2....................46
is --....................46
j -- n....................46
k -- n....................47
key -- char....................47
key? -- fl....................47
L! n addr --....................47
L, n --....................47
latestxt -- xt....................48
leave --....................48
list n --....................48
literal x --....................48
load n --....................48
loop --....................48
LSHIFT x1 u -- x2....................49
max n1 n2 -- n1|n2....................49
min n1 n2 -- n1|n2....................49
mod n1 n2 -- n3....................49
ms n --....................49
ms-ticks -- n....................49
mv -- "src" "dest"....................50
n. n --....................50
negate n -- -n'....................50
next --....................50
nip n1 n2 -- n2....................50
nl -- 10....................50
normal --....................50
OCTAL --....................50
OF n --....................50
ok --....................51

only   --..51
open-blocks   addr len --...51
OPEN-FILE   addr n opt -- n...51
OR   n1 n2 -- n3...51
order   --..52
over   n1 n2 -- n1 n2 n1...52
page   --..52
PARSE   c "string" -- addr count..52
pause   --..52
PI   -- r..52
precision   -- n...52
prompt   --..53
r"   comp: -- <string> | exec: addr len...53
R/O   -- 0...53
R/W   -- 2...53
r>   R: n -- S: n...53
R@   -- n..53
rdrop   S: -- R: n --..53
READ-FILE   a n fh -- n ior...53
recognizers   --...53
recurse   --..53
remaining   -- n...54
remember   --...54
repeat   --...54
REPOSITION-FILE   ud fileid -- ior...54
required   addr len --..54
reset   --..54
RESIZE-FILE   ud fileid -- ior...54
restore   -- <:name>...54
revive   --...55
rm   -- "path"...55
rot   n1 n2 n3 -- n2 n3 n1..55
rp0   -- addr...55
RSHIFT   x1 u -- x2...55
r| comp: -- <string> | exec: addr len...55
s"   comp: -- <string> | exec: addr len...55
S>F   n -- r: r...55
s>z   a n -- z...55
save   -- <:name>...56
save-buffers   --...56
SCR   -- addr...56
SDL2   --..56
see   -- name>..56
set-precision   n --...56
set-title   a n --...56
SF!   r addr --...56
sf,   r --..56
SF@   addr -- r...57

sfloat   -- 4........57
sfloat+   addr -- addr+4........57
sfloats   n -- n*4........57
SL@   addr -- n........57
sp0   -- addr........57
SP@   -- addr........57
space   --........57
spaces   n --........57
startup: -- <name>........58
state   -- fl........58
str   n -- addr len........58
str=   addr1 len1 addr2 len2 -- fl........58
streams   --........58
structures   --........58
SW@   addr -- n........58
swap   n1 n2 -- n2 n1........58
task   comp: xt dsz rsz -- <name> | exec: -- task........59
tasks   --........59
then   --........59
throw   n --........59
thru   n1 n2 --........59
tib   -- addr........60
to   n --- <valname>........60
touch   -- "path"........60
type   addr c --........60
u.   n --........60
U/MOD   u1 u2 -- rem quot........60
UL@   addr -- un........60
unloop   --........60
until   fl --........61
update   --........61
use   -- <name>........61
used   -- n........61
UW@   addr -- un[2exp0..2exp16-1]........61
value   comp: n -- <valname> | exec: -- n........61
variable   comp: -- <name> | exec: -- addr........62
visual   --........62
vlist   --........62
vocabulary   comp: -- <name> | exec: --........62
W!   n addr --........62
W/O   -- 1........62
while   fl --........62
windows   --........63
words   --........63
WRITE-FILE   a n fh -- ior........63
XOR   n1 n2 -- n3........63
z"   comp: -- <string> | exec: -- addr........63
z>s   z -- a n........63

[--........63
['] comp: -- <name> | exec: -- addr........63
[char] comp: -- <spaces>name | exec: -- xchar........63
[ELSE] --........64
[IF] fl --........64
[THEN] --........64
] --........64
{ -- <names..>........65

graphics........66

color -- n........66
CreatePen iStyle cWidth color -- hPen........66
event -- 0........66
EXPOSED -- 2........66
FINISHED -- 7........66
g{ --........66
height -- 0........66
hwnd -- n........67
IDLE -- 0........67
key-count -- 256........67
last-char -- 0........67
last-key -- 0........67
LEFT-BUTTON -- 255........67
LineTo hdc x y -- fl........67
MIDDLE-BUTTON -- 254........68
MOTION -- 3........68
mouse-x -- 0........68
mouse-y -- 0........68
moveTo x y --........68
MoveToEx hdc x y LPPOINT -- fl........68
pixel w h -- a........69
PRESSED -- 4........69
PS_DOT -- 2........69
PS_SOLID -- 0........69
RELEASED -- 5........69
RESIZED -- 1........69
RIGHT-BUTTON -- 253........69
screen>g x y -- x' y'........70
SetTextColor hdc color -- fl........70
TYPED -- 6........70
vertical-flip --........70
width -- 0........70
window x y --........70
}g --........70

streams........71

>stream addr len stream --........71
ch>stream c stream --........71
empty? -- fl........71

full?   -- fl..71
stream   comp: n -- <name> | exec: -- addr...71
stream#   sz -- n...71
stream>ch   addr -- c..71

structures...73
field   comp: n -- <:name>..73
i16   -- 2..73
i32   -- 4..73
i64   -- 8..73
i8   -- 1..73
last-struct   -- addr...73
long   -- 4...73
ptr   -- 4...74
struct   comp: -- <:name>...74
typer   comp: n1 n2 -- <name> | exec: -- n..74

tasks...75
.tasks   --..75
main-task   -- task...75
task-list   -- addr..75

windows...76
->biBitCount   addr -- addr'...76
->biClrImportant   addr -- addr'..76
->biClrUsed   addr -- addr'..76
->biCompression   addr -- addr'..76
->biHeight   addr -- addr'..76
->biPlanes   addr -- addr'...76
->biSize   addr -- addr'...76
->biSizeImage   addr -- addr'...76
->biWidth   addr -- addr'...76
->biXPelsPerMeter   addr -- addr'..76
->bmiColors   addr -- addr'...76
->bmiHeader   addr -- addr'..76
->bottom   addr -- addr'...77
->left   addr -- addr'..77
->rgbBlue   addr -- addr'...77
->rgbGreen   addr -- addr'...77
->rgbRed   addr -- addr'..77
->rgbReserved   addr -- addr'...77
->right   addr -- addr'..77
->top   addr -- addr'...77
->x   addr -- addr'..77
->y   addr -- addr'..77
>biYPelsPerMeter   addr -- addr'..77
ANSI_FIXED_FONT   -- n..77
ANSI_VAR_FONT   -- n...77
BeginPaint   hWnd lpPaint -- lpPaint...78
BITMAPINFO   -- n...78

BITMAPINFOHEADER -- n........78
BI_RGB -- n........78
BLACK_BRUSH -- n........78
BLACK_PEN -- n........78
BM_CLICK -- 245........79
BM_GETCHECK -- 240........79
BM_GETIMAGE -- 246........79
BM_GETSTATE -- 242........79
BM_SETCHECK -- 241........79
BM_SETDONTCLICK -- 248........79
BM_SETIMAGE -- 247........79
BM_SETSTYLE -- 244........79
calls -- addr........80
CB_ADDSTRING -- 323........80
CB_FINDSTRING -- 332........80
CB_FINDSTRINGEXACT -- 344........80
CB_GETCOMBOBOXINFO -- 356........80
CB_GETCOUNT -- 326........80
CB_GETCURSEL -- 327........80
CB_GETDROPPEDCONTROLRECT -- 338........81
CB_GETDROPPEDSTATE -- 343........81
CB_GETDROPPEDWIDTH -- 351........81
CB_GETEDITSEL -- 320........81
CB_GETEXTENDEDUI -- 342........81
CB_GETHORIZONTALEXTENT -- 349........81
CB_GETITEMDATA -- 336........81
CB_GETITEMHEIGHT -- 340........81
CB_GETLBTEXT -- 328........81
CB_GETLBTEXTLEN -- 329........82
CB_GETLOCALE -- 346........82
CB_GETTOPINDEX -- 347........82
CB_INITSTORAGE -- 353........82
CB_INSERTSTRING -- 330........82
CB_LIMITTEXT -- 321........82
CB_MSGMAX -- 357........82
CB_MULTIPLEADDSTRING -- 355........82
CB_RESETCONTENT -- 331........82
CB_SELECTSTRING -- 333........83
CB_SETCURSEL -- 334........83
CB_SETDROPPEDWIDTH -- 352........83
CB_SETEDITSEL -- 322........83
CB_SETEXTENDEDUI -- 341........83
CB_SETHORIZONTALEXTENT -- 350........83
CB_SETITEMDATA -- 337........83
CB_SETITEMHEIGHT -- 339........83
CB_SETLOCALE -- 345........83
CB_SETTOPINDEX -- 348........84
CB_SHOWDROPDOWN -- 335........84

COLOR_WINDOW -- 5....84
CommandLineToArgvW lpCmdLine *pNumArgs -- LPWSTR....84
console-started -- 0....84
CreateSolidBrush param -- null|brush....84
CreateWindowExA 12params -- 0|HWND....84
DC_BRUSH -- n....85
DC_PEN -- n....85
DefaultInstance -- $400000....85
DEFAULT_GUI_FONT -- n....85
DEFAULT_PALETTE -- n....85
DEVICE_DEFAULT_PALETTE -- n....85
DIB_RGB_COLORS -- 0....86
DISABLE_NEWLINE_AUTO_RETURN -- n....86
DKGRAY_BRUSH -- n....86
dll comp: zStr -- <:name>....86
EM_CHARFROMPOS -- 215....86
EM_EMPTYUNDOBUFFER -- 205....86
EM_FMTLINES -- 200....86
EM_GETFIRSTVISIBLELINE -- 206....86
EM_GETIMESTATUS -- 217....86
EM_GETLIMITTEXT -- 213....86
EM_GETMARGINS -- 212....87
EM_GETPASSWORDCHAR -- 210....87
EM_GETWORDBREAKPROC -- 209....87
EM_LINEFROMCHAR -- 201....87
EM_POSFROMCHAR -- 214....87
EM_SETIMESTATUS -- 216....87
EM_SETMARGINS -- 211....87
EM_SETPASSWORDCHAR -- 204....87
EM_SETREADONLY -- 207....87
EM_SETTABSTOPS -- 203....88
EM_SETWORDBREAK -- 202....88
EM_SETWORDBREAKPROC -- 209....88
EM_UNDO -- 199....88
ENABLE_INSERT_MODE -- n....88
ENABLE_PROCESSED_INPUT -- n....88
ExitProcess uExitCode --....88
FillRect hDC *lprc hbr -- fl....88
gdi32 zstr n --....89
GetCommandLineW -- str....89
GetDC hWnd -- hdc....89
GetLastError -- err....89
GetMessageA lpMsg hWnd wMsgFilterMin wMsgFilterMax -- fl....89
GetModuleHandleA lpModuleName -- HMODULE....89
GetProcessHeap -- handle....89
GetRect LPRECT -- left top right bottom....89
GetStockObject i --....90
GetTickCount -- ms....90

IDI_MAIN_ICON -- 1001..90
init-console --..90
Kernel32 --...90
LoadLibraryA dllname-z -- module...90
LTGRAY_BRUSH -- $80000001...90
MALLOC_CAP_32BIT -- 2..90
MALLOC_CAP_8BIT -- 4..90
MALLOC_CAP_DMA -- 8...91
MALLOC_CAP_EXEC -- 1..91
MB_ABORTRETRYIGNORE -- 2...91
MB_CANCELTRYCONTINUE -- 6...91
MB_OK -- 0...91
MB_OKCANCEL -- 1..91
MB_RETRYCANCEL -- 5...91
MB_YESNO -- 4..91
MB_YESNOCANCEL -- 3...92
MessageBoxA hWnd lpText lbCaption uType -- 0|val...92
NULL -- 0..92
NULL_BRUSH -- n...92
PAINTSTRUCT -- n..92
POINT -- n...93
RECT -- n...93
RGB r g b -- n...93
RGBQUAD -- n..93
SBM_ENABLE_ARROWS -- 228...93
SBM_GETPOS -- 225...94
SBM_GETRANGE -- 227..94
SBM_GETSCROLLBARINFO -- 235...94
SBM_GETSCROLLINFO -- 234..94
SBM_SETPOS -- 224...94
SBM_SETRANGE -- 226...94
SBM_SETRANGEREDRAW -- 230..94
SBM_SETSCROLLINFO -- 233..94
SetForegroundWindow hWnd -- fl..94
SetRect LPRECT xLeft yTop xRight yBottom -- fl..95
SetupCtrlBreakHandler --..95
Shell32 zstr n --..95
ShowWindow hWnd nCmdShow -- fl..95
Sleep ms --...95
SRCCOPY -- $00cc0020...95
stdin -- 0...96
stdout -- 0...96
User32 zstr n --..96
WaitForSingleObject hHandle Ms --..96
wargc -- addr...96
wargv -- addr...96
WHITE_BRUSH -- $80000000...96
win-type addr len --...96

WINDCLASSA -- n....96
WindowProcShim --....97
windows-builtins -- n....97
WM_>name msg -- a n....97
WM_ACTIVATE -- 6....97
WM_AFXFIRST -- 864....97
WM_AFXLAST -- 896....97
WM_APPCOMMAND -- 793....97
WM_CHANGECBCHAIN -- 781....97
WM_CHAR -- 258....98
WM_CLEAR -- 771....98
WM_COPY -- 769....98
WM_CREATE -- 1....98
WM_CUT -- 768....98
WM_DEADCHAR -- 259....98
WM_DESTROY -- 2....98
WM_DESTROYCLIPBOARD -- 775....98
WM_DRAWCLIPBOARD -- 776....98
WM_ENABLE -- 10....98
WM_ENTERIDLE -- 289....99
WM_GETTEXT -- 13....99
WM_GLOBALRCCHANGE -- 899....99
WM_HANDHELDFIRST -- 856....99
WM_HANDHELDLAST -- 863....99
WM_HEDITCTL -- 901....99
WM_HOOKRCRESULT -- 898....99
WM_HOTKEY -- 786....99
WM_HSCROLL -- 276....99
WM_HSCROLLCLIPBOARD -- 782....100
WM_IMEKEYDOWN -- 656....100
WM_IMEKEYUP -- 657....100
WM_IME_CHAR -- 646....100
WM_IME_COMPOSITIONFULL -- 644....100
WM_IME_CONTROL -- 643....100
WM_IME_KEYDOWN -- 656....100
WM_IME_KEYUP -- 657....100
WM_IME_NOTIFY -- 642....100
WM_IME_REPORT -- 640....101
WM_IME_REQUEST -- 648....101
WM_IME_SELECT -- 645....101
WM_IME_SETCONTEXT -- 641....101
WM_INITMENU -- 278....101
WM_INITMENUPOPUP -- 279....101
WM_INPUT -- 255....101
WM_KEYDOWN -- 256....101
WM_KEYUP -- 257....101
WM_KILLFOCUS -- 0....102
WM_LBUTTONDBLCLK -- 515....102

WM_LBUTTONDOWN -- 513........102
WM_LBUTTONUP -- 514........102
WM_MBUTTONDBLCLK -- 521........102
WM_MBUTTONDOWN -- 519........102
WM_MENUCHAR -- 288........102
WM_MENUSELECT -- 287........102
WM_MOUSEFIRST -- 512........102
WM_MOUSEHOVER -- 673........103
WM_MOUSELAST -- 521........103
WM_MOUSELEAVE -- 675........103
WM_MOUSEMOVE -- 512........103
WM_MOVE -- 3........103
WM_NCMOUSEHOVER -- 672........103
WM_NCMOUSELEAVE -- 674........103
WM_NULL -- 0........103
WM_PAINTCLIPBOARD -- 777........103
WM_PALETTECHANGED -- 785........104
WM_PALETTEISCHANGING -- 784........104
WM_PASTE -- 770........104
WM_PENCTL -- 901........104
WM_PENEVENT -- 904........104
WM_PENMISC -- 902........104
WM_PENMISCINFO -- 899........104
WM_PENWINFIRST -- 896........104
WM_PENWINLAST -- 911........104
WM_PRINTCLIENT -- 792........105
WM_QUERYNEWPALETTE -- 783........105
WM_RBUTTONDBLCLK -- 518........105
WM_RBUTTONDOWN -- 516........105
WM_RBUTTONUP -- 517........105
WM_RCRESULT -- 898........105
WM_RENDERALLFORMATS -- 774........105
WM_RENDERFORMAT -- 774........105
WM_SETFOCUS -- 7........105
WM_SETREDRAW -- 11........105
WM_SETTEXT -- 12........106
WM_SIZE -- 5........106
WM_SKB -- 900........106
WM_SYSDEADCHAR -- 258........106
WM_SYSTIMER -- 280........106
WM_UNDO -- 772........106
WM_VSCROLL -- 277........106
WM_VSCROLLCLIPBOARD -- 778........106

Mots FORTH par utilisation........107

arithmetic integer........107
arithmetic real........107
block edit list........108
chars strings........108

comparaison logical....108
definition words....108
display....109
files words....110
loop and branch....110
memory access....110
stack manipulation....111

forth

## ! n addr --

Store n to address. n is a 64 bits value.

```
VARIABLE TEMPERATURE
32 TEMPERATURE !
```

# d1 -- d2

Perform a division modulo the current numeric base and transform the rest of the division into a string of characters. The character is dropped in the buffer set to running <#

```
: hh ( c -- adr len)
    base @ >r  hex
    <# # # #>
    r> base !
  ;
 3 hh type  \ display 03
26 hh type  \ display 1a
```

#! --

Behaves like \ for ESP32forth.

Serves as a text file header to indicate to the operating system (Unix-like) that this file is not a binary file but a script (set of commands). On the same line is specified the interpreter allowing to execute this script.

```
#! /usr/bin/env ueforth
```

#> n -- addr len

Drop n. Make the pictured numeric output string available as a character string. *addr* and *len* specify the resulting character string.

```
\ display address in format: NNNN-NNNN
: DUMPaddr ( n -- )
    <# # # # #  [char] - hold # # # # #>
    type
  ;
```

#FS r --

Converts a real number to a string. Used by f.

#s   n1 -- n=0

Converts the rest of n1 to a string in the character string initiated by <#.

```
: EUROS ( d1 --- str len)
    <#
    # #               \ convert € cents
    [char] , hold     \ add char "," to str buffer
    #s #>             \ convert rest after ","
  ;
15630. EUROS type     \ display 156,30 ok
```

#tib   -- n

Number of characters received in terminal input buffer.

'   exec: <space>name -- xt

Skip leading space delimiters. Parse name delimited by a space. Find name and return xt, the execution token for name.

When interpreting, `' xyz EXECUTE` is equivalent to `xyz`.

'tib   -- addr

Pointer to Terminal Input Buffer.

(local)   a n --

Word used to manage the creation of local variables.

*   n1 n2 -- n3

Integer multiplication of two numbers.

```
6 3   *    \ push 18 operation 6*3
7 3   *    \ push 21 operation 7*3
-7 3 *     \ push -21
7 -3 *     \ push -21
-7 -3 *    \ push 21
```

*/   n1 n2 n3 -- n4

Multiply n1 by n2 producing the intermediate double-cell result d. Divide d by n3 giving the single-cell quotient n4.

```
5000 1000 4000 */ .     \ display    1250
```

*/MOD   n1 n2 n3 -- n4 n5

Multiply n1 by n2 producing the intermediate double-cell result d. Divide d by n3 producing the single-cell remainder n4 and the single-cell quotient n5.

```
50000 10 4001 */MOD .     \ display    124 3876
```

+ n1 n2 -- n3

Leave sum of n1 n2 on stack.

```
7 15 +    \ leave 22 on stack
```

+! n addr --

Increments the contents of the memory address pointed to by addr.

```
variable valX
15 valX !
1 valX +!
valX ?   \ display 16
```

+loop n --

Increment index loop with value n.

Mark the end of a loop `n1 0 do ... n2 +loop`.

```
: loopTest
   100 0 do
       i .
   5 +loop
  ;
loopTest  \ display 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95
```

+to n --- <valname>

add n to the content of *valname*

```
5 value FINAL-SCORE
1 +to FINAL-SCORE      \ increment content of FINAL-SCORE
FINAL-SCORE  .         \ display 6
```

, x --

Append x to the current data section.

- n1 n2 -- n1-n2

Subtract two integers.

```
6 3  - .  \ display 3
-6 3 - .  \ display -9
```

-rot n1 n2 n3 -- n3 n1 n2

Inverse stack rotation. Same action than `rot rot`

. n --

Remove the value at the top of the stack and display it as a signed single precision integer.

```
1 .                        \ display 1
1 2 .                      \ display 2  leave 1 on stack
1 2 + .                    \ display 3  addition 1 and 2, leave nothing on the
stack
6 3  * .                   \ display 18
7 3  * 6 3 * + .           \ display 39 operation (7*3)+(6*3)
```

." -- <string>

The word `."` can only be used in a compiled definition.

At runtime, it displays the text between this word and the delimiting **"** character end of string.

```
: TITLE
    ."      GENERAL MENU" CR
    ."      ============" ;
: line1
    ." 1.. Enter datas" ;
: line2
    ." 2.. Display datas" ;
: last-line
    ." F.. end program" ;
: MENU ( ---)
    title cr cr cr
    line1 cr cr
    line2 cr cr
    last-line ;
```

.s --

Displays the content of the data stack, with no action on the content of this stack.

/ n1 n2 -- n3

Divide n1 by n2, giving the single-cell quotient n3.

```
6 3  / .  \ display 2 opération 6/3
7 3  / .  \ display 2 opération 7/3
8 3  / .  \ display 2 opération 8/3
9 3  / .  \ display 3 opération 9/3
```

/mod n1 n2 -- n3 n4

Divide n1 by n2, giving the single-cell remainder n3 and the single-cell quotient n4.

```
22 7 /MOD . .     \ display    3 1
```

0<   x1 --- fl

Test if x1 is less than zero.

0<>   n -- fl

Leave -1 if n <> 0

0=   x -- fl

flag is true if and only if x is equal to zero.

```
5 0=        \ push  FALSE on stack
0 0=        \ push  TRUE  on stack
```

1+   n -- n+1

Increments the value at the top of the stack.

1-   n -- n-1

Decrements the value at the top of the stack.

1/F   r -- r'

Performs a 1/r operation.

```
12e 1/F f.  \ display 0.083333  (op: 1/12)
```

2!   d addr --

Store double precision value in memory address addr.

2*   n -- n*2

Multiply n by two.

2/   n -- n/2

Divide n by two.

n/2 is the result of shifting n one bit toward the least-significant bit, leaving the most-significant bit unchanged

```
24 2/ .     \ display    12
25 2/ .     \ display    12
26 2/ .     \ display    13
```

2@ addr -- d

Leave on stack double precision value d stored at address addr.

2drop n1 n2 n3 n4 -- n1 n2

Removes the double-precision value from the top of the data stack.

```
1 2 3 4 2drop   \ leave 1 2 on top of stack
```

2dup n1 n2 -- n1 n2 n1 n2

Duplicates the double precision value n1 n2.

```
1 2 2dup  \ leave 1 2 1 2 on stack
```

3dup n1 n2 n3 -- n1 n2 n3 n1 n2 n3

Duplicates the three values at the top of the data stack.

4* n -- n*4

Multiply n by four.

4/ n -- n/4

Divide n by four.

: comp: -- <word> | exec: --

Skip leading space delimiters. Parse name delimited by a space. Create a definition for name, called a "colon definition". Enter compilation state and start the current definition.

Subsequent execution of `NOM` performs the execution sequence words compiled in his "colon" definition.

After `: NOM`, the interpreter enters compile mode. All non-immediate words are compiled in the definition, the numbers are compiled in literal form. Only immediate words or placed in square brackets (words `[` and `]`) are executed during compilation to help control it.

A "colon" definition remains invalid, ie not inscribed in the current vocabulary, as long as the interpreter did not execute `;` (semi-colon).

```
: NAME  nomex1 nomex2 ... nomexn ;
NAME  \ execute NAME
```

:noname -- cfa-addr

Define headerless forth code. cfa-addr is the code execution of a definition.

```
:noname s" Saturday" ;
```

```
:noname s" Friday" ;
:noname s" Thursday" ;
:noname s" Wednesday" ;
:noname s" Tuesday" ;
:noname s" Monday" ;
:noname s" Sunday" ;

create (ENday) ( --- addr)
        , , , , , , ,

:noname s" Samedi" ;
:noname s" Vendredi" ;
:noname s" Jeudi" ;
:noname s" Mercredi" ;
:noname s" Mardi" ;
:noname s" Lundi" ;
:noname s" Dimanche" ;

create (FRday) ( --- addr)
        , , , , , , ,

defer (day)

: ENdays
    ['] (ENday) is (day) ;

: FRdays
    ['] (FRday) is (day) ;

3 value dayLength
: .day
    (day)
    swap cell *
    + @ execute
    dayLength ?dup if
        min
    then
    type
;
ENdays
0 .day \ display Sun
1 .day \ display Mon
2 .day \ display Tue
FRdays  ok
0 .day \ display Dim
1 .day \ display Lun
2 .day \ display Mar
```

; --

Immediate execution word usually ending the compilation of a "colon" definition.

```
: NAME
    nomex1 nomex2
    nomexn ;
```

< n1 n2 -- fl

Leave fl true if n1 < n2

```
4 10 <=    \ leave -1 on stack
4 4  <=    \ leave  0 on stack
4 3  <=    \ leave  0 on stack
```

<# n --

Marks the start of converting a integer number to a string of characters.

```
\ display address in format: NNNN-NNNN
: DUMPaddr ( n -- )
    <# # # # #  [char] - hold # # # # #>
    type
  ;

\ display byte in format: NN
: DUMPbyte ( c -- )
    <# # # #>
    type
  ;
```

<= n1 n2 -- fl

Leave fl true if n1 <= n2

```
4 10 <=    \ leave -1 on stack
4 4  <=    \ leave -1 on stack
4 3  <=    \ leave  0 on stack
```

<> x1 x2 -- fl

flag is true if and only if x1 is different x2.

```
5 5 <>      \ push  FALSE on stack
5 4 <>      \ push  TRUE  on stack
```

= n1 n2 -- fl

Leave fl true if n1 = n2

```
4 10 =   \ leave  0 on stack
4 4  =   \ leave -1 on stack
```

> x1 x2 -- fl

Test if x1 is greater than x2.

>= x1 x2 -- fl

flag is true if and only if x1 is equal x2.

```
5 5 >=      \ push  FALSE on stack
5 4 >=      \ push  TRUE  on stack
```

>body   cfa -- pfa

pfa is the data-field address corresponding to cfa.

>flags   xt -- flags

Convert cfa address to flags address.

>in   -- addr

Number of characters consumed from TIB

```
tib >in @ type
\ display:
tib >in @
```

>link   cfa -- cfa2

Converts the cfa address of the current word into the cfa address of the word previously defined in the dictionary.

```
' dup >link   \ get cfa from word defined before dup
>name type    \ display "XOR"
```

>link&   cfa -- lfa

Transforms the execution address of the current word into the link address of this word. This link address points to the cfa of the word defined before this word.

Used by `>link`

>name   cfa -- nfa len

finds the name field address of a token from its code field address.

```
' words       \ push cfa of 'words' on stack
>name         \ convert cfa of 'words' in nfa field followed by len
type          \ display 'words'
```

>name-length   cfa -- n

Transforms a cfa address into the length of the word name of this cfa address. Word used by `vlist`

>r   S: n -- R: n

Transfers n to the return stack.

This operation must always be balanced with `r>`

```
\ display n in binary format
: b. ( n -- )
    base @ >r
    binary .
    r> base !
  ;
```

? addr -- c

Displays the content of any variable or address.

?do n1 n2 --

Executes a `do loop` or `do +loop` loop if n1 is strictly greater than n2.

```
DECIMAL
: qd ?DO I LOOP ;
   789   789 qd \
 -9876 -9876 qd \
     5     0 qd \  display: 0 1 2 3 4
```

?dup n -- n | n n

Duplicate n if n is not nul.

@ addr -- n

Retrieves the integer value n stored at address addr.

```
TEMPERATURE @
```

abort --

Raises an exception and interrupts the execution of the word and returns control to the interpreter.

abort" comp: --

Displays an error message and aborts any FORTH execution in progress.

```
: abort-test
    if
        abort" stop program"
    then
    ." continue program"
  ;

0 abort-test   \ display: continue program
1 abort-test   \ display: stop program ERROR
```

abs   n -- n'

Return the absolute value of n.

```
-7 abs .    \ display 7
```

accept   addr n -- n

Accepts n characters from the keyboard (serial port) and stores them in the memory area pointed to by addr.

```
create myBuffer 100 allot
myBuffer 100 accept     \ on prompt, enter: This is an example
myBuffer swap type      \ display: This is an example
```

afliteral   r:r --

Compiles a real number. Used by `fliteral`

aft   --

Jump to THEN in FOR-AFT-THEN-NEXT loop 1st time through.

```
: test-aft1 ( n -- )
  FOR
    ."  for "      \ first iteration
    AFT
      ."  aft "    \ following iterations
    THEN
    I .           \ all iterations
  NEXT ;
3 test-aft1
\ display for 3 aft 2 aft 1 aft 0
```

again   --

Mark the end on an infinit loop of type `begin ... again`

```
: test ( -- )
    begin
        ." Diamonds are forever" cr
    again
 ;
```

align   --

Align the current data section dictionary pointer to cell boundary.

aligned   addr1 -- addr2

addr2 is the first aligned address greater than or equal to addr1.

allot   n --

Reserve n address units of data space.

also   --

Duplicate the vocabulary at the top of the vocabulary stack.

AND   n1 n2 --- n3

Execute logic AND.

The words `AND`, `OR`, and `XOR` perform operations binary **bitwise** logic on single-precision integers at the top of the data stack.

```
0   0 and .      \ display 0
0  -1   and .    \ display 0
-1    0 and .    \ display 0
-1    -1   and . \ display -1
```

ansi   --

Selects the `ansi` vocabulary.

argc   -- n

Push content of `'argc` on stack

ARSHIFT   x1 u -- x2

Arithmetic right shift of u

asm   --

Select the `asm` vocabulary.

assert   fl --

For tests and asserts.

at-xy   x y --

Positions the cursor at the x y coordinates.

```
: menu ( -- )
    page
    10 4 at-xy
      0 bg 7 fg   ."  Your choice, press: " normal
    12 5 at-xy  ." A - accept"
    12 6 at-xy  ." D - deny"
  ;
```

base -- addr

Single precision variable determining the current numerical base.

The `BASE` variable contains the value 10 (decimal) when FORTH starts.

```
DECIMAL      \ select decimal base
2 BASE !     \ selevt binary base

\ other example
: GN2 \ ( -- 16 10 )
   BASE @ >R HEX BASE @ DECIMAL BASE @ R> BASE !
  ;
```

begin --

Mark start of a structure `begin..until`, `begin..again` or `begin..while..repeat`

```
: endless ( -- )
    0
    begin
        dup . 1+
    again
  ;
```

bg color[0..255] --

Selects the background display color. The color is in the range 0..255 in decimal.

```
: testBG ( -- )
  normal
  256 0 do
    i bg ." X"
  loop ;
```

BIN mode -- mode'

Modify a file-access method to include BINARY.

BINARY --

Select binary base.

```
255 BINARY .    \ display 11111111
DECIMAL         \ return to decimal base
```

bl -- 32

Value 32 on stack.

```
\ definition of bl
: bl   ( -- 32 )
    32
  ;
```

blank addr len --

If len is greater than zero, store byte $20 (space) in each of len consecutive characters of memory beginning at addr.

block n -- addr

Get addr 1024 byte for block n.

block-fid -- n

Flag indicating the state of a block file.

block-id -- n

Pointer to a block file.

buffer n - addr

Get a 1024 byte block without regard to old contents.

bye --

Word defined by `defer`.

c! c addr --

Stores an 8-bit c value at address addr.

c, c --

Append c to the current data section.

```
create myDatas
    36 c,   42 c,   24 c,   12 c,
myDatas 1+ c@    \ push 42 on stack
```

c@ addr -- c

Retrieves the 8-bit c value stored at address addr.

CASE --

```
: day ( n -- addr len )
    CASE
        0 OF s" Sunday"      ENDOF
        1 OF s" Monday"      ENDOF
        2 OF s" Tuesday"     ENDOF
        3 OF s" Wednesday"   ENDOF
        4 OF s" Thursday"    ENDOF
        5 OF s" Friday"      ENDOF
        6 OF s" Saturday"    ENDOF
    ENDCASE
  ;
```

cat   -- <path>

Display the file content.

```
cat /tools/dumpTool.txt
\ display content of file dumpTool.txt
\ if this file was edited and saved in /spiffs/ file system
```

catch   cfa -- fl

Initializes an action to perform in the event of an exception triggered by `throw`.

cell   -- 8

Return number of bytes in a 64-bit integer.

```
cell .     \ display 8
```

cell+   n -- n'

Increment `CELL` content.

cell/   n -- n'

Divide `CELL` content.

cells   n -- n'

Multiply `CELL` content.

Allows you to position yourself in an array of integers.

```
create table ( -- addr)
    1 ,  5 ,  10 ,  50 ,  100 , 500 ,
\ get values indexed 0 and 3 from table
table 0 cells + @ .   \ display 1
table 3 cells + @ .   \ display 50
```

char   -- <string>

Word used in interpretation only.

Leave the first character of the string following this word.

```
char v .             \ display: 118 (ascii code for "v")
char house .         \ display: 104 - code for "h"
```

CLOSE-FILE   fileid -- ior

Close an open file.

cmove   c-addr1 c-addr2 u --

If u is greater than zero, copy u consecutive characters from the data space starting at c-addr1 to that starting at c-addr2, proceeding character-by-character from lower addresses to higher addresses.

code   -- <:name>

Defines a word whose definition is written in assembly language.

constant   comp: n -- <name> | exec: -- n

Define a constant.

```
$00000001 constant SDL_INIT_TIMER           \ timer subsystem
$00000010 constant SDL_INIT_AUDIO           \ audio subsystem
$00000020 constant SDL_INIT_VIDEO           \ video subsystem; automatically
initializes the events subsystem
$00000200 constant SDL_INIT_JOYSTICK        \ joystick subsystem; automatically
initializes the events subsystem
```

context   -- addr

Pointer to pointer to last word of context vocabulary

copy   from to --

Copy contents of block 'from' to block 'to'

cp   -- "src" "dst"

Copy "src" file to "dst".

cr   --

Show a new line return.

```
: .result ( ---)
    ." Port analys result" cr
    . "pool detectors" cr ;
```

CREATE   comp: -- <name> | exec: -- addr

The word **CREATE** can be used alone.

The word after **CREATE** is created in the dictionary, here **DATAS**. The execution of the word thus created deposits on the data stack the memory address of the parameter zone. In this example, we have compiled 4 8-bit values. To recover them, it will be necessary to increment the address stacked with the value shifting the data to be recovered.

```
\ Peripherals accessed by the CPU via 0x3FF40000 ~ 0x3FF7FFFF address space
\ (DPORT address) can also be accessed via 0x60000000 ~ 0x6003FFFF
\ (AHB address). (0x3FF40000 + n) address and (0x60000000 + n)
\ address access the same content, where n = 0 ~ 0x3FFFF.
create uartAhbBase
    $60000000 ,
    $60010000 ,
    $6002E000 ,

: REG_UART_AHB_BASE { idx -- addr }      \ id=[0,1,2]
    uartAhbBase  idx cell *  + @
  ;
```

CREATE-FILE   a n mode -- fh ior

Create a file on disk, returning a 0 ior for success and a file id.

current   -- cfa

Pointer to pointer to last word of current vocabulary

```
: test ( -- )
   ." only for test" ;
current @ @ >name type   \ display test
```

DECIMAL   --

Selects the decimal number base. It is the default digital base when FORTH starts.

```
HEX
FF DECIMAL .   \ display 255
```

default-key   -- c

Execute `win-key`.

default-key?   -- fl

Execute `win-key?`.

default-type   addr len --

Execute `win-type`.

defer   -- <vec-name>

Define a deferred execution vector.

`vec-name` execute the word whose execution token is stored in vec-name's data space.

DEFINED?   -- <word>

Returns a non-zero value if the word is defined. Otherwise returns 0.

```
\ other example:
```

```
DEFINED? --DAout [if] forget --DAout  [then]
create --DAout
```

definitions   --

Make the compilation word list the same as the first word list in the search order. Specifies that the names of subsequent definitions will be placed in the compilation word list. Subsequent changes in the search order will not affect the compilation word list.

```
VOCABULARY LOGO          \ create vocabulary LOGO
LOGO DEFINITIONS         \ will set LOGO context vocabulary
: EFFACE
    page ;               \ create word EFFACE in LOGO vocabulary
```

depth   -- n

n is the number of single-cell values contained in the data stack before n was placed on the stack.

```
\ test this after reset:
depth       \ leave 0 on stack
10 32 25
depth       \ leave 3 on stack
```

do   n1 n2 --

Set up loop control parameters with index n2 and limit n1.

```
: testLoop
    256 32 do
        I emit
    loop
  ;
```

DOES>   comp: -- | exec: -- addr

The word **CREATE** can be used in a new word creation word...

Associated with **DOES>**, we can define words that say how a word is created then executed.

drop   n --

Removes the single-precision integer that was there from the top of the data stack.

```
2 5 8  drop   \ leave 2 and 5 on stack
```

dump   a n --

Dump a memory region

dump-file   addr len addr2 len2 --

Transfers the contents of a text string addr len to a file pointed by addr2 len2

The content of the */spiffs/autoexec.fs* file is automatically interpreted and/or compiled when ESP32Forth starts.

This feature can be leveraged to set up WiFi access when starting ESP32Forth by injecting the access parameters like this:

dup   n -- n n

Duplicates the single-precision integer at the top of the data stack.

```
: SQUARE ( n --- nE2)
    DUP * ;
5 SQUARE .     \ display 25
10 SQUARE .    \ display 100
```

echo   -- addr

Variable. Value is -1 by default. If 0, commands are not displayed.

editor   --

Select `editor`.

- `l` lists the content of the current block
- `n` select the next block
- `p` select the previous block
- `wipe` empties the content of the current block
- `d` delete line n. The line number must be in the range 0..14. The following lines go up.

  Example: `3 D` erases the content of line 3 and brings up the content of lines 4 to 15.
- `e` erases the content of line n. The line number must be in the range 0..15. The other lines do not go up.
- `a` inserts a line n. The line number must be in the range 0..14. The lines located after the inserted line come down.

  Example: `3 A test` inserts **test** on line 3 and move the contents of lines 4 to 15.
- `r` replaces the content of line n. Example: `3 R test` replace the contents of line 3 with **test**

else --

Word of immediate execution and used in compilation only. Mark a alternative in a control structure of the type `IF ... ELSE ... THEN`

At runtime, if the condition on the stack before `IF` is false, there is a break in sequence with a jump following `ELSE`, then resumed in sequence after `THEN`.

```
: TEST ( ---)
    CR ." Press a key " KEY
    DUP 65 122 BETWEEN
    IF
        CR 3 SPACES ." is a letter "
    ELSE
        DUP 48 57 BETWEEN
        IF
            CR 3 SPACES ." is a digit "
        ELSE
            CR 3 SPACES ." is a special character "
        THEN
    THEN
    DROP ;
```

emit x --

If x is a graphic character in the implementation-defined character set, display x.

The effect of `EMIT` for all other values of x is implementation-defined.

When passed a character whose character-defining bits have a value between hex 20 and 7E inclusive, the corresponding standard character is displayed. Because different output devices can respond differently to control characters, programs that use control characters to perform specific functions have an environmental dependency. Each `EMIT` deals with only one character.

```
65 emit     \ display A
66 emit     \ display B
```

empty-buffers --

Empty all buffers.

ENDCASE --

Marks the end of a `CASE OF ENDOF ENDCASE` structure

```
: day ( n -- addr len )
    CASE
        0 OF s" Sunday"     ENDOF
        1 OF s" Monday"     ENDOF
        2 OF s" Tuesday"    ENDOF
        3 OF s" Wednesday"  ENDOF
        4 OF s" Thursday"   ENDOF
        5 OF s" Friday"     ENDOF
        6 OF s" Saturday"   ENDOF
    ENDCASE
  ;
```

ENDOF --

Marks the end of a `OF .. ENDOF` choice in the control structure between `CASE ENDCASE`.

```
: day ( n -- addr len )
    CASE
        0 OF s" Sunday"     ENDOF
        1 OF s" Monday"     ENDOF
        2 OF s" Tuesday"    ENDOF
        3 OF s" Wednesday"  ENDOF
        4 OF s" Thursday"   ENDOF
        5 OF s" Friday"     ENDOF
        6 OF s" Saturday"   ENDOF
    ENDCASE
  ;
```

erase addr len --

If len is greater than zero, store byte $00 in each of len consecutive characters of memory beginning at addr.

evaluate addr len --

Evaluate the content of a string.

```
s" words"
evaluate   \ execute the content of the string, here: words
```

EXECUTE xt --

Execute word at xt.

Take the execution address from the data stack and executes that token. This powerful word allows you to execute any token which is not a part of a token list.

exit --

Aborts the execution of a word and gives back to the calling word.

Typical use: `: X ... test IF ... EXIT THEN ... ;`

At run time, the word `EXIT` will have the same effect as the word `;`

extract n base -- n c

Extract the least significant digit of n. Leave on the stack the quotient of n/base and the ASCII character of this digit.

F* r1 r2 -- r3

Multiplication of two real numbers.

```
1.35e 2.2e F*
F.  \ display 2.969999
```

F** r_val r_exp -- r

Raises a real r_val to the power r_exp.

```
2e 3e f** f.    \ display 8.000000
  2e 4e f** f.    \ display 16.000000
 10e 1.5e f** f.  \ display 31.622776
```

F+ r1 r2 -- r3

Addition of two real numbers.

```
3.75e 5.21e F+
F.  \ display 8.960000
```

F- r1 r2 -- r3

Subtraction of two real numbers.

```
10.02e 5.35e F-
F.  \ display 4.670000
```

f. r --

Displays a real number. The real number must come from the real stack.

```
pi f.    \ display 3.141592
```

f.s --

Display content of reals stack.

```
2.35e
36.512e
f.s  \ display: <2> 2.350000 36.511996
```

F/ r1 r2 -- r3

Division of two real numbers.

```
22e 7e F/   \ PI approximation
F.          \ display 3.142857
```

F0< r -- fl

Tests if a real number is less than zero.

```
5e F0<    \ leave  0 on stack
-3e F0<    \ leave -1 on stack
```

F0= r -- fl

Indicates true if the real is null.

```
3e 3e F- F0= .  \ display -1
```

f< r1 r2 -- fl

fl is true if r1 < r2

```
3.2e 5.25e f<
.  \ display -1
```

f<= r1 r2 -- fl

fl is true if r1 <= r2.

```
3.2e 5.25e f<=
.  \ display -1
5.25e 5.25e f<=
.  \ display -1
8.3e 5.25e f<=
.  \ display 0
```

f<> r1 r2 -- fl

fl is true if r1 <> r2.

```
3.2e 5.25e f<>
.  \ display -1
5.25e 5.25e f<>
.  \ display 0
```

f= r1 r2 -- fl

fl is true if r1 = r2.

```
3.2e 5.25e f=
.  \ display 0
5.25e 5.25e f=
.  \ display -1
```

f> r1 r2 -- fl

fl is true if r1> r2.

```
3.2e 5.25e f>
.  \ display 0
```

f>=   r1 r2 -- fl

fl is true if r1> = r2.

```
3.2e 5.25e f>=
.  \ display 0
5.25e 5.25e f>=
.  \ display -1
8.3e 5.25e f>=
.  \ display -1
```

F>S   r -- n

Convert a real to an integer. Leaves the integer part on the data stack if the real has fractional parts.

```
3.5e F>S .   \ display 3
```

FABS   r1 -- r1'

Returns the absolute value of a real number.

```
-2e FABS F.  \ display 2.000000
```

FATAN2   r-tan -- r-rad

Calculates the angle in radians from the tangent.

```
0.5e fatan2 f.    \ display 1.325917
  1e fatan2 f.    \ display 0.785398
```

fconstant   comp: r -- <name> | exec: -- r

Defines a constant of type real.

```
9.80665e fconstant g    \ gravitation constant on Earth
g f.  \ display 9.806649
```

FCOS   r1 -- r2

Calculates the cosine of an angle expressed in radians.

```
pi 2e f/       \ calc angle 90 deg
FCOS F.        \ display 0.000000
```

fdepth -- n

n is the number of reals values contained in the real stack.

FDROP r1 --

Drop real r1 from real stack.

FDUP r1 -- r1 r1

Duplicate real r1 from real stack.

FEXP ln-r -- r

Calculate the real corresponding to e EXP r

```
4.605170e FEXP F.    \ display 100.000018
```

fg color[0..255] --

Selects the text display color. The color is in the range 0..255 in decimal.

```
: testFG ( -- )
  256 0 do
    i fg ." X"
  loop ;
```

file-exists? addr len --

Tests if a file exists. The file is designated by a character string.

FILE-POSITION fileid -- ud ior

Return file position, and return ior=0 on success.

FILE-SIZE fileid -- ud ior

Get size in bytes of an open file as a double number, and return ior=0 on success.

fill addr len c --

If len is greater than zero, store c in each of len consecutive characters of memory beginning at addr.

FIND addr len -- xt | 0

Find a word in dictionnary.

```
32 string t$
s" vlist" t$ $!
t$ find    \ push cfa of VLIST on stack
```

fliteral r:r --

Immediate execution word. Compiles a real number.

FLN r -- ln-r

Calculates the natural logarithm of a real number.

```
100e FLN f.    \ display 4.605170
```

FLOOR r1 -- r2

Rounds a real down to the integer value.

```
45.67e FLOOR F.   \ display 45.000000
```

flush --

Save and empty all buffers.

After editing the contents of a block file, running `flush` ensures that changes to the contents of blocks are saved.

FLUSH-FILE fileid — ior

Attempt to force any buffered information written to the file referred to by fileid to be written to mass storage. If the operation is successful, ior is zero.

FMAX r1 r2 -- r1|r2

Let the greatest real of r1 or r2.

```
3e 4e FMAX F.    \ display 4.000000
```

FMIN r1 r2 -- r1|r2

Let the smaller real of r1 or r2.

```
3e 4e FMIN F.    \ display 3.000000
```

FNEGATE r1 -- r1'

Reverses the sign of a real number.

```
5e FNEGATE f.     \ display -5.000000
-7e FNEGATE f.     \ display  7.000000
```

FNIP r1 r2 -- r2

Delete second element on reals stack.

```
2.5e 4.32e
fnip
f.s  \ display: <1> 4.320000
```

for n --

Marks the start of a loop `for .. next`

WARNING: the loop index will be processed in the interval [n..0], i.e. n+1 iterations, which is contrary to the other versions of the FORTH language implementing FOR..NEXT (FlashForth).

```
: myLoop ( ---)
    10 for
        r@ . cr  \ display loop index
    next
  ;
```

forget -- <name>

Searches the dictionary for a name following it. If it is a valid word, trim dictionary below this word. Display an error message if it is not a valid word.

forth --

Select the `FORTH` vocabulary in the word search order to execute or compile words.

forth-builtins -- cfa

Entry point of `forth` vocabulary.

FOVER r1 r2 -- r1 r2 r1

Duplicate second real on reals stack.

```
2.6e 3.4e fover
f.s  \ display <3> 2.600000 3.400000 2.600000
```

fp0 -- addr

Points to the bottom of reals stack.

FP@ -- addr

Retrieves the stack pointer address of the reals.

FSIN r1 -- r2

Calculates the sine of an angle expressed in radians.

```
pi 2e f/      \ calc angle 90¨ deg
```

```
FSIN F.        \ display 1.000000
```

FSINCOS r1 -- rcos rsin

Calculates the cosine eand sine of an angle expressed in radians.

```
pi 4e f/
FSINCOS f. f.   \ display 0.707106 0.707106
pi 2e f/
FSINCOS f. f.   \ display 0.000000 1.000000
```

fsqrt r1 -- r2

Square root of a real number.

```
64e fsqrt
F.          \ display 8.000000
```

FSWAP r1 r2 -- r1 r2

Reverses the order of the two values on the ESP32Forth real stack.

```
3.75e 5.21e FSWAP
F.  \ display 3.750000
F.  \ display 5.210000
```

fvariable comp: -- <name> | exec: -- addr

Defines a floating point variable.

```
fvariable arc
pi 0.5e F*  \ angle 90° in radian   --  PI/2
arc SF!
arc SF@ f.  \ display 1.570796
```

graphics --

select `graphics` vocabulary.

here -- addr

Leave the current data section dictionary pointer.

The dictionary pointer is incremented as the words are compiled and variables and data tables are defined.

```
here u.        \ display 1073709120
: null ;
here u.        \ display 1073709144
```

HEX --

Selects the hexadecimal digital base.

```
255 HEX .    \ display FF
DECIMAL      \ return to decimal base
```

hld -- addr

Pointer to text buffer for number output.

hold c --

Inserts the ASCII code of an ASCII character into the character string initiated by **<#**.

i -- n

n is a copy of the current loop index.

```
: mySingleLoop ( -- )
    cr
    10 0 do
        i .
    loop
  ;
mySingleLoop
\ display 0 1 2 3 4 5 6 7 8 9
```

if fl --

The word **IF** is executed immediately.

IF marks the start of a control structure for type **IF..THEN** or **IF..ELSE..THEN**.

```
: WEATHER? ( fl ---)
    IF
        ." Nice weather "
    ELSE
        ." Bad weather "
    THEN ;
1 WEATHER?    \ display: Nice weather
0 WEATHER?    \ display: Bad weather
```

immediate --

Make the most recent definition an immediate word.

Sets the compile-only lexicon bit in the name field of the new word just compiled. When the interpreter encounters a word with this bit set, it will not execute this word, but spit out an error message. This bit prevents structure words to be executed accidentally outside of a compound word.

include -- <:name>

Loads the contents of a file designated by <name>.

included addr len --

Loads the contents of a file from the SPIFFS filesystem, designated by a character string.

The word `included` can be used in a FORTH listing stored in the SPIFFS file system.

For this reason, the filename to load should always be preceded by */spiffs/*

included? addr len -- f

Tests whether the file named in the character string has already been compiled.

internalized --

select `internalized` vocabulary.

internals --

Select `internals` vocabulary.

invert x1 -- x2

Complement to one of x1. Acts on 16 or 32 bits depending on the FORTH versions.

```
1 invert .  \ display -2
```

is --

Affecte le code d'exécution d'un mot à un mot d'exécution vectorisée.

j -- n

n is a copy of the next-outer loop index.

```
: myDoubleLoop ( -- )
    cr
    10 0 do
        cr
        10 0 do
            i 1+  j 1+  * .
        loop
    loop
  ;
myDoubleLoop
\ display:
1 2 3 4 5 6 7 8 9 10
2 4 6 8 10 12 14 16 18 20
3 6 9 12 15 18 21 24 27 30
4 8 12 16 20 24 28 32 36 40
5 10 15 20 25 30 35 40 45 50
6 12 18 24 30 36 42 48 54 60
```

```
7 14 21 28 35 42 49 56 63 70
8 16 24 32 40 48 56 64 72 80
9 18 27 36 45 54 63 72 81 90
10 20 30 40 50 60 70 80 90 100
```

k -- n

n is a copy of the next-next-outer loop index.

```
: myTripleLoop ( -- )
    cr
    5 0 do
        cr
        5 0 do
            cr
            5 0 do
                i 1+  j 1+  k 1+  * * .
            loop
        loop
    loop
  ;
myTripleLoop
```

key -- char

Waits for a key to be pressed. Pressing a key returns its ASCII code.

```
key .    \ display 97 if key "a" is active
key .    \ affiche 65 if key "A" is active
```

key? -- fl

Returns *true* if a key is pressed.

```
: keyLoop
    begin
    key? until
  ;
```

L! n addr --

Store a value n. n is a 32 bits value.

L, n --

Word not implemented in eForth Windows.

Stores a value in 32-bit format in the dictionary.

Definition:

```
DEFINED? L, invert [IF]
\ compile 32 bits value in dictionnary
: L,  ( u -- )
```

```
    dup c,
    8 rshift dup c,
    8 rshift dup c,
    8 rshift dup c,
    drop
  ;
[THEN]
```

latestxt -- xt

Stacks the execution code (cfa) address of the last compiled word.

```
: txtxtx  ;
latest
>name type  \ display txtxtx
```

leave --

Prematurely terminates the action of a `do..loop` loop.

list n --

Displays the contents of block n.

literal x --

Compiles the value x as a literal value.

```
: valueReg ( --- n)
   [ 36 2 * ] literal ;

\ equivalent to:
: valueReg ( --- n)
   72 ;
```

load n --

Evaluate a block.

`load` preceded by the number of the block you want to execute and/or compile the content. To compile the content of our block 0, we will execute `0 load`

loop --

Add one to the loop index. If the loop index is then equal to the loop limit, discard the loop parameters and continue execution immediately following the loop. Otherwise continue execution at the beginning of the loop.

```
: myLoop
  128 32 do
    i emit
  loop ;
```

LSHIFT x1 u -- x2

Shift to the left of u bits by the value x1.

```
8 2 lshift .  \ display 32
```

max n1 n2 -- n1|n2

Leave the unsigned larger of u1 and u2.

min n1 n2 -- n1|n2

Leave min of n1 and n2

mod n1 n2 -- n3

Divide n1 by n2, giving the single-cell remainder n3.

The modulo function can be used to determine the divisibility of one number by another.

```
21 7 mod . \ display 0
22 7 mod . \ display 1
23 7 mod . \ display 2
24 7 mod . \ display 3

: DIV? ( n1 n2 ---)
    OVER OVER MOD CR
    IF
        SWAP . ." is not "
    ELSE
        SWAP . ." is "
    THEN
    ." divisible by " .
 ;
```

ms n --

Waiting in millisencondes.

For long waits, set a wait word in seconds.

```
500 ms \ delay for 1/2 second

: seconds ( n --)
    0
    for
        1000 ms
    next
  ;
12 seconds \ delay for 12 seconds
```

ms-ticks -- n

System ticks. One tick per millisecond.

Useful for measuring the execution time of a definition.

```
: ms-ticks ( -- n )
    GetTickCount ;
```

mv -- "src" "dest"

Rename "src" file to "dst".

n. n --

Display anay value n in decimal format.

negate n -- -n'

Two's complement of n.

```
5 negate .    \ display -5
```

next --

Marks the end of a loop `for .. next`

```
: myLoop
  24 for
    r@ .
  next ;
myLoop   \ display: 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3
2 1 0
```

nip n1 n2 -- n2

Remove n1 from the stack.

nl -- 10

Value 10 on stack.

normal --

Disables selected colors for display.

OCTAL --

Selects the octal digital base.

```
255 OCTAL .      \ display 377
DECIMAL          \ return to decimal base
```

OF n --

Marks a `OF .. ENDOF` choice in the control structure between `CASE ENDCASE`

If the tested value is equal to the one preceding `OF`, the part of code located between `OF` `ENDOF` will be executed.

```
: day ( n -- addr len )
    CASE
        0 OF s" Sunday"     ENDOF
        1 OF s" Monday"     ENDOF
        2 OF s" Tuesday"    ENDOF
        3 OF s" Wednesday"  ENDOF
        4 OF s" Thursday"   ENDOF
        5 OF s" Friday"     ENDOF
        6 OF s" Saturday"   ENDOF
    ENDCASE
  ;
```

ok --

Displays the version of the FORTH language.

```
ok
\ display: uEforth
```

only --

Reset context stack to one item, the FORTH dictionary

Non-standard, as there's no distinct ONLY vocabulary

open-blocks addr len --

Open a block file. The default blocks file is *blocks.fb*

OPEN-FILE addr n opt -- n

Open a file.

opt is one of the values `R/O` or `R/W` or `W/O`.

```
s" myFile" r/o open-file
```

OR n1 n2 -- n3

Execute logic OR.

The words `AND`, `OR`, and `XOR` perform operations binary **bitwise** logic on single-precision integers at the top of the data stack.

```
0  -1    or  .  \ display 0
0  -1    or  .  \ display -1
-1   0   or  .  \ display -1
-1   -1  or  .  \ display -1
```

order --

Print the vocabulary search order.

```
windows
order   \ display: windows >> FORTH
```

over n1 n2 -- n1 n2 n1

Place a copy of n1 on top of the stack.

```
2 5 OVER  \ duplicate 2 on top of the stack
```

page --

Erases the screen.

PARSE c "string" -- addr count

Parse the next word in the input stream, terminating on character c. Leave the address and character count of word. If the parse area was empty then count=0.

pause --

Yield to other tasks.

PI -- r

PI constant.

```
pi
F.          \ display 3.141592
\ perimeter of a circle, for r = 5.2   ---   P = 2 π R
5.2e 2e F*  pi  F*
F.          \ display 32.672560
```

precision -- n

Pseudo constant determining the display precision of real numbers.

Initial value 6.

If we reduce the display precision of real numbers below 6, the calculations will be when even performed with precision to 6 decimal places.

```
precision . \ display 6
pi f.       \ display 3.141592
4 set-precision
precision . \ display 4
pi f.       \ display 3.1415
```

prompt   --

Displays an interpreter availability text. Default poster:

`ok`

r"   comp: -- <string> | exec: addr len

Creates a temporary counted string ended with "

R/O   -- 0

System constant. Stack 0.

R/W   -- 2

System constant. Stack 2.

r>   R: n -- S: n

Transfers n from the return stack.

This operation must always be balanced with `>r`

```
\ display n in binary format
: b. ( n -- )
    base @ >r
    binary .
    r> base !
  ;
```

R@   -- n

Copies the contents of the top of the return stack onto the data stack.

rdrop   S: -- R: n --

Discard top item of return stack.

READ-FILE   a n fh -- n ior

Read data from a file. The number of character actually read is returned as u2, and ior is returned 0 for a successful read.

recognizers   --

Select `recognizers` vocabulary.

recurse   --

Append the execution semantics of the current definition to the current definition.

The usual example is the coding of the factorial function.

```
: FACTORIAL ( +n1 -- +n2)
   DUP 2 < IF DROP 1 EXIT THEN
   DUP 1- RECURSE *
;
```

remaining -- n

Indicates the remaining space for your definitions.

```
remaining .       \ display 76652
: t ;
remaining .       \ display 76632
```

remember --

Save a snapshot to the default file.

The word `REMEMBER` allows you to *freeze* the compiled code. If you compiled an application, run `REMEMBER`. Unplug the ESP32 board. Plug it back in. You should find your app.

Use `STARTUP:` to set your application's password to run on startup.

repeat --

End a indefinite loop `begin.. while.. repeat`

REPOSITION-FILE ud fileid -- ior

Set file position, and return ior=0 on success

required addr len --

Loads the contents of the file named in the character string if it has not already been loaded.

reset --

Delete the default filename.

RESIZE-FILE ud fileid -- ior

Set the size of the file to ud, an unsigned double number. After using `RESIZE-FILE`, the result returned by `FILE-POSITION` may be invalid

restore -- <:name>

Restore a snapshot from a file.

revive --

Restore the default filename.

rm -- "path"

Delete the file designed in file path.

rot n1 n2 n3 -- n2 n3 n1

Rotate three values on top of stack.

rp0 -- addr

Points to the bottom of Forth's return stack.

RSHIFT x1 u -- x2

Right shift of the value x1 by u bits.

```
64 2 rshift .  \ display 16
```

r| comp: -- <string> | exec: addr len

Creates a temporary counted string ended with |

s" comp: -- <string> | exec: addr len

In interpretation, leaves on the data stack the string delimited by "

In compilation, compiles the string delimited by "

When executing the compiled word, returns the address and length of the string...

```
\ header for DUMP
: headDump
    s" --addr----- 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F"
  ;
headDump        \ push addr len on stack
headDump type   \ display: --addr----- 00 01 02 03 04 05 06 07 08 09 0A 0B 0C
0D 0E 0F
```

S>F n -- r: r

Converts an integer to a real number and transfers this real to the stack of reals.

```
35 S>F
F.   \ display 35.000000
```

s>z a n -- z

Convert a counted string string to null terminated (copies string to heap)

save -- <:name>

Saves a snapshot of the current dictionary to a file.

save-buffers --

Save all buffers.

SCR -- addr

Variable pointing to the block being edited.

SDL2 --

Select `SDL2` vocabulary.

see -- name>

Decompile a FORTH definition.

```
see include
: include  bl PARSE included ;

see space
: space  bl emit ;
```

set-precision n --

Changes the display precision of Real numbers.

The calculation precision on real numbers stops at 6 decimal places. If you request a precision greater than 6 on the decimal places of real numbers, the values displayed beyond 6 decimal places will be false.

```
pi f.    \ display 3.141592
2 set-precision
pi f.    \ display 3.14
```

set-title a n --

Changes the title of the eForth Windows window.

SF! r addr --

Stores a real previously deposed on the real stack at the memory address addr.

```
fvariable PRICE
3.25E PRICE SF!
```

sf, r --

Compile a real number.

SF@ addr -- r

Get the actual number stored at address addr, usually a variable defined by `fvariable`.

```
fvariable PRICE
35.25E PRICE SF!
PRICE SF@ F.     \ display: 35.250000
```

sfloat -- 4

Constant. value 4.

sfloat+ addr -- addr+4

Increments a memory address by the length of a real.

sfloats n -- n*4

Calculate needed space for n reals.

SL@ addr -- n

Retrieves a signed 32-bit value from address addr.

sp0 -- addr

Points to the bottom of Forth's parameter stack.

SP@ -- addr

Push on stack the address of data stack.

```
\ return number cells used on stack
: stackSize ( -- n )
    SP@ SP0 - CELL/
  ;
```

space --

Display one space.

```
\ definition of space
: space  ( -- )
    bl emit
  ;
```

spaces n --

Displays the space character n times.

Defined since version 7.071

startup: -- <name>

Indicates the word that should run when ESP32forth starts after initialization of the general environment.

state -- fl

Compilation state. State can only be changed by `[` and `]`.

-1 for compiling, 0 for interpreting

str n -- addr len

Transforms any value n into an alphanumeric string, in the current numeric base.

```
352 str type    \ display: 352
```

str= addr1 len1 addr2 len2 -- fl

Compare two strings. Leave true if they are identical.

```
s" 123"   s" 124"
str = .        \ display 0
s" 156"   s" 156"
str= .         \ display -1
```

streams --

Select `streams` vocabulary.

structures --

Select the `structures` vocabulary.

```
structures
\ Information about the version of SDL in use
struct SDL_version    ( -- 3 )             \ OK 2024-11-06
     i8 field ->version-major
     i8 field ->version-minor
     i8 field ->version-patch
```

SW@ addr -- n

Retrieves a signed 16-bit value from address addr.

swap n1 n2 -- n2 n1

Swaps values at the top of the stack.

```
2 5 SWAP
.   \ display 2
.   \ display 5
```

task   comp: xt dsz rsz -- <name> | exec: -- task

Create a new task with dsz size data stack and rsz size return stack running xt.

```
tasks
: hi   begin ." Time is: " ms-ticks . cr 1000 ms again ;
' hi 100 100 task my-counter
my-counter start-task hi
```

tasks   --

Select `tasks` vocabulary.

then   --

Immediate execution word used in compilation only. Mark the end a control structure of type `IF..THEN` or `IF..ELSE..THEN` .

throw   n --

Generates an error if n is not equal to zero.

If any bits of n are non-zero, pop the topmost exception frame from the exception stack, along with everything on the return stack above that frame. Then restore the input source specification in use before the corresponding CATCH and adjust the depths of all stacks defined by this standard so that they are the same as the depths saved in the exception frame (i is the same number as the i in the input arguments to the corresponding CATCH), put n on top of the data stack, and transfer control to a point just after the CATCH that pushed that exception frame.

```
: could-fail ( -- char )
   KEY DUP [CHAR] Q = IF 1 THROW THEN ;

: do-it ( a b -- c) 2DROP could-fail ;

: try-it ( --)
   1 2 ['] do-it CATCH IF
   ( x1 x2 ) 2DROP ." There was an exception" CR
   ELSE ." The character was " EMIT CR
   THEN
;

: retry-it ( -- )
   BEGIN 1 2 ['] do-it CATCH WHILE
   ( x1 x2) 2DROP ." Exception, keep trying" CR
   REPEAT ( char )
   ." The character was " EMIT CR
;
```

thru   n1 n2 --

Loads the contents of a block file, from block n1 to block n2.

tib -- addr

returns the address of the the terminal input buffer where input text string is held.

```
tib >in @ type
\ display:
tib >in @
```

to n --- <valname>

`to` assign new value to *valname*

```
0 value MAX_SCORE
120 to MAX_SCORE
```

touch -- "path"

Create "path" file if it doesn't exist.

type addr c --

Display the string characters over c bytes.

```
: hello ( --- addr c)
s" Hello world" ;
hello type              \ display: Hello world
hello drop 5 type       \ display: Hello
```

u. n --

Removes the value from the top of the stack and displays it as an unsigned single precision integer.

```
1 U.      \ display 1
-1 U.     \ display 18446744073709551615
```

U/MOD u1 u2 -- rem quot

Unsigned int/int->int division.

UL@ addr -- un

Retrieve a unsigned 32 bits value.

unloop --

Stop a do..loop action. Using `unloop` before `exit` only in a do..loop structure.

```
: example ( -- )
    100 0 do
        cr i .
        key bl = if
```

```
            unloop exit
        then
    loop
  ;
```

until fl --

End of **begin.. until** structure.

```
: myTestLoop ( -- )
    begin
        key dup .
        [char] A =
    until
  ;
myTestLoop \ end loop if key A pressed
```

update --

Used for block editing. Forces the current block to the modified state.

use -- <name>

Use "name" as the blockfile.

```
USE /spiffs/foo
```

used -- n

Specifies the space taken up by user definitions. This includes already defined words from the FORTH dictionary.

UW@ addr -- un[2exp0..2exp16-1]

Extracts the least significant 16 bits part of a memory zone pointed to by its unsigned address.

```
variable valX
hex 10204080 valX !
valX UW@ .      \ display 4080
valX 2 + UW@ .  \ display 1020
```

value comp: n -- <valname> | exec: -- n

Define value.

valname leave value on stack.

A Value behaves like a Constant, but it can be changed.

```
12 value APPLES     \ Define APPLES with an initial value of 12
34 to APPLES        \ Change the value of APPLES. to is a parsing word
```

```
APPLES                    \ puts 34 on the top of the stack
```

variable   comp: -- <name> | exec: -- addr

Creation word. Defines a simple precision variable.

```
variable speed
75 speed !    \ store 75 in speed
speed @ .     \ display 75
```

visual   --

Selects the `visual` vocabulary.

vlist   --

Display all words from a vocabulary.

```
Serial vlist  \ display content of Serial vocabulary
```

vocabulary   comp: -- <name> | exec: --

Definition word for a new vocabulary. In 83-STANDARD, vocabularies are no longer declared to be executed immediately.

```
\ create new vocabulary FPACK
VOCABULARY FPACK
```

W!   n addr --

Stores a 16-bit value at address addr.

W/O   -- 1

System constant. Stack 1.

while   fl --

Mark the conditionnal part execution of a structure `begin..while..repeat`

```
\ logarithmus dualis of n1>0, rounded down to the next integer
: log2 ( +n1 -- n2 )
    2/ 0 begin
        over 0 >
    while
        1+ swap 2/ swap
    repeat
    nip
  ;
  7 log2 .      \ display 2
100 log2 .      \ display 6
```

windows   --

select windows vocabulary.

words   --

List the definition names in the first word list of the search order. The format of the display is implementation-dependent.

WRITE-FILE   a n fh -- ior

Write a block of memory to a file.

XOR   n1 n2 -- n3

Execute logic eXclusif OR.

The words AND, OR, and XOR perform operations binary **bitwise** logic on single-precision integers at the top of the data stack.

```
0 -1 xor .      \ display 0
0 -1  xor .     \ display -1
-1  0 xor .     \ display -1
-1  0  xor .    \ display 0
```

z"   comp: -- <string> | exec: -- addr

Compile zero terminated string into definition.

WARNING: these character strings marked with z" can only be used for specific functions.

z>s   z -- a n

Convert a null terminated string to a counted string.

[--

Enter interpretation state. [is an immediate word.

```
\ source for [
: [
    0 state !
    ; immediate
```

[']   comp: -- <name> | exec: -- addr

Use in compilation only. Immediate execution.

Compile the cfa of <name>

[char]   comp: -- <spaces>name | exec: -- xchar

Place xchar, the value of the first xchar of name, on the stack.

```
: GC1 [CHAR] X     ;
: GC2 [CHAR] HELLO ;
GC1 \ empile 58
GC2 \ empile 48
```

[ELSE] --

Mark a part of conditional sequence in `[IF] ... [ELSE] ... [THEN]`.

[IF] fl --

Begins a conditional sequence of type `[IF] ... [ELSE]` or `[IF] ... [ELSE] ... [THEN]`.

If flag is 'TRUE' do nothing (and therefore execute subsequent words as normal). If flag is 'FALSE', parse and discard words from the parse area including nested instances of `[IF]`.. `[ELSE]`.. '[THEN]' and `[IF]`.. `[THEN]` until the balancing `[ELSE]` or `[THEN]` has been parsed and discarded.

```
DEFINED? L, invert [IF]
\ compile 32 bits value in dictionnary
: L,   ( u -- )
    dup c,
    8 rshift dup c,
    8 rshift dup c,
    8 rshift dup c,
    drop
  ;
[THEN]
```

[THEN] --

Ends a conditional sequence of type `[IF] ... [ELSE]` or `[IF] ... [ELSE] ... [THEN]`.

```
DEFINED? mclr [IF]
: mclr   ( mask addr -- )
    dup >r c@ swap invert and r> c!
    ;
[THEN]
```

] --

Return to compilation. `]` is an immediate word.

With FlashForth, the words [and] allow you to use assembly code, subject to first compiling an assembler.

{   -- <names..>

Marks the start of the definition of local variables. These local variables behave like pseudo-constants.

Local variables are an interesting alternative to the manipulation of stack data. They make the code more readable.

```
: summ { n1 n2 }
    n1 n2 + . ;
3 5 summ    \ display 8
```

graphics

color -- n

Definie color. Default value: 0

```
\ Pen in red color:
$ff0000 to color    \ $rrggbb
```

CreatePen iStyle cWidth color -- hPen

Creates a logical pen that has the specified style, width, and color. The pen can then be selected in a device context and used to draw lines and curves.

Parameters:

- **iStyle** style of the line
- **cWidth** thickness of the line
- **color** color of the line

In return, we get a handle needed to select the pen.

```
0 value HPEN_RED
0 value HPEN_BLUE

: setPens   ( -- )
    PS_SOLID    3 $FF $00 $00 RGB CreatePen to HPEN_RED
    PS_DOT      1 $00 $00 $FF RGB CreatePen to HPEN_BLUE
  ;
```

event -- 0

Constant. Default Value 0

EXPOSED -- 2

Constant. Value 2

FINISHED -- 7

Constant. Value 7

g{ --

Preserve transform.

height -- 0

Value. Default Value 0

hwnd -- n

A window object is identified by a value called a window handle. And the window handle is of type HWND.

The word `CreateWindowExA` leaves a value that is stored in `hwnd`.

IDLE -- 0

Constant. Value 0

key-count -- 256

Constant. Value 255

last-char -- 0

Constant. Default Value 0

last-key -- 0

Constant. Default Value 0

LEFT-BUTTON -- 255

Constant. Value 255

LineTo hdc x y -- fl

Draws a line from the current position to, but not including, the specified point.

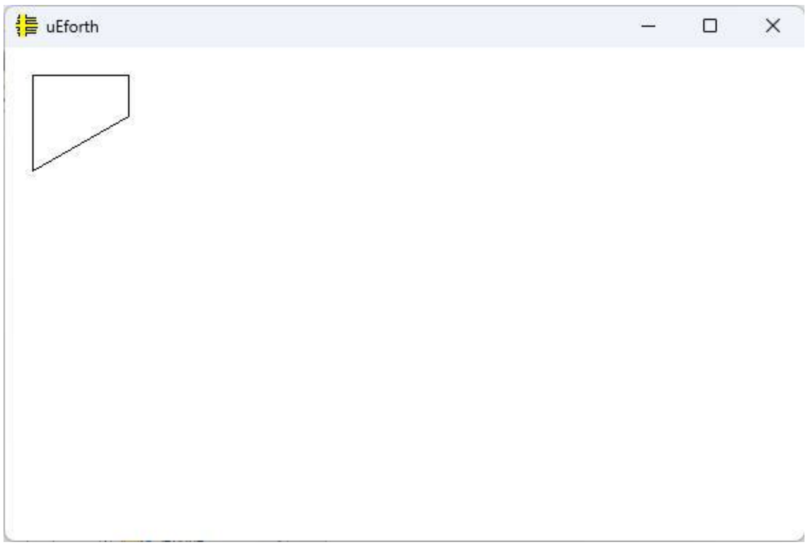
`LineTo` parameters:

- **hdc** Handle to a device context
- **x** Specifies the x coordinate, in logical units, of the new position
- **y** Specifies the y coordinate, in logical units, of the new position

Definition:

```
\ LineTo draws a line from the current position to,
\ but not including, the specified point.
z" LineTo"      3 Gdi32 LineTo ( hdc x y -- fl )

: draw
    hdc 20 20 NULL moveToEx drop
    hdc 90 20 LineTo drop
    hdc 90 50 LineTo drop
    hdc 20 90 LineTo drop
    hdc 20 20 LineTo drop
;
```



MIDDLE-BUTTON -- 254

Constant. Value 254

MOTION -- 3

Constant. Value 3

mouse-x -- 0

Constant. Default Value 0

mouse-y -- 0

Constant. Default Value 0

moveTo x y --

Moves graphic point to x y position from current position.

Source code:

```
create LPPOINT
    POINT allot

: moveTo ( x y -- )
    hdc -rot LPPOINT Gdi.MoveToEx gdiError
  ;
```

MoveToEx hdc x y LPPOINT -- fl

Updates the current position to the specified point and optionally returns the previous position.

`MoveToEx` parameters:

- **hdc** Handle to a device context

- **x** Specifies the x coordinate, in logical units, of the new position
- **y** Specifies the y coordinate, in logical units, of the new position
- **LPPOINT** Pointer to a `POINT` structure that receives the previous current position. If this parameter is a `NULL` pointer, the previous position is not returned

Definition:

```
\ MoveToEx updates the current position
z" MoveToEx"    4 Gdi32 MoveToEx ( hdc x y LPPOINT -- fl )
```

pixel   w h -- a

xxx

PRESSED   -- 4

Constant. Value 4

PS_DOT   -- 2

Constant. Value 2.

The pen is dotted. This style is valid only when the pen width is equal to or less than one device unit.

```
0 value HPEN_BLUE
PS_DOT 1 $00 $00 $FF RGB CreatePen to HPEN_BLUE
```

PS_SOLID   -- 0

Constant. Value 0.

The pen is full.

```
0 constant PS_SOLID
0 value HPEN_RED
PS_SOLID 1 $FF $00 $00 RGB CreatePen to HPEN_RED
```

RELEASED   -- 5

Constant. Value 5

RESIZED   -- 1

Constant. Value 1

RIGHT-BUTTON   -- 253

Constant. Value 253

screen>g   x y -- x' y'

Transform screen to viewport.

SetTextColor   hdc color -- fl

Sets the text color for the specified device context to the specified color.

Definition:

```
\ Set text color
z" SetTextColor"        2 Gdi32 SetTextColor
```

TYPED   -- 6

Constant. Value 6

vertical-flip   --

Use math style viewport.

width   -- 0

Value. Default Value 0

window   x y --

Opens a new window of dimension x y in pixels.

```
graphics
600 400 window
```

}g   --

Restore transform.

streams

>stream addr len stream --

Store a string characters in a stream.

```
streams
1000 stream myStream
s" this is " myStream >stream
s" a test."  myStream >stream
\ now, myStream content is: "this is a test."
```

ch>stream c stream --

add character c to a stream.

```
streams
1000 stream myStream
s" this is" myStream >stream
$0d myStream ch>stream
$0a myStream ch>stream
s" a test" myStream >stream

myStream dup
    0 swap >offset
    swap cell + @
    type
\ display:
\ this is
\ a test.
```

empty? -- fl

Push -1 if stream is empty, otherwise push 0.

full? -- fl

Push -1 if stream is full, otherwise push 0.

stream comp: n -- <name> | exec: -- addr

Create a memory space of n characters.

```
200 stream input-stream
```

stream# sz -- n

Used bye `full?` and `empty?`.

stream>ch addr -- c

Fetch a character from stream.

structures

field comp: n -- <:name>

Definition word for a new field in a structure.

```
also structures
struct esp_partition_t
  ( Work around changing struct layout )
  esp_partition_t_size 40 >= [IF]
    ptr field p>gap
  [THEN]
  ptr field p>type
  ptr field p>subtype
  ptr field p>address
  ptr field p>size
  ptr field p>label
```

i16 -- 2

Pseudo constant defined by `typer`. At runtime, drops the size of the datatype and puts a copy of that size in the `last-align` variable

i32 -- 4

Pseudo constant defined by `typer`. At runtime, drops the size of the datatype and puts a copy of that size in the `last-align` variable

i64 -- 8

Pseudo constant defined by `typer`. At runtime, drops the size of the datatype and puts a copy of that size in the `last-align` variable

i8 -- 1

Pseudo constant defined by `typer`. At runtime, drops the size of the datatype and puts a copy of that size in the `last-align` variable

last-struct -- addr

Variable pointing to the last defined structure.

long -- 4

Pseudo constant defined by `typer`. At runtime, drops the size of the datatype and puts a copy of that size in the `last-align` variable

ptr -- 4

Pseudo constant defined by `typer`. At runtime, drops the size of the datatype and puts a copy of that size in the `last-align` variable

struct comp: -- <:name>

Definition word for structures.

```
also structures
struct esp_partition_t
```

typer comp: n1 n2 -- <name> | exec: -- n

Definition word for `i8 i16 i32 i64 ptr long`

tasks

.tasks   --

Display list active tasks.

```
.tasks  \ display: main-task
```

main-task   -- task

Main task. Leave pointer task on stack

task-list   -- addr

Variable. Point to tasks list.

windows

->biBitCount **addr -- addr'**

16-bit accessors for `BITMAPINFOHEADER`.

->biClrImportant **addr -- addr'**

32-bit accessors for `BITMAPINFOHEADER`.

->biClrUsed **addr -- addr'**

32-bit accessors for `BITMAPINFOHEADER`.

->biCompression **addr -- addr'**

32-bit accessors for `BITMAPINFOHEADER`.

->biHeight **addr -- addr'**

32-bit accessors for `BITMAPINFOHEADER`.

->biPlanes **addr -- addr'**

16-bit accessors for `BITMAPINFOHEADER`.

->biSize **addr -- addr'**

16-bit accessors for `BITMAPINFOHEADER`.

->biSizeImage **addr -- addr'**

32-bit accessors for `BITMAPINFOHEADER`.

->biWidth **addr -- addr'**

32-bit accessors for `BITMAPINFOHEADER`.

->biXPelsPerMeter **addr -- addr'**

32-bit accessors for `BITMAPINFOHEADER`.

->bmiColors **addr -- addr'**

Accessors for `BITMAPINFO`. Size is `RGBQUAD`.

->bmiHeader **addr -- addr'**

Accessors for `BITMAPINFO`. Size is `BITMAPINFOHEADER`.

->bottom **addr -- addr'**

Accessor for RECT structure.

->left **addr -- addr'**

Accessor for RECT structure.

->rgbBlue **addr -- addr'**

8-bit accessors for `RGBQUAD`.

->rgbGreen **addr -- addr'**

8-bit accessors for `RGBQUAD`.

->rgbRed **addr -- addr'**

8-bit accessors for `RGBQUAD`.

->rgbReserved **addr -- addr'**

8-bit accessors for `RGBQUAD`.

->right **addr -- addr'**

Accessor for RECT structure.

->top **addr -- addr'**

Accessor for RECT structure.

->x **addr -- addr'**

Accessor for POINT structure.

->y **addr -- addr'**

Accessor for POINT structure.

>biYPelsPerMeter **addr -- addr'**

32-bit accessors for `BITMAPINFOHEADER`.

ANSI_FIXED_FONT **-- n**

Constant, value: $8000000b

ANSI_VAR_FONT **-- n**

Constant, value: $8000000c

BeginPaint hWnd lpPaint -- lpPaint

Prepares the specified window for painting and fills a `PAINTSTRUCT` structure with information about the painting.

BITMAPINFO -- n

BITMAPINFO structure.

Accessors list:

- **->bmiHeader**
- **->bmiColors**

BITMAPINFOHEADER -- n

Accessors list:

- **->biSize** 16 bits
- **->biWidth** 32 bits
- **->biHeight** 32 bits
- **->biPlanes** 16 bits
- **->biBitCount** 16 bits
- **->biCompression** 32 bits
- **->biSizeImage** 32 bits
- **->biXPelsPerMeter** 32 bits
- **->biYPelsPerMeter** 32 bits
- **->biClrUsed** 32 bits
- **->biClrImportant** 32 bits

BI_RGB -- n

Constant, value: 0

BLACK_BRUSH -- n

Constant, value: $80000004

BLACK_PEN -- n

Constant, value: $80000007

BM_CLICK -- 245

Constant. Value 245

Used by `WM_>name`

BM_GETCHECK -- 240

Constant. Value 240

Used by `WM_>name`

Gets the check state of a radio button or check box.

BM_GETIMAGE -- 246

Constant. Value 246

Used by `WM_>name`

BM_GETSTATE -- 242

Constant. Value 242

Used by `WM_>name`

Retrieves the state of a button or check box.

BM_SETCHECK -- 241

Constant. Value 241

Used by `WM_>name`

Sets the check state of a radio button or check box.

BM_SETDONTCLICK -- 248

Constant. Value 248

Used by `WM_>name`

BM_SETIMAGE -- 247

Constant. Value 247

Used by `WM_>name`

BM_SETSTYLE -- 244

Constant. Value 244

Used by `WM_>name`

calls -- addr

Marks an array containing the executable codes from `call0` to `call15`

CB_ADDSTRING -- 323

Constant. Value 323

Used by `WM_>name`

Adds a string to the list box of a combo box. If the combo box does not have the CBS_SORT style, the string is added to the end of the list. Otherwise, the string is inserted into the list, and the list is sorted.

CB_FINDSTRING -- 332

Constant. Value 332

Used by `WM_>name`

Searches the list box of a combo box for an item beginning with the characters in a specified string.

CB_FINDSTRINGEXACT -- 344

Constant. Value 344

Used by `WM_>name`

CB_GETCOMBOBOXINFO -- 356

Constant. Value 356

Used by `WM_>name`

CB_GETCOUNT -- 326

Constant. Value 326

Used by `WM_>name`

Gets the number of items in the list box of a combo box.

CB_GETCURSEL -- 327

Constant. Value 327

Used by `WM_>name`

An application sends a CB_GETCURSEL message to retrieve the index of the currently selected item, if any, in the list box of a combo box.

CB_GETDROPPEDCONTROLRECT -- 338

Constant. Value 338

Used by `WM_>name`

CB_GETDROPPEDSTATE -- 343

Constant. Value 343

Used by `WM_>name`

CB_GETDROPPEDWIDTH -- 351

Constant. Value 351

Used by `WM_>name`

CB_GETEDITSEL -- 320

Constant. Value 320

Used by `WM_>name`

CB_GETEXTENDEDUI -- 342

Constant. Value 342

Used by `WM_>name`

CB_GETHORIZONTALEXTENT -- 349

Constant. Value 349

Used by `WM_>name`

CB_GETITEMDATA -- 336

Constant. Value 336

Used by `WM_>name`

CB_GETITEMHEIGHT -- 340

Constant. Value 340

Used by `WM_>name`

CB_GETLBTEXT -- 328

Constant. Value 328

Used by `WM_>name`

CB_GETLBTEXTLEN -- 329

Constant. Value 329

Used by `WM_>name`

CB_GETLOCALE -- 346

Constant. Value 346

Used by `WM_>name`

CB_GETTOPINDEX -- 347

Constant. Value 347

Used by `WM_>name`

CB_INITSTORAGE -- 353

Constant. Value 353

Used by `WM_>name`

CB_INSERTSTRING -- 330

Constant. Value 330

Used by `WM_>name`

CB_LIMITTEXT -- 321

Constant. Value 321

Used by `WM_>name`

CB_MSGMAX -- 357

Constant. Value 357

Used by `WM_>name`

CB_MULTIPLEADDSTRING -- 355

Constant. Value 355

Used by `WM_>name`

CB_RESETCONTENT -- 331

Constant. Value 331

Used by `WM_>name`

CB_SELECTSTRING -- 333

Constant. Value 333

Used by `WM_>name`

CB_SETCURSEL -- 334

Constant. Value 334

Used by `WM_>name`

CB_SETDROPPEDWIDTH -- 352

Constant. Value 352

Used by `WM_>name`

CB_SETEDITSEL -- 322

Constant. Value 322

Used by `WM_>name`

CB_SETEXTENDEDUI -- 341

Constant. Value 341

Used by `WM_>name`

CB_SETHORIZONTALEXTENT -- 350

Constant. Value 350

Used by `WM_>name`

CB_SETITEMDATA -- 337

Constant. Value 337

Used by `WM_>name`

CB_SETITEMHEIGHT -- 339

Constant. Value 339

Used by `WM_>name`

CB_SETLOCALE -- 345

Constant. Value 345

Used by `WM_>name`

CB_SETTOPINDEX -- 348

Constant. Value 348

Used by `WM_>name`

CB_SHOWDROPDOWN -- 335

Constant. Value 335

Used by `WM_>name`

COLOR_WINDOW -- 5

Constant. Value 5.

CommandLineToArgvW lpCmdLine *pNumArgs -- LPWSTR

Parses a Unicode command-line string and returns an array of pointers to the command-line arguments, along with a count of those arguments, in a manner similar to the standard C runtime argv and argc values.

console-started -- 0

Value initialized to zero.

Used by `init-console`

CreateSolidBrush param -- null|brush

Creates a logical brush that has the specified solid color.

```
255 192 0 RGB CreateSolidBrush constant orange
0 255 0   RGB CreateSolidBrush constant green
```

CreateWindowExA 12params -- 0|HWND

Allows you to create a sub-window or a pop-up window.

Parameters:

- **dwExStyle** allows to indicate the style of the extended window when it is created.
- **lpClassName** allows to indicate the string or the name of the class atom created by a previous call to the RegisterClassA or RegisterClassExA function.
- **lpWindowName** allows to indicate the name of the window. If the window style to specify a title bar, the title of the window pointed to by the lpWindowName parameter is displayed in the title bar.
- **dwStyle** is used to indicate the style of the window to be created.
- **x** is used to indicate the initial horizontal position of the window.

- **y** is used to indicate the initial vertical position of the window.
- **nWidth** is used to indicate the width, in device units, of the window.
- **nHeight** is used to indicate the height, in device units, of the window.
- **hWndParent** is used to indicate the Handle handler identifier of the parent window or the window owner of the window to be created. This parameter is optional in the case of a pop-up window.
- **hMenu** allows to indicate the identifier of the manager to a menu or specifies the child window, independently of the window style.
- **hInstance** allows to indicate the identifier of the Handle manager of the module instance associated with the window.
- **lpParam** allows to indicate a pointer to a value to pass to the window by the CREATESTRUCT structure (member of lpCreateParams) pointed by the lParam parameter of the WM_CREATE message.

If the function succeeds, the return value is a handle to the new window.

If the function fails, the return value is NULL. To get detailed information about the error, call GetLastError.

DC_BRUSH -- n

Constant, value: $80000012

Solid color brush. Default color is white.

DC_PEN -- n

Constant, value: $80000013

DefaultInstance -- $400000

Constant, value $400000.

DEFAULT_GUI_FONT -- n

Constant, value: $80000011

DEFAULT_PALETTE -- n

Constant, value: $8000000f

DEVICE_DEFAULT_PALETTE -- n

Constant, value: $8000000e

DIB_RGB_COLORS -- 0

Constant. value 0.

DISABLE_NEWLINE_AUTO_RETURN -- n

Constant. Value $0008

DKGRAY_BRUSH -- n

Constant, value: $80000003

Dark gray brush.

dll comp: zStr -- <:name>

Creates an access ticket to a Windows library.

```
z" Kernel32.dll" dll Kernel32
```

EM_CHARFROMPOS -- 215

Constant. Value 215

Used by `WM_>name`

EM_EMPTYUNDOBUFFER -- 205

Constant. Value 205

Used by `WM_>name`

EM_FMTLINES -- 200

Constant. Value 200

Used by `WM_>name`

EM_GETFIRSTVISIBLELINE -- 206

Constant. Value 206

Used by `WM_>name`

EM_GETIMESTATUS -- 217

Constant. Value 217

Used by `WM_>name`

EM_GETLIMITTEXT -- 213

Constant. Value 213

Used by `WM_>name`

EM_GETMARGINS -- 212

Constant. Value 212

Used by `WM_>name`

EM_GETPASSWORDCHAR -- 210

Constant. Value 210

Used by `WM_>name`

EM_GETWORDBREAKPROC -- 209

Constant. Value 209

Used by `WM_>name`

EM_LINEFROMCHAR -- 201

Constant. Value 201

Used by `WM_>name`

EM_POSFROMCHAR -- 214

Constant. Value 214

Used by `WM_>name`

EM_SETIMESTATUS -- 216

Constant. Value 216

Used by `WM_>name`

EM_SETMARGINS -- 211

Constant. Value 211

Used by `WM_>name`

EM_SETPASSWORDCHAR -- 204

Constant. Value 204

Used by `WM_>name`

EM_SETREADONLY -- 207

Constant. Value 207

Used by `WM_>name`

EM_SETTABSTOPS -- 203

Constant. Value 203

Used by `WM_>name`

EM_SETWORDBREAK -- 202

Constant. Value 202

Used by `WM_>name`

EM_SETWORDBREAKPROC -- 209

Constant. Value 209

Used by `WM_>name`

EM_UNDO -- 199

Constant. Value 199

Used by `WM_>name`

ENABLE_INSERT_MODE -- n

Constant, value: $0020

ENABLE_PROCESSED_INPUT -- n

Constant, value: $0001

ExitProcess uExitCode --

Exit code for the process and all threads.

FillRect hDC *lprc hbr -- fl

Fill a rectangle using the specified brush. Includes the left and top borders, but excludes the right and bottom borders of the rectangle.

Parameters:

- **hDC** Handle to the device context.
- **lprc** Pointer to a RECT structure that contains the logical coordinates of the rectangle to fill.
- **hbr** Brush handle used to fill the rectangle.

gdi32 *zstr n --*

Word defined by `dll`.

`Gdi32` is used to create words related to the **Gdi32.dll** library.

```
z" DeleteObject" 1 Gdi32 DeleteObject
```

GetCommandLineW *-- str*

Retrieves the command line string for the current process.

GetDC *hWnd -- hdc*

Retrieves a handle to a device context (DC) for the client area of a specified window or the entire screen. You can use the returned handle in the following GDI functions to draw to the DC.

GetLastError *-- err*

Retrieves the calling thread's last-error code value. The last-error code is maintained on a per-thread basis. Multiple threads do not overwrite each other's last-error code.

GetMessageA *lpMsg hWnd wMsgFilterMin wMsgFilterMax -- fl*

Retrieve a message from the calling thread's message queue.

Parameters:

- **lpMsg** Pointer to a MSG structure that receives message information from the thread's message queue
- **hWnd** Handle to the window from which messages are to be retrieved. The window must belong to the active thread.
- **wMsgFilterMin** Integer value of the lowest message value to retrieve.
- **wMsgFilterMax** Integer value of the highest message value to retrieve.<:li>

GetModuleHandleA *lpModuleName -- HMODULE*

Retrieves a module handle for the specified module. The module must have been loaded by the calling process.

GetProcessHeap *-- handle*

Retrieves a handle to the default heap of the calling process. This handle can then be used in subsequent calls to the heap functions.

GetRect *LPRECT -- left top right bottom*

Get the coordinates of the specified rectangle.

Definition:

```
: GetRect  ( LPRECT -- left top right bottom )
    >r
    r@ ->left   SL@
    r@ ->top    SL@
    r@ ->right  SL@
    r@ ->bottom SL@
    r> drop
  ;
```

GetStockObject   i --

Retrieves a handle from one of the stock pens, brushes, fonts, or palettes.

GetTickCount   -- ms

Retrieves the number of milliseconds elapsed since system startup, up to 49.7 days.

IDI_MAIN_ICON   -- 1001

Constant, value 1001.

init-console   --

Initializes the Windows console.

Kernel32   --

Word defined by `dll`.

Then allows access to the functions of **Kernel32.dll**

LoadLibraryA   dllname-z -- module

The wealth of Windows .DLL and system functionality can be accessed via the dynamic loading interface.

A handle to a library is obtained with `LOADLIBRARYA`, and then individual symbols are accessed with `GETPROCADDRESS`

LTGRAY_BRUSH   -- $80000001

Kight grey brush.

MALLOC_CAP_32BIT   -- 2

Constant. Value 2

MALLOC_CAP_8BIT   -- 4

Constant. Value 4

MALLOC_CAP_DMA -- 8

Constant. Value 8

MALLOC_CAP_EXEC -- 1

Constant. Value 1

MB_ABORTRETRYIGNORE -- 2

Constant. Value 2.

MB_CANCELTRYCONTINUE -- 6

Constant. Value 6.

MB_OK -- 0

Constant. Value 0. Used by `MessageBoxA`.

The message box contains a send button: OK. This is the default.

MB_OKCANCEL -- 1

Constant. Value 1.

MB_RETRYCANCEL -- 5

Constant. Value 5.

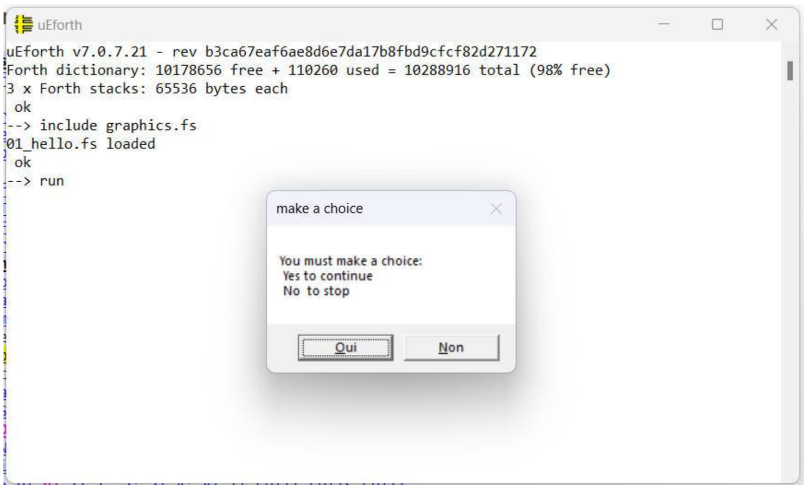
MB_YESNO -- 4

Constant. Value 4. Used by `MessageBoxA`.

The message box contains two push buttons: Yes and No.

```
z" Will you continue?" constant lpText
z" make a choice"      constant lpCaption

: MSGbox  ( -- )
    NULL lpText lpCaption MB_YESNO MessageBoxA
    ?dup if
        cr ." You have pressed: "
        case
            6 of ." Yes"       endof
            7 of ." No"        endof
        endcase
    then
  ;
```


```
uEforth v7.0.7.21 - rev b3ca67eaf6ae8d6e7da17b8fbd9cfcf82d271172
Forth dictionary: 10178656 free + 110260 used = 10288916 total (98% free)
3 x Forth stacks: 65536 bytes each
 ok
--> include graphics.fs
01_hello.fs loaded
 ok
--> run
```
```
make a choice

You must make a choice:
 Yes to continue
 No  to stop
```

MB_YESNOCANCEL -- 3

Constant. Value 3.

MessageBoxA hWnd lpText lbCaption uType -- 0|val

Displays a modal dialog box that contains a system icon, a set of buttons, and a brief application-specific message, such as status or error information. The message box returns an integer value that indicates which button the user clicked.

If the function fails, the return value is zero.

`MessageBoxA` accepts ANSI (American Standard Code for Information Interchange) character strings. ANSI is a single-byte character encoding, which means that it can represent a limited number of characters, primarily the Latin alphabet. It is therefore less suitable for handling text in other languages, particularly those using accented characters or non-Latin alphabets.

NULL -- 0

Same as 0 value.

NULL_BRUSH -- n

Constant. Value $80000005

PAINTSTRUCT -- n

Structure.

List of accessors:

- **->hdc** 64-bit
- **->fErase** 32 bits
- **->rcPaint** size `RECT`

- **->fRestore** 32 bits
- **->fIncUpdate** 32 bits
- **->rgbReserved** 32 bytes

POINT -- n

POINT structure.

Accessors list:

- **->x** 32 bits
- **->y** 32 bits

RECT -- n

Structure.

Accessors list:

- **->left**
- **->top**
- **->right**
- **->bottom**

RGB r g b -- n

Assembles three **r g b** colors, 8-bit values into a single color.

```
255 192 0 RGB CreateSolidBrush constant orange
```

RGBQUAD -- n

RGBQUAD structure

Accessors list:

- **->rgbBlue** 8 bits
- **->rgbGreen** 8 bits
- **->rgbRed** 8 bits
- **->rgbReserved** 8 bits

SBM_ENABLE_ARROWS -- 228

Constant. Value 228

Used by `WM_>name`

SBM_GETPOS -- 225

Constant. Value 225

Used by `WM_>name`

SBM_GETRANGE -- 227

Constant. Value 227

Used by `WM_>name`

SBM_GETSCROLLBARINFO -- 235

Constant. Value 235

Used by `WM_>name`

SBM_GETSCROLLINFO -- 234

Constant. Value 234

Used by `WM_>name`

SBM_SETPOS -- 224

Constant. Value 224

Used by `WM_>name`

SBM_SETRANGE -- 226

Constant. Value 226

Used by `WM_>name`

SBM_SETRANGEREDRAW -- 230

Constant. Value 230

Used by `WM_>name`

SBM_SETSCROLLINFO -- 233

Constant. Value 233

Used by `WM_>name`

SetForegroundWindow hWnd -- fl

Brings the thread that created the specified window to the foreground and activates the window.

SetRect   LPRECT xLeft yTop xRight yBottom -- fl

Sets the coordinates of the specified rectangle. This is equivalent to assigning the left, top, right, and bottom arguments to the appropriate members of the RECT structure

Definition:

```
\ sets the coordinates of the specified rectangle
z" SetRect"     5 User32 SetRect

\ Example:
create zone  RECT allot
zone 10 10 80 50 SetRect
```

SetupCtrlBreakHandler   --

Internal Windows usage.

Shell32   zstr n --

Word defined by dll

Then allows access to the functions of Shell32.dll

```
z" CommandLineToArgvW" 2 Shell32 CommandLineToArgvW
```

ShowWindow   hWnd nCmdShow -- fl

Sets the display state of the specified window.

Parameters:

- **hWnd** Handle to the window.
- **nCmdShow** Controls how the window should be displayed. This parameter is ignored the first time an application calls `ShowWindow`, if the program that launched the application provides a STARTUPINFO structure. Otherwise, the first time `ShowWindow` is called, the value should be the value obtained by the `WinMain` function in its nCmdShow parameter

Sleep   ms --

Suspends execution of the active thread until the timeout interval elapses.

```
: ms ( n -- )
    Sleep ;
```

SRCCOPY   -- $00cc0020

Constant. value $00cc0020.

stdin -- 0

Value initialized to zero.

Used by `init-console`

stdout -- 0

Value initialized to zero.

Used by `init-console`

User32 zstr n --

Creation of words related to the User32.dll library.

```
z" MessageBoxA" 4 User32 MessageBoxA
```

WaitForSingleObject hHandle Ms --

Waits for the specified object to be in the signaled state or for the timeout interval to elapse.

If the function succeeds, the return value indicates the event that caused the function to return. It can be one of the following values.

wargc -- addr

Remembers the action of `GetCommandLineW`

wargv -- addr

Remembers the action of `CommandLineToArgvW`

WHITE_BRUSH -- $80000000

White brush.

win-type addr len --

Dispaly string on windows console

WINDCLASSA -- n

Structure.

List of accessors of this structure:

- **->style** 16 bits
- **->lpfnWndProc** pointer
- **->cbClsExtra** 32 bits

- **->cbWndExtra** 32 bits
- **->hInstance** pointer
- **->hIcon** pointer
- **->hCursor** pointer
- **->hbrBackground** pointer
- **->lpszMenuName** pointer
- **->lpszClassName** pointer

WindowProcShim --

Internal Windows usage.

windows-builtins -- n

Vocabulary entry point `windows`

WM_>name msg -- a n

Extracts the address in length from the header corresponding to the Windows message between `WM_PENWINLAST` and `WM_NULL`

WM_ACTIVATE -- 6

Constant. Value 6

Used by `WM_>name`

WM_AFXFIRST -- 864

Constante. value 864.

Use by `WM_>name`

WM_AFXLAST -- 896

Constante. value 895.

Use by `WM_>name`

WM_APPCOMMAND -- 793

Constante. value 793.

Use by `WM_>name`

WM_CHANGECBCHAIN -- 781

Constant. Value 781

WM_CHAR -- 258

stack 258.

Used by `WM_>name`

WM_CLEAR -- 771

Constant. Value 771

Used by `WM_>name`

WM_COPY -- 769

Constant. Value 769

Used by `WM_>name`

WM_CREATE -- 1

stack 1.

WM_CUT -- 768

Constant. Value 768

Used by `WM_>name`

WM_DEADCHAR -- 259

stack 259.

WM_DESTROY -- 2

Constant. Value 2

Used by `WM_>name`

WM_DESTROYCLIPBOARD -- 775

Constant. Value 775

Used by `WM_>name`

WM_DRAWCLIPBOARD -- 776

Constant. Value 776

Used by `WM_>name`

WM_ENABLE -- 10

Constant. Value 10

Used by `WM_>name`

WM_ENTERIDLE -- 289

Constant. Value 289

Used by `WM_>name`

WM_GETTEXT -- 13

Constant. Value 13

Used by `WM_>name`

WM_GLOBALRCCHANGE -- 899

Constante. value 899.

Use by `WM_>name`

WM_HANDHELDFIRST -- 856

Constante. value 856.

Use by `WM_>name`

WM_HANDHELDLAST -- 863

Constante. value 863.

Use by `WM_>name`

WM_HEDITCTL -- 901

Constant. Value 901

Used by `WM_>name`

WM_HOOKRCRESULT -- 898

Constante. value 898.

Use by `WM_>name`

WM_HOTKEY -- 786

Constant. Value 786

WM_HSCROLL -- 276

Constant. Value 276

Used by `WM_>name`

WM_HSCROLLCLIPBOARD -- 782

Constant. Value 782

WM_IMEKEYDOWN -- 656

Constant. Value 656

Used by `WM_>name`

WM_IMEKEYUP -- 657

Constant. Value 657

Used by `WM_>name`

WM_IME_CHAR -- 646

Constant. Value 646

Used by `WM_>name`

WM_IME_COMPOSITIONFULL -- 644

Constant. Value 644

Used by `WM_>name`

WM_IME_CONTROL -- 643

Constant. Value 643

Used by `WM_>name`

WM_IME_KEYDOWN -- 656

Constant. Value 656

Used by `WM_>name`

WM_IME_KEYUP -- 657

Constant. Value 657

Used by `WM_>name`

WM_IME_NOTIFY -- 642

Constant. Value 642

Used by `WM_>name`

WM_IME_REPORT -- 640

Constant. Value 640

Used by `WM_>name`

WM_IME_REQUEST -- 648

Constant. Value 648

Used by `WM_>name`

WM_IME_SELECT -- 645

Constant. Value 645

Used by `WM_>name`

WM_IME_SETCONTEXT -- 641

Constant. Value 641

Used by `WM_>name`

WM_INITMENU -- 278

Constant. Value 278

Used by `WM_>name`

WM_INITMENUPOPUP -- 279

Constant. Value 279

Used by `WM_>name`

WM_INPUT -- 255

Constant. Value 255

Used by `WM_>name`

WM_KEYDOWN -- 256

Constant. Value 256

Used by `WM_>name`

WM_KEYUP -- 257

Constant. Value 257

Used by `WM_>name`

WM_KILLFOCUS -- 0

Constant. Value 0

WM_LBUTTONDBLCLK -- 515

Constant. Value 515

Used by `WM_>name`

WM_LBUTTONDOWN -- 513

Constant. Value 513

Used by `WM_>name`

WM_LBUTTONUP -- 514

Constant. Value 514

Used by `WM_>name`

WM_MBUTTONDBLCLK -- 521

Constant. Value 521

Used by `WM_>name`

WM_MBUTTONDOWN -- 519

Constant. Value 519

Used by `WM_>name`

WM_MENUCHAR -- 288

Constant. Value 288

Used by `WM_>name`

WM_MENUSELECT -- 287

Constant. Value 287

Used by `WM_>name`

WM_MOUSEFIRST -- 512

Constant. Value 512

Used by `WM_>name`

WM_MOUSEHOVER -- 673

Constant. Value 673

Used by `WM_>name`

WM_MOUSELAST -- 521

Constant. Value 521

Used by `WM_>name`

WM_MOUSELEAVE -- 675

Constant. Value 675

Used by `WM_>name`

WM_MOUSEMOVE -- 512

Constant. Value 512

Used by `WM_>name`

WM_MOVE -- 3

Constant. Value 3

Used by `WM_>name`

WM_NCMOUSEHOVER -- 672

Constant. Value 672

Used by `WM_>name`

WM_NCMOUSELEAVE -- 674

Constant. Value 674

Used by `WM_>name`

WM_NULL -- 0

Constant. Value 0

WM_PAINTCLIPBOARD -- 777

Constant. Value 777

Used by `WM_>name`

WM_PALETTECHANGED -- 785

Constant. Value 785

WM_PALETTEISCHANGING -- 784

Constant. Value 784

WM_PASTE -- 770

Constant. Value 770

Used by `WM_>name`

WM_PENCTL -- 901

Constant. Value 901

Used by `WM_>name`

WM_PENEVENT -- 904

Constant. Value 904

Used by `WM_>name`

WM_PENMISC -- 902

Constant. Value 902

Used by `WM_>name`

WM_PENMISCINFO -- 899

Constante. value 899.

Use by `WM_>name`

WM_PENWINFIRST -- 896

Constante. value 896.

Use by `WM_>name`

WM_PENWINLAST -- 911

Constant. Value 911

Used by `WM_>name`

Value used to set an upper limit for Pen Windows (PenWin) style messages.

WM_PRINTCLIENT -- 792

Constant. Value 792

WM_QUERYNEWPALETTE -- 783

Constant. Value 783

WM_RBUTTONDBLCLK -- 518

Constant. Value 518

Used by `WM_>name`

WM_RBUTTONDOWN -- 516

Constant. Value 516

Used by `WM_>name`

WM_RBUTTONUP -- 517

Constant. Value 517

Used by `WM_>name`

WM_RCRESULT -- 898

Constante. value 897.

Use by `WM_>name`

WM_RENDERALLFORMATS -- 774

Constant. Value 774

Used by `WM_>name`

WM_RENDERFORMAT -- 774

Constant. Value 773

Used by `WM_>name`

WM_SETFOCUS -- 7

Constant. Value 7

WM_SETREDRAW -- 11

Constant. Value 11

WM_SETTEXT -- 12

Constant. Value 12

Used by `WM_>name`

WM_SIZE -- 5

Constant. Value 5

Used by `WM_>name`

WM_SKB -- 900

Constant. Value 900

Used by `WM_>name`

WM_SYSDEADCHAR -- 258

stack 263.

WM_SYSTIMER -- 280

Constant. Value 280

Used by `WM_>name`

WM_UNDO -- 772

Constant. Value 772

Used by `WM_>name`

WM_VSCROLL -- 277

Constant. Value 277

Used by `WM_>name`

WM_VSCROLLCLIPBOARD -- 778

Constant. Value 778

Mots FORTH par utilisation

arithmetic integer

* (n1 n2 -- n3)
*/ (n1 n2 n3 -- n4)
*/MOD (n1 n2 n3 -- n4 n5)
+ (n1 n2 -- n3)
- (n1 n2 -- n1-n2)
/mod (n1 n2 -- n3 n4)
1+ (n -- n+1)
1- (n -- n-1)
2* (n -- n*2)
2/ (n -- n/2)
4* (n -- n*4)
4/ (n -- n/4)
ARSHIFT (x1 u -- x2)
mod (n1 n2 -- n3)
negate (n -- -n')

arithmetic real

#f+s (r:r)
1/F (r -- r')
F* (r1 r2 -- r3)
F** (r_val r_exp -- r)
F+ (r1 r2 -- r3)
F- (r1 r2 -- r3)
F/ (r1 r2 -- r3)
F0< (r -- fl)
F0= (r -- fl)
F>S (r -- n)
FABS (r1 -- r1')
FATAN2 (r-tan -- r-rad)
fconstant (comp: r -- <name> | exec: -- r)
FCOS (r1 -- r2)
FEXP (ln-r -- r)
FLN (r -- ln-r)
FLOOR (r1 -- r2)
FMAX (r1 r2 -- r1|r2)
FMIN (r1 r2 -- r1|r2)
FNEGATE (r1 -- r1')
FSIN (r1 -- r2)
FSINCOS (r1 -- rcos rsin)
fsqrt (r1 -- r2)
pi (-- r)
S>F (n -- r: r)

block edit list

a (n --)
copy (from to --)
d (n --)
e (n --)
editor (--)
flush (--)
list (n --)
load (n --)
n (--)
open-blocks (addr len --)
p (--)
r (n --)
thru (n1 n2 --)
update (--)
use (-- <name>)
wipe (--)

chars strings

# (n1 -- n2)
#FS (r:r --)
#s (n1 -- n=0)
<# (n --)
extract (n base -- n c)
F>NUMBER? (addr len -- real:r fl)
hold (c --)
r| (comp: -- <string> | exec: addr len)
s" (comp: -- <string> | exec: addr len)
s>z (a n -- z)
str (n -- addr len)
str= (addr1 len1 addr2 len2 -- fl)
z" (comp: -- <string> | exec: -- addr)
z>s (z -- a n)
[char] (comp: -- name | exec: -- xchar)

comparaison logical

0< (x1 --- fl)
0<> (n -- fl)
0= (x -- fl)
< (n1 n2 -- fl)
<= (n1 n2 -- fl)
<> (x1 x2 -- fl)
= (n1 n2 -- fl)
> (x1 x2 -- fl)
>= (x1 x2 -- fl)
f< (r1 r2 -- fl)
f<= (r1 r2 -- fl)
f<> (r1 r2 -- fl)
f= (r1 r2 -- fl)
f> (r1 r2 -- fl)
f>= (r1 r2 -- fl)
invert (x1 -- x2)
max (n1 n2 -- n1|n2)
min (n1 n2 -- n1|n2)
OR (n1 n2 -- n3)
XOR (n1 n2 -- n3)

definition words

: (comp: -- <word> | exec: --)
:noname (-- cfa-addr)
; (--)
constant (comp: n -- <name> | exec: -- n)
CREATE (comp: -- <name> | exec: -- addr)
defer (-- <vec-name>)
DOES> (comp: -- | exec: -- addr)
fvariable (comp: -- <name> | exec: -- addr)
value (comp: n -- <valname> | exec: -- n)
variable (comp: -- <name> | exec: -- addr)
vocabulary (comp: -- <name> | exec: --)

display

. (n --)
." (-- <string>)
.s (--)
? (addr -- c)
cr (--)
emit (x --)
esc (--)
f. (r --)
f.s (--)
ip. (--)
n. (n --)
normal (--)
ok (--)
prompt (--)
see (-- name>)
space (--)
spaces (n --)
type (addr c --)
u. (n --)
vlist (--)
words (--)

files words

BIN (mode -- mode')
block (n -- addr)
block-fid (-- n)
block-id (-- n)
cat (-- <path>)
CLOSE-FILE (fileid -- ior)
common-default-use (--)
cp (-- "src" "dst")
CREATE-FILE (a n mode -- fh ior)
DELETE-FILE (a n -- ior)
dump-file (addr len addr2 len2 --)
edit (-- <filename>)
file-exists? (addr len --)
FILE-POSITION (fileid -- ud ior)
FILE-SIZE (fileid -- ud ior)
FLUSH-FILE (fileid –- ior)
include (-- <:name>)
included? (addr len -- f)
ls (-- "path")
mv (-- "src" "dest")
OPEN-FILE (addr n opt -- n)
R/O (-- 0)
R/W (-- 2)
READ-FILE (a n fh -- n ior)
REPOSITION-FILE (ud fileid -- ior)
required (addr len --)
RESIZE-FILE (ud fileid -- ior)
rm (-- "path")
save-buffers (--)
touch (-- "path")
W/O (-- 1)
WRITE-FILE (a n fh -- ior)

loop and branch

+loop (n --)
?do (n1 n2 --)
aft (--)
begin (--)
CASE (--)
else (--)
ENDCASE (--)
ENDOF (--)
for (n --)
if (fl --)
loop (--)
next (--)
OF (n --)
repeat (--)
then (--)
unloop (--)
until (fl --)
while (fl --)
[ELSE] (--)
[IF] (fl --)
[THEN] (--)

memory access

! (n addr --)
2! (n1 n2 addr --)
2@ (addr -- d)
@ (addr -- n)
c! (c addr --)
c@ (addr -- c)
FP@ (-- addr)
m! (val shift mask addr --)
m@ (shift mask addr -- val)
UL@ (addr -- un)
UW@ (addr -- un[2exp0..2exp16-1])

stack manipulation

-rot (n1 n2 n3 -- n3 n1 n2)
2drop (n1 n2 n3 n4 -- n1 n2)
2dup (n1 n2 -- n1 n2 n1 n2)
>r (S: n -- R: n)
?dup (n -- n | n n)
drop (n --)
dup (n -- n n)
FDROP (r1 --)
FDUP (r1 -- r1 r1)
FNIP (r1 r2 -- r2)
FOVER (r1 r2 -- r1 r2 r1)
FSWAP (r1 r2 -- r1 r2)
nip (n1 n2 -- n2)
over (n1 n2 -- n1 n2 n1)
r> (R: n -- S: n)
R@ (-- n)
rdrop (S: -- R: n --)
swap (n1 n2 -- n2 n1)