Binary, Hex and Decimal Conversion

There are three standard numerical bases used when working with QuickSilver products. Because many of the status words and parameters are defined in a bitwise fashion, the most direct representation is a binary number. QuickSilver also uses parameters in either decimal format or hexadecimal format. This Technical Document explains how to convert between these values.

For this example, a generic 16 bit binary word has been selected:

16 Bit Binary Word = 1001110000001010

Begin by copying the binary word into the second row of the table.

The next step is to convert the binary number into a hexadecimal number. This is done by first grouping the binary values into sets of 4, called nibbles. In hexadecimal, a nibble represents a value of 0 to 15. The letters A, B, C, D, E, F are used in place of 10, 11, 12, 13, 14, 15, respectively. This gives a numbering system as shown in the following set:

{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F}

Binary nibbles are converted to a number by adding up the value of each binary digit. The table below shows the value of each bit in a nibble. If a bit is set to 1 its associated value is added into the nibble. Remember to convert the numbers 10 – 15 to A – F for Hexadecimal notation.

The example binary word grouped in nibbles: 1001 1100 0000 1010

Bit Values	8	4	2	1	8	4	2	1	8	4	2	1	8	4	2	1
Binary word	1	0	0	1	1	1	0	0	0	0	0	0	1	0	1	0
Nibbles	8 + 1 = **9**				8 + 4 = 12 = **C**				0				8 + 2 = 10 = **A**			

The nibbles are now joined together to form the Hexadecimal word.

Nibbles	9	C	0	A
Hexadecimal Word	**9C0A**			

When working in hexadecimal programmers use a "0x" notation at the beginning of the number to identify it as a hexadecimal value. This avoids any confusion as to the base system of the number.

Hexadecimal Word = 0x9C0A

Hexadecimal is useful for programmers who are writing software in Basic, Visual Basic, C/C++, or working with the QuickSilver 9-bit binary protocol.

For those who are trying to put together ASCII strings on a PLC or other simple controller, the number needs to be converted to decimal. The easiest way to do this is to use the Scientific Calculator application available in Microsoft Windows; however many other calculator applications exist that can supply this functionality. The MS Calculator is found in Start > Programs > Accessories > Calculator.

If the calculator does not appear like the image to the right, select View > Scientific.

Put the calculator into hex input mode by clicking the "Hex" button.

Be sure the "Qword" button is selected to ensure no rounding occurs.

Now enter the hexadecimal number into the calculator. (A to F is used in Hex mode).
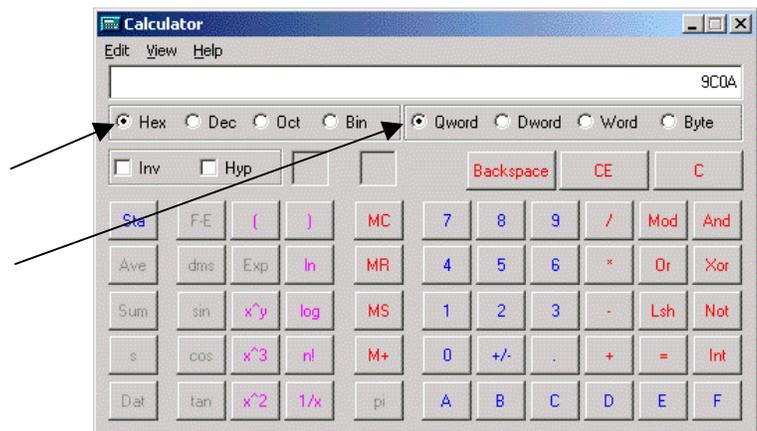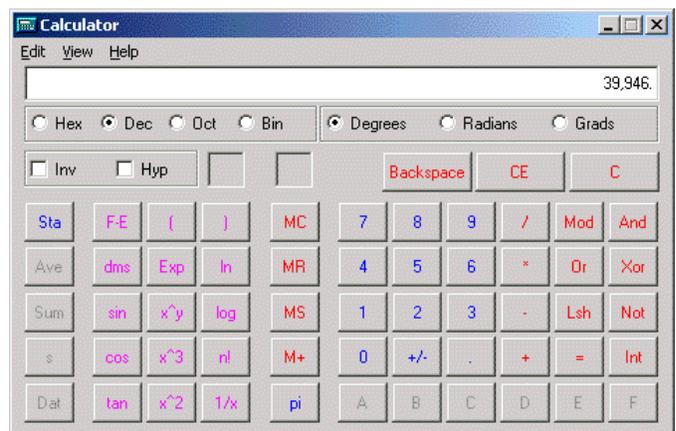
Hexadecimal Word = 0x9C0A

The hexadecimal number can now be converted to decimal by simply clicking the "Dec" button.

Decimal Number = 39946

This number can now be used in an ASCII string.

Note: Binary, hex, and decimal values may be entered directly into the Windows Calculator providing a simple conversion process.