

# amforth 2.5 Reference Card

## Arithmetics

```
1-      ( n1 -- n2 )
1+      ( n1 -- n2 )
2/      ( n1 -- n2 )
2*      ( n1 -- n2 )
abs     ( n1 -- u1 )
><      ( n1 -- n2 )
cell+   ( n1 -- n2 )
cells   ( n1 -- n2 )
d2/     ( d1 -- d2 )
d2*     ( d1 -- d2 )
dinvert ( d1 -- d2 )
d-      ( d1 d2 -- d3 )
d+      ( d1 d2 -- d3 )
invert  ( n1 -- n2 )
log2    ( n1 -- n2 )
lshift  ( n1 n2 -- n3 )
-       ( n1 n2 -- n3 )
mod     ( n1 n2 -- n3 )
m*      ( n1 n2 -- d )
*       ( n1 n2 -- n3 )
+       ( n1 n2 -- n3 )
+!      ( n addr -- )
rshift  ( n1 n2 -- n3 )
/       ( n1 n2 -- n3 )
/mod    ( n1 n2 -- rem quot )
*/      ( n1 n2 n3 -- n4 )
*/mod   ( n1 n2 n3 -- rem quot )
um/mod  ( u1 u2 -- rem quot )
u/mod   ( u1 u2 -- rem quot )
u*/mod  ( u1 u2 u3 -- rem quot )
0       ( -- 0 )
```

## Compiler

```
\       ( -- )
[']     ( -- XT )
:       ( -- )
:noname ( -- xt )
constant ( n -- )
does>   ( -- )
."      ( -- )
Edefer  ( n <name> -- )
else    ( addr1 -- addr2 )
endcase ( f -- )
endof   ( addr1 -- addr2 )
exit    ( -- )
        R(xt --)
immediate ( -- )
[       ( -- )
literal  ( n -- )
(       ( -- )
of       ( -- )
]       ( -- )
Rdefer  ( n <name> -- )
recurse ( -- )
s,      ( addr len -- )
;       ( -- )
s"      ( <cchar> -- )
state   ( -- addr )
then    ( addr -- )
until   ( addr -- )
user    ( n -- )
value   ( n <name> -- )
variable ( -- )
```

## Exceptions

```
abort    ( n*x -- )
          R(n*y --)
abort"   ( n*x -- )
          R(n*y --)
catch    ( xt -- )
handler  ( -- addr )
throw    ( n -- )
```

## Hardware Access

```
rx0      ( -- c )
rx0?     ( -- f )
>usart0  ( -- )
tx0      ( c -- )
tx0?     ( -- f )
+usart0  ( -- )
```

## IO

```
refill   ( -- f )
```

## Interrupt

```
int@     ( i -- xt )
-int      ( -- sreg )
+int      ( -- )
int!      ( xt i -- )
#int      ( -- n )
sleep     ( -- )
wdr       ( -- )
```

## Control Structure

### Character IO

```
bl       ( -- 32 )
cr       ( -- )
emit     ( -- eaddr )
emit?    ( -- c )
key      ( -- c )
key?     ( -- f )
/key     ( -- f )
space    ( -- )
spaces   ( n -- )
type     ( addr n -- )
```

```
again    ( addr -- )
begin    ( -- addr )
case     ( -- 0 )
do       ( -- addr )
i        ( -- n )
; R( loop-sys -- loop-sys )
if       ( -- addr )
j        ( -- n )
; R( loop-sys1 loop-sys2 -- loop-sys1 loop-sys2 )
leave    ( -- )
R(loop-sys --)
loop     ( addr -- )
+loop    ( addr -- )
?do      ( -- addr )
repeat   ( addr1 -- addr2 )
unloop   ( -- )
; R(loop-sys -- )
while    ( dest -- orig dest )
```

### Logic

```
and      ( n1 n2 -- n3 )
negate   ( n1 -- n2 )
not      ( flag -- flag' )
or       ( n1 n2 -- n3 )
xor      ( n1 n2 -- n3 )
```

## MCU

```
spirw    ( txbyte -- rxbyte)
```

## Compare

```
d>       ( d1 d2 -- flag )
d<       ( d1 d2 -- flag )
=        ( n1 n2 -- flag )
0=       ( n -- flag )
>        ( n1 n2 -- flag )
0>       ( n1 -- flag )
<        ( n1 n2 -- flag )
0<       ( n1 -- flag )
max      ( n1 n2 -- n1|n2 )
min      ( n1 n2 -- n1|n2 )
<>      ( n1 n2 -- flag )
0<>     ( n -- flag )
u>       ( u1 u2 -- flag )
u<       ( u1 u2 -- flag )
```

## Conversion

```
d>s      ( d1 -- n1 )
s>d      ( n1 -- d1 )
```

## Dictionary

```
,        ( n -- )
compile  ( -- )
create   ( -- )
'        ( -- XT )
```

## Memory

```
c@       ( addr - c1 )
cmove>   ( addr-from addr-to n -- )
c!       ( c addr -- )
e@       ( addr - n )
e!       ( n addr -- )
@        ( addr -- n )
fill     ( c-addr u c -- )
i@       ( addr -- n1 )
i!       ( n addr -- )
!        ( n addr -- )
```

## Multitasking

```
pause    ( -- )
```

## Numeric IO

```
base      ( -- addr )
decimal   ( -- )
digit     ( c base -- number flag )
.         ( n -- )
hex       ( -- )
hld       ( -- addr )
hold      ( c -- )
<#        ( -- )
number    ( addr -- n )
#         ( d1 -- d2 )
#>        ( d1 -- addr count )
#s        ( d1 -- 0 )
sign      ( n -- )
u.        ( n -- )
```

## Stack

```
depth     ( -- n )
drop      ( n -- )
dup        ( n -- n n )
over       ( n1 n2 -- n1 n2 n1 )
?dup       ( n1 -- [ n1 n1 ] | 0 )
rot        ( n1 n2 n3 -- n2 n3 n1 )
r@         ( -- n )
           R( n -- n )
r>         ( -- n )
           ; R( n -- )
swap       ( n1 n2 -- n2 n1 )
>r         ( n -- )
           ; R( -- n )
```

## Stackpointer

```
rp0        ( -- addr )
rp@         ( -- n )
rp!         ( n -- )
           ; R( -- xy )
sp          ( -- addr )
sp0         ( -- addr )
sp0         ( -- addr )
sp@         ( -- n )
sp!         ( addr -- i*x )
```

## String

```
count      ( addr -- addr+1 n )
cscan      ( addr1 n1 c -- addr1 n2 )
cskip      ( addr1 n1 c -- addr2 n2 )
parse      ( char "ccc" -- c-addr u )
place      ( addr1 len1 addr2 -- )
/string     ( addr1 u1 n -- addr2 u2 )
```

## System

```
accept     ( addr n1 -- n2 )
allot      ( n -- )
cold       ( -- )
defer@     ( xt1 -- xt2 )
defer!     ( xt1 xt2 -- )
execute    ( xt -- )
f_cpu      ( -- f_cou )
>in        ( -- addr )
interpret  ( -- )
           ; R(i*x - j*x )
is         ( xt1 c<char> -- )
#tib       ( -- addr )
?execute   ( xt|0 -- )
quit       ( -- )
source     ( -- addr n )
up@        ( -- addr )
up!        ( addr -- )
```

## System Pointer

```
dp         ( -- eaddr )
edp        ( -- eaddr )
head       ( -- eaddr )
heap       ( -- eaddr )
here       ( -- addr )
pad        ( -- addr )
tib        ( -- addr )
turnkey    ( -- eaddr )
```

## System Value

```
baud0      ( -- v )
```

## Time

```
1ms        ( -- )
```

## Tools

```
[char]     ( -- c )
char       ( -- c )
.s         ( -- )
find       ( addr -- [ addr 0 ] | [ xt [-1|1] ] )
icount     ( adr -- adr n )
itype      ( addr n -- )
           ( -- )
noop       ( -- )
to         ( n <name> -- )
unused     ( -- n )
unused     ( -- )
ver        ( -- )
word       ( c -- addr )
words      ( -- )
```

## internal/hidden

```
(branch)   ( -- )
(?branch)  ( f -- )
(constant) ( -- addr )
(create)   ( -- )
(do)       ( limit counter -- )
           R(-- limit counter )
(does>)    ( -- )
(defer)    ( i*x -- j*x )
(literal)  ( -- n1 )
(loop)     ( -- )
           R(limit counter -- limit counter+1|)
(+loop)    ( n1 -- )
           R(llimit counter -- limit counter+n1|)
(?do)      ( limit counter -- )
           R(-- limit counter| )
(rp0)      .dw XT_FETCH
           .dw XT_EXIT
(spm)      (spmcsr x addr -- )
(to)       ( n -- )
           R(IP -- IP+1)
(user)     ( -- addr )
(variable) ( -- addr )
Edefer@    ( xt1 -- xt2 )
Edefer!    ( xt1 xt2 -- )
>mark      ( -- addr )
>resolve   ( addr -- )
hiemit     ( w -- )
int_restore sreg -- )
<mark      ( -- addr )
<resolve   ( addr -- )
Rdefer@    ( xt1 -- xt2 )
Rdefer!    ( xt1 xt2 -- )
(sliteral) ( -- addr n )
spmbuf     ( x addr -- )
spmerase   ( addr -- )
spmpage    ( addr -- )
spmrrw     ( -- )
spmrrw?    ( -- )
spmwrite   (spmcsr x addr -- )
Udefer@    ( xt1 -- xt2 )
Udefer!    ( xt1 xt2 -- )
```

## unclassified

```
icompare ; ( addr-ram addr-flash -- f )
```