Numbering Systems

• Decimal is simply base 10, 0-9.

• Integer is similar to decimal with a finite number range. Signed Integer will be used in the PLC-5 and SLC-500 systems.

• Signed Integer is -32,768 to +32,767. This is based on a 16 bit word, that is weighted in a binary format, but uses a sign bit. In the Allen Bradly SLC-500 and PLC-5, this number range is used for timers (only half the range is used for timers 0-32767), counters and integer files.

• Unsigned Integer is 0 to 65,535. This is based on a 16 bit word, that is weighted in a binary format. This is common in many PLCs, but not the PLC-5 or SLC-500.

• BCD – Binary Coded Decimal
PLC memory terminology

• Bit – Bit stands for binary digit. It is the smallest unit of memory. A bit is either on or off. An example of a bit is an input point in the input image table.

• Nibble – A nibble is four consecutive bits in a PLC memory. This term is not used very much in modern day PLCs. The four bits are weighted in BCD or Hexidecimal.

• Byte – A byte is 8 consecutive bits used together. An 8 point I/O module is sometimes referred to as a byte card.
BCD/Hex

BCD stands for Binary Coded Decimal

Hex stands for Hexadecimal (base 16)

BCD/HEX will be used for masking in certain instructions.

Some equipment will also have a BCD/HEX output, that would then feed into a PLC, 24 Vdc discrete input module. This is the way to get a value from a piece of external equipment into the PLC processor.

<table>
<thead>
<tr>
<th>BCD</th>
<th>Hex</th>
</tr>
</thead>
</table>
| 0   | 0   | 0000 = 0
| 1   | 1   | 0001 = 1
| 2   | 2   | 0010 = 2
| 3   | 3   | 0011 = 3
| 4   | 4   | 0100 = 4
| 5   | 5   | 0101 = 5
| 6   | 6   | 0110 = 6
| 7   | 7   | 0111 = 7
| 8   | 8   | 1000 = 8
| 9   | 9   | 1001 = 9
| A   | 10  | 1010 = 10 = A
| B   | 11  | 1011 = 11 = B
| C   | 12  | 1100 = 12 = C
| D   | 13  | 1101 = 13 = D
| E   | 14  | 1110 = 14 = E
| F   | 15  | 1111 = 15 = F

This is the weight (value) of each bit
This is the bit number within a word
PLC memory terminology, cont.

• Word – A word is made up of 16 consecutive bits, and is currently the basic memory unit used to store PLC data in an Allen Bradley PLC-5 and SLC-500 processors.

• Element – An element is a word or a group of words used together in the PLC data table, that an instruction controls. An Allen Bradley PLC timer element is made up of 3 words:
  • Present value word (T4:5.PRE)
  • Accumulated value word (T4:5.ACC)
  • Status bit word (T4:5/EN, T4:5/TT, T4:5/DN), notice only 3 bits used in this 16 bit word.
SLC-500 Data Files go up to 255

Default Data Files in a PLC-5 Memory

SLC-500 Program Files go up to 255
This is an input image table on a PLC system.

The Allen Bradley PLC-5 input image table word has octal addressed bits.

The SLC-500 input image table words have decimal addressed bits.
Data File Types:
O – Output Type (only 1 output file, data file 0)
I – Input Type (only 1 input file, data file 1)
S – Status Type (only 1 status file, data file 2)
B – Binary, used as internal memory, relay bits
T – Timer file type (3 word elements created)
C – Counter file type (3 word elements created)
R – Control file type (used in file type instructions)
N – Integer file type, signed integer.
F – Floating Point file type, real numbers (signs, decimal point and exponents)
A – ASCII file (alphanumeric data info)
D – BCD/HEX data type (PLC-5 only)

SLC-500 can have up to 256 data files
PLC-5 can have up to 1000 data files

SLC-500 can have up to 256 program files
PLC-5 can have up to 1000 program files
Moving the pointer over the timer present value, will show the word of the element, and the symbol assigned to the timer.
More Data Terminology

• File – a file is a group of consecutive words in the PLC-5 or SLC-500 data files. A file is used in a File Instruction to manipulate data. As an example, a file could hold the preset values for 10 consecutive timers used in an industrial process.
Notice that a BCD value of 7863 is an Integer value of 30819.
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