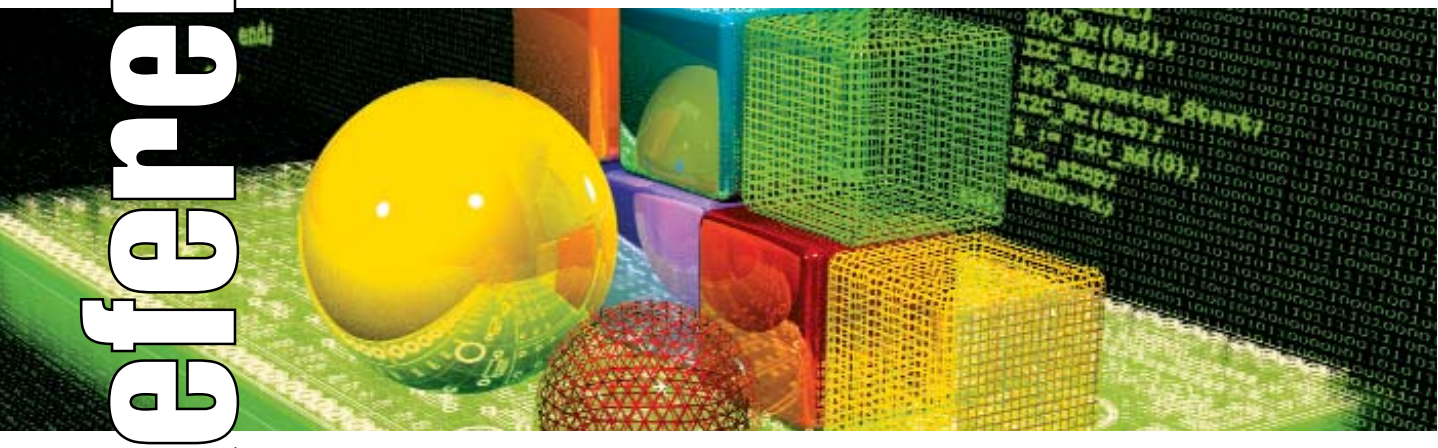
mikroElektronika
Development tools - Books - Compilers

Quick Reference Guide
for Basic language

Quick Reference



with
EXAMPLES

This reference guide is intended to quickly introduce users to BASIC language syntax with the aim to easily start programming microcontrollers along with other applications.

Why BASIC in the first place? The answer is simple: it is legible, easy-to-learn, structured programming language, with sufficient power and flexibility needed for programming microcontrollers. Whether you had any previous programming experience, you will find that writing programs in BASIC is very easy.

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COMMENTS

Any text between an apostrophe and the end of the line constitutes a comment. May span one line only.

Example:
```
' Put your comment here!
' It may span one line only.
```

LITERALS

Character Literals
Character literal is one character from the extended ASCII character set, enclosed by quotes.

Example:
```
"A"    // this is character A
```

String Literals
String literal is a sequence of up to 255 characters from the extended ASCII character set, enclosed by quotes.

Example:
```
"Hello!"      ' 12 chars long
"C"           ' 1 char long
```

KEYWORDS

absolute	**float**	**or**
abs	**for**	**org**
and	**function**	**print**
array	**goto**	**procedure**
asm	**gosub**	**program**
begin	**if**	**read**
boolean	**include**	**select**
case	**in**	**sub**
char	**int**	**step**
chr	**integer**	**string**
clear	**interrupt**	**switch**
const	**is**	**then**
dim	**loop**	**to**
div	**label**	**until**
do	**mod**	**wend**
double	**module**	**while**
else	**new**	**with**
end	**next**	**xor**
exit	**not**	

Note:
User can not use keywords for variable or function names. Keywords are reserved only for making basic language statements.

VARIABLES

Syntax:
```
dim identifier_list as type
```

Example:
```
dim i, j, k as byte
```

CONSTANTS

Syntax:
```
const constant_name [as type] = value
```

Example:
```
const MAX as longint = 10000
const MIN = 1000            ' compiler will assume word type
const SWITCH = "n"          ' compiler will assume char type
const MSG = "Hello"         ' compiler will assume string type
```

LABELS

Syntax:
```
label_identifier : statement
```

Example:
```
loop: Beep     ' infinite loop
goto loop      ' that calls the
               ' Beep procedure
```

SYMBOLS

Syntax:
```
symbol alias = code
```

Example:
```
symbol MAXALLOWED = 216
' Symbol as alias for numeric value
symbol PORT = PORTC
' Symbol as alias for SFR
```

FUNCTIONS AND PROCEDURES

Functions

Syntax:
```
sub function function_name(parameter_list) as return_type
  [ local declarations ]
  function body
end sub
```

Example:
```
sub function add(dim a, b as byte) as byte
  result = a + b
end sub
```

We can call it to calculate sum of two numbers:

```
dim c as byte
c = add(4, 5)
```

Variable c will then be 9.

Procedures

Syntax:
```
sub procedure procedure_name(parameter_list)
  [ local declarations ]
  procedure body
end sub
```

Example:
```
sub procedure add(dim byref c as byte, dim a, b as byte)
  c = a + b
end sub
```

Note:

When we want the parameter to be changed in function or procedure body then we must declare that parameter with dim byref directive instead with dim directive. If declared with dim directive changes to the parameter will take effect only in that function or procedure.

We can call it to calculate sum of two numbers (last two parameters) and place result in first parameter:

```
dim c as byte
add(c, 4, 5)
```

Variable c will then be 9.

SIMPLE TYPES

Type	Size	Range
byte	8-bit	0 .. 255
char	8-bit	0 .. 255
word	16-bit	0 .. 65535
short	8-bit	- 128 .. 127
integer	16-bit	-32768 .. 32767
longint	32-bit	-2147483648 .. 2147483647
float	32-bit	$\pm 1.17549435082 * 10^{-38}$ ... $\pm 6.80564774407 * 10^{38}$

ARRAYS

Syntax:
```
type[array_length]
```
Example:
```
dim weekdays as byte[7]
dim samples  as word[10]
' now we can access elements of array variables, for example:
samples[0] = 1
if weekdays[1] = 1 then    ' if it is Tuesday (day with index 1)
   samples[0] = 20         ' then order 20 samples with index 0
   else samples[3] = 10    ' else order 10 samples with index 3
end if
```

CONSTANT ARRAYS

Example:
```
' Declare a constant array which holds no. of days
' in each month:
const MONTHS as byte[12] = (31,28,31,30,31,30,31,31,30,31,30,31)
```

STRINGS

Syntax:
```
string[string_length]
```

Example:
```
dim msg1 as string[20]
dim msg2 as string[19]
begin
  msg1 = "First message"
  msg2 = "Second message"
  msg1 = msg2
```

This is ok, but vice versa would be illegal (because length of string msg1 is greater then length of string msg2).

POINTERS

To declare a pointer data type, add a carat prefix (^) before type. For example, if you are creating a pointer to an `integer`, you would write:

```
^integer
```

A pointer can be assigned to another pointer. However, note that only the address, not the value, is copied.

Example:
```
dim p as ^word
...
p^ = 5
```

This will assign the pointed memory location value 5.

@ Operator
The @ operator returns the address of a variable or routine; that is, @ constructs a pointer to its operand. The following rules apply to @:
- If X is a variable, @X returns the address of X.
- If F is a routine (a function or procedure), @F returns F's entry point

STRUCTURES

Syntax:
```
structure structname
   dim member1 as type1
   ...
   dim membern as typen
end structure
```

Example:
```
structure Dot
  dim x as float
  dim y as float
end structure
```

Memory is allocated when you instantiate the record, like this:

```
dim m as Dot
dim n as Dot
```

Accessing Fields

Example:

```
m.x = 3.6
m.y = 5
```

OPERATORS

There are four types of operators in mikroBasic:

- Arithmetic Operators
- Bitwise Operators
- Boolean Operators
- Relational Operators

Note:

You can commit assignments between complex variables, if they are of the same type:

```
n = m
```

This will copy values of all fields.

Operators Precedence and Associativity

Precedence	Operands	Operators	Associativity
4	1	@ not + -	right-to-left
3	2	* / div mod and << >>	left-to-right
2	2	+ - or xor	left-to-right
1	2	= <> < > <= >=	left-to-right

Arithmetic Operators

Operator	Operation	Precedence
+	addition	2
-	subtraction	2
*	multiplication	3
/	division	3
div	division, rounds down to nearest integer (cannot be used with floating points)	3
mod	returns the remainder of integer division (cannot be used with floating points)	3

Relational Operators

Operator	Operation	Precedence
=	equal	1
<>	not equal	1
>	greater than	1
<	less than	1
>=	greater than or equal	1
<=	less than or equal	1

Note:

Use relational operators to test equality or inequality of expressions. All relational operators return TRUE or FALSE.

Bitwise Operators

Operator	Operation	Precedence
and	bitwise AND; returns 1 if both bits are 1, otherwise returns 0	3
or	bitwise (inclusive) OR; returns 1 if either or both bits are 1, otherwise returns 0	2
xor	bitwise exclusive OR (XOR); returns 1 if the bits are complementary, otherwise 0	2
not	bitwise complement (unary); inverts each bit	4
<<	bitwise shift left; moves the bits to the left, see below	3
>>	bitwise shift right; moves the bits to the right, see below	3

Examples:

```
operand1 :          %0001 0010
operand2 :          %0101 0110
------------------------------
operator and :      %0001 0010
operator  or :      %0101 0110
operator xor :      %0100 0100
```

Examples:

```
operand :           %0101 0110
------------------------------
operator not :      %1010 1001
operator  << :      %1010 1100
operator  >> :      %0010 1011
```

Note:

With shift left (<<), left most bits are discarded, and "new" bits on the right are assigned zeroes. With shift right (>>), right most bits are discarded, and the "freed" bits on the left are assigned zeroes (in case of unsigned operand) or the value of the sign bit (in case of signed operand).

Boolean Operators

Operator	Operation
and	logical AND
or	logical OR
xor	logical exclusive OR
not	logical negation

These operators conform to standard Boolean logic. If used in conditional expressions they are compared with TRUE or FALSE.

Example:

```
if (%1001 and %0111) = FALSE then LED1 = 1 else LED2 = 1 end if
```

Because expression (`%1001 and %0111`) gives `%0001`, when compared with `FALSE` (all zeros) it gives `FALSE` because they are not equal. It means that `else` statement will be executed and `LED2` will be turned on. If it was written like this:

```
if (%1001 and %0111) then LED1 = 1 else LED2 = 1 end if
```

than expression (`%1001 and %0111`) is compared with `TRUE` (all ones) by default.

STATEMENTS

asm Statement
Syntax:
```
asm
    block of assembly instructions
end asm
```

Assignment Statements
Syntax:
```
variable = expression
```
Example:
```
counter = 1
```

CONDITIONAL STATEMENTS

If Statement
Syntax:
```
if expression then
  statements
[else
  other statements]
end if
```

Example:
```
if movex = 1 then
  x = x + 20
else
  y = y - 10
end if
```

Note:
The else keyword with an alternate statement is optional.

Select Case Statement
Syntax:
```
select case selector
  case value_1
    statements_1
  ...
  case value_n
    statements_n
  [case else
    default_statements]
end select
```

Example:
```
select case input
  case 1
    LED1 = 1
  case 2
    LED2 = 1
  case 3
    LED3 = 1
  case else
    LED7 = 1
end select
```

Note:
This code will turn on LED depending of input value. If the value is diffrent then ones mentioned in value list in case statement then else statement is executed by default.

ITERATION STATEMENTS (LOOPS)

For Statement
Syntax:
```
for counter = initial_value to final_value [step step_value]
  statements
next counter
```
Example:
```
s = 0
for i = 0 to 4
  s = s + 2
next i
```

This code will add number 2 to variable s 5 times. At the end s will be 10.

Note:
step directive is optional. It defines incrementing (or decrementing if negative) value of counter after each iteration. Default step value is 1.

While Statement
Syntax:
```
while expression
  statements
wend
```

Example:
```
s = 0
i = 0
while i < 6
  s = s + 2
  i = i + 1
wend
```

This code will add number 2 to variable s 6 times. At the end s will be 12.

Do Statement

Syntax:

```
do
   statements
loop until expression
```

Example:

```
s = 0
i = 0
do
   s = s + 2
   i = i + 1
loop until i = 7
```

This code will add number 2 to variable s 7 times. At the end s will be 14.

JUMP STATEMENTS

Break Statement

Use the `break` statement within loops to pass control to the first statement following the innermost loop (`for`, `while`, and `do`).

Example:

```
i = 0                    ' initiate value of counter i
s = 1                    ' and variable s
while true               ' infinite loop
   if i = 4 then break
   end if
   s = s * 2
   i = i + 1
wend
```

This code will multiply variable `s` with number `2` (until counter `i` becomes equal `4` and `break` statement executes). At the end `s` will be `16`.

Continue Statement

You can use the `continue` statement within loops to skip the rest of the statements and jump to the first statement in loop.

Example:

```
i = 0                    ' initiate value of counter i
s = 1                    ' and variable s
while true               ' infinite loop
   s = s * 2
   i = i + 1
   if i <> 4 then continue
   end if
   break
wend
```

This code will multiply variable `s` with number `2` (`continue` statement executes until counter `i` is not equal `4`). At the end `s` will be `16`.

Goto Statement

Syntax:

```
goto label_name
```

Example:

```
loop: Beep      ' infinite loop
goto loop       ' that calls the
                ' Beep procedure
```

Goto Statement

Syntax:

```
gosub label_name
...
label_name:
...
return
```

Exit Statement

The `exit` statement allows you to break out of a routine (function or procedure). It passes the control to the first statement following the routine call.

Example:

```
sub procedure Proc1()
dim error as byte
   ... ' we're doing something here
   if error = TRUE then exit
   end if
   ...      ' some code, which won't be
end sub   ' executed if error is true
```