Pixie Virtual Machine

The PixieVM CPU is a 16-bit Big Endian CPU with 4 16-bit general purpose registers A, B, C, D, one 16-bit index register X, a 16-bit stack pointer SP, a 16-bit instruction pointer IP and a 16-bit flags register FLAGS. FLAGS holds various CPU state flags ie. negative, overflow, break, interrupt disable, zero and carry in the following format:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| - | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **N** | **V** | **-** | **-** | **B** | **I** | **Z** | **C** |

Each general purpose register can be referred to by it's high and low byte:

|  |  |  |  |
| --- | --- | --- | --- |
| AX | BX | CX | DX |
| |  |  | | --- | --- | | AH | AL | | |  |  | | --- | --- | | BH | BL | | |  |  | | --- | --- | | CH | CL | | |  |  | | --- | --- | | DH | DL | |

# Addressing Modes

The PixieVM CPU has a very orthogonal instruction set. The table below describes the various addressing modes supported with examples of their usage.

|  |  |  |
| --- | --- | --- |
| Mode | Description | Example |
| RR8 | 8-bit source and destination register | xor ch, ch |
| RR16 | 16-bit source and destination register | xor d, d |
| RM8 | 8-bit destination register, memory source | mov al, [d+x] |
| RM16 | 16-bit destination register, memory source | mov a, [b+x] |
| RA8 | 8-bit destination register, absolute source | mov bl, [$c000] |
| RA16 | 16-bit destination register, absolute source | mov a, [$ffe0] |
| RI8 | 8-bit destination register, 8-bit immediate source | mov dh, $c0 |
| RI16 | 16-bit destination register, 16-bit immediate source | mov d, $8000 |
| MR8 | memory destination, 8-bit register source | mov [d+x], al |
| MR16 | memory destination, 16-bit register source | mov [a+x], b |
| M8I8 | 8-bit memory destination, 8-bit immediate source | mov BYTE [a+x], $ff |
| M16I8 | 16-bit memory destination, 8-bit immediate source | mov [a+x], $ff |
| MI16 | 16-bit memory destination, 16-bit immediate source | mov [b+x], $c000 |
| AR8 | 16-bit absolute destination, 8-bit register source | mov $ce00, al |
| AR16 | 16-bit absolute destination, 16-bit register source | mov $cd00, b |
| A8I8 | 8-bit absolute destination, 8-bit immediate source | mov BYTE [$e000], $1 |
| A16I8 | 16-bit absolute destination, 8-bit immediate source | mov [$e000], $1 |
| AI16 | 16-bit absolute destination, 16-bit immediate source | mov [$0800], $ffff |
| R8 | 8-bit register | inc al |
| R16 | 16-bit register | inc b |
| M8 | 8-bit memory | dec BYTE [a+x] |
| M16 | 16-bit memory | dec [a+x] |
| A8 | 8-bit absolute | dec BYTE [$fe00] |
| A16 | 16-bit absolute | inc [$cd00] |
| IMPLIED | Implied | sei |
| I8 | Immediate 8-bit | push $c0 |
| I16 | Immediate 16-bit | jmp $8000 |