# XCPL Language Description

## Code

Code ignores case, *except* in quoted strings and character constants. # is a constant and marks the rest of the line as to be ignored.

The general syntax is similar to that of C, with semicolons used to end lines and curly brackets { } to group multiple commands together. The language itself is much closer to BCPL in design, or its sister language B.

A major variation is that all local variables are static

## Types

Types are all 16 bit unsigned integers. It is possible to access byte data using indirection, but not have byte variables.

## Term

A term can be one of the following :

* A decimal integer (192)
* A hexadecimal constant prefixed with $ ($FA74)
* A character constant (‘x’)
* A constant which is the address of an identifier prefixed with @ (@count)
* A Double-Quoted String. This evaluates to an address of the string in memory, which is length prefixed (e.g. the first byte is the length of the string)
* An identifier representing a variable.
* An expression in parenthesis ( (count+7) )
* A negated term (-count)
* A byte indirection. This specifies the byte value at a particular address (?$F4) – this is equivalent to PEEK($F4)
* A word indirection. This specifies the word value at a particular address (?$F7) – this is equivalent to DEEK($F7) in some BASICs.

## Expressions

Expressions are chains of terms seperated by binary operators (the terms can include parenthesised expressions). All operators operate in the same way irrespective of what data they represent.

The following operators are supported :

* Standard arithmetic operators + - \* / % (% is modulus). These are all unsigned arithmetic. Division and Modulus by zero is indetermined but does not (currently) cause an error. If you want to multiply or divide by a power of 2 use the << and >> operators which are faster as the 6502 does multiply/divide the hard way.
* Binary operators & (and) | (or) ^ (exclusive-or). These are binary operators *not* logical operators. If you write 3 & 7 it is not the same as (3 <> 0) & (7 <> 0)
* Comparison operators == <> >= <= > and <. These all operate in an unsigned arithmetic mode. They evaluate to $FFFF if true and 0 if false. In comparisons (e.g. while and if tests) the value does not matter other than it is non zero ; so you can use if (a) as a shorthand for if (a<>0)
* Shift operators << and >>, do a logical shift left or right of the data (e.g. count << 2 is the value in count shifted left twice). Zeros are shifted in.
* Indirection operators ? and !. Thse are like the term indirection operators, except the address is the sum of the left and right hand side. So if a = 10 then a!4 reads the word at offset 10+4, 14. Note that in BCPL n!1 reads the nth word, in XCPL it reads the nth byte. So if you use word data in structures, it has to be done in steps of 2.

## Precedence

The precedence rules are as follows (lowest to highest) :

* Logic operators : & | ^
* Comparison operators : < == > <= <> >=
* Additive operators : + -
* Multiplicative operators : \* % >> <<
* Indirection operators : ! ?

## Assignment

Assignment is of the form <lexpr> = <expression> . The left hand side can be either a variable, or one of the four types of indirection : ?term !term term!term term?term

Generally ?term and !term are used for accessing specific memory locations – control registers and so on, and the binary form is used for structures. One may allocate a block of memory to an object and access it indirectly e.g. if missile points to a block of 4 bytes then one can say:

missile!0 = x;

missile!2 = y;

This is the same as the BASIC DOKE missile+0,x:DOKE missile+2,y

(DOKE is a double byte POKE, so missile?5 = count is POKE missile+5,count)

## Variables

Variables can be declared either globally or locally. Local variables are declared in a procedure body.

The var command is the keyword var followed by a list of comma seperated variables. Each variable can have a block of memory allocated by specifying the bytes in square brackets.

var count,scores[4];

declares two variables, one called ‘count’, and one called ‘scores’. The scores variable is initialised to the address of a block of 4 bytes.

All locals are static. This means that if you allocate memory to a local variable it will have that value when the routine is first call, and will maintain it over subsequent invocations. Code *can* recurse but you have to handle the variables yourselves.

## Increment and Decrement

Variables *only* can be incremented or decremented using ++ and – e.g.

count++;

score--;

## Procedure calls

There are no functions. Procedures are called with a list of values, up to a maximum of 12. You shouldn’t have that many anyway. The compiler does keep track of the number of parameters in a call.

Parameters are all word values, but you can pass references using @ e.g.

getSquare(@v,12);

so you can return values this way.