## VP Processor Model

VP has 5 banks of general purpose registers, Int, Long, Float, Double and Pointer, numbered from zero upwards.

| Bank | |
|---|---|
| **Int** | General Purpose 32 bit integers |
| **Long** | General Purpose 64 bit integer registers |
| **Float** | General Purpose 32 bit IEEE-754 floats |
| **Double** | General Purpose 64 bit IEEE-754 floats |
| **Pointer** | General Purpose 32 bit pointers |

| Specials | |
|---|---|
| **gp** | globals pointer |
| **lp** | link pointer |
| **sp** | stack pointer (grows downwards) |
| **pp** | parameter pointer (sp before call) |
| **si** | signature integer |

VP has no program counter or condition code register flags. Conditional branches must be immediately preceded by a compare instruction.

## ASCII Table (ISO 10646 Page 0 Low)

| | $0x | $1x | $2x | $3x | $4x | $5x | $6x | $7x |
|---|---|---|---|---|---|---|---|---|
| $0 | NUL | DLE | SP | 0 | @ | P | ` | p |
| $1 | SOH | DC1 | ! | 1 | A | Q | a | q |
| $2 | STX | DC2 | " | 2 | B | R | b | r |
| $3 | ETX | DC3 | # | 3 | C | S | c | s |
| $4 | EOT | DC4 | $ | 4 | D | T | d | t |
| $5 | ENQ | NAK | % | 5 | E | U | e | u |
| $6 | ACK | SYN | & | 6 | F | V | f | v |
| $7 | BEL | ETB | ' | 7 | G | W | g | w |
| $8 | BS | CAN | ( | 8 | H | X | h | x |
| $9 | HT | EM | ) | 9 | I | Y | i | y |
| $A | LF | SUB | * | : | J | Z | j | z |
| $B | VT | ESC | + | ; | K | [ | k | { |
| $C | FF | FS | , | < | L | \ | l | \| |
| $D | CR | GS | - | = | M | ] | m | } |
| $E | SO | RS | . | > | N | ^ | n | ~ |
| $F | SI | US | / | ? | O | _ | o | DEL |

## VP Programmers Quick Reference Guide

| Instructions | Types | Description |
|---|---|---|
| als | c | allocate structure on stack |
| bc | cond | conditional branch |
| bcn | cond | branch conditional (non-probable) |
| bcp | cond | branch conditional (probable) |
| cpbb src,dst,len | p | copy block of bytes |
| cpbi src,dst,len | p | copy block of integers |
| cpsb src,dst,tmp | p | copy string until NUL (src++, dst++) |
| cpy src,dst | bsilfdp ns ni nl nd t | copy source to destination |
| d_i | d | double bit pattern to two consecutive integers |
| ent | | subroutine entry |
| entih | | interrupt handler entry |
| f_i | f | float bit pattern to integer |
| go tag | tp | goto |
| gos tag | tp | gosub |
| i_d | i | two consecutive integers bit pattern to double |
| i_f | i | integer bit pattern to float |
| i_l | i | 2 consecutive ints to long |
| l_i | l | long to 2 consecutive ints |
| ncall px,method | | named object call |
| noret | | return which is never reached |
| qcall tool, {x : x} | | virtual call. Params in and returned |
| ret | | return from subroutine |
| schk | | stack check |
| zap | | undefine register |

| Expressions | Abbr. | Types | |
|---|---|---|---|
| add | + | ilfdpc | add |
| and | & | ilc | bitwise and |
| and | && | ilc | logical and |
| asr | | ilc | arithmetic shift right |
| b2i | | b | sign extend byte to int |
| bclr | | ic | bit clear |
| bset | | ic | set bit |
| c2i | | cond | conditional to int (0..1) |
| d2f | | d | double to float |
| d2ir | | d | double to int (round) |
| d2it | | d | double to int (truncate) |
| d2lr | | d | double to long (round) |
| d2lt | | d | double to long (truncate) |
| div | / | ilfdc | divide |
| divh | | hc | fixed point divide |
| divu | | ilc | unsigned divide |
| f2d | | f | float to double |
| f2ir | | f | float to integer (round) |
| f2it | | f | float to integer (truncate) |
| i2d | | i | integer to double |
| i2f | | i | integer to float |
| i2l | | i | sign extend int to long |
| i2p | | i | integer to pointer |
| imm | | ilfdpc | expression to immediate |
| l2d | | l | long to double |
| l2i | | l | long to integer |
| ld | | bsilfdp ns ni nl nd | load from memory |
| lsl | << | ilc | logical shift left |
| lsr | >> | ilc | logical shift right |
| mul | * | ilfd | multiply |
| mulh | | h | multiply fixed point integer |
| not | ~ | ilc | bitwise not |
| not | ! | ilc | logical not |
| or | \| | ilc | bitwise or |
| or | \|\| | ilc | logical or |
| ord | | fd | true if ordered |
| p2i | | p | pointer to integer |
| rem | % | ilc | remainder |
| remu | | ilc | unsigned remainder |
| s2i | | s | short to integer |
| st | | bsilfdp ns ni nl nd | store to memory |
| sub | - | ilfdpc | subtract |
| swb | | i | reverse byte order in word |
| uno | | fd | true if unordered |
| xor | ^ | ilc | bitwise xor |

| Conditionals | Abbr. | |
|---|---|---|
| ge | >= | greater than or equal |
| geu | | greater than or equal (unsigned) |
| gt | > | greater than |
| gtu | | greater than (unsigned) |
| le | <= | less than or equal |
| leu | <= | less than or equal (unsigned) |
| lt | < | less than |
| ltu | < | less than (unsigned) |
| eq | = | equal |
| ne | <> or != | not equal |
| bit | ? | true if bit 'n' (0..31) is set |
| nbit | !? | true if bit 'n' (0..31) is clear |

Types: ilfd (Integer, Long, Float, Double) p (Pointer), b Byte(8) s Short(16), h fixed point 16.16(32), u unsigned(32), t tag, cond conditional, c constant. Prefix 'n' = non-aligned

## Opcode suffixes, Number formats and sizes

| | | Size | sizeof() |
|---|---|---|---|
| .b | Byte | 8 bits | 1 |
| .s | Short | 16 bits | 2 |
| .i | Integer | 32 bits | 4 |
| .p | pointer | 32 bits | 4 |
| .f | IEEE 754 Float | 32 bits | 4 |
| .l | Long | 64 bits | 8 |
| .d | IEEE 754 Double | 64 bits | 8 |

## High level language macros

allocstruct <size> / freestruct <size>
printf / tracef / ktrace "<format string>"[, <varargs>]
epeat / until <condition>
or <count>, <integer register> / next <integer register>
while <condition> / endwhile
oop / endloop
break
breakif <condition>
continue
continueif <condition>
bool <condition>, <label>

f <condition> / elseif <condition> / else / endif

## Varargs

Varargs are always 8 byte aligned.
Expressions default to int, other types can be specified
eg printf "Byte at $%x = %d\n", {p0+5}.p, [p0+5].b

## Assembly time macros (note the preceding dot)

if <condition> / .elseif <condition> / .else / .endif
include <file>
align
macro / .endm
rept <count> / .endr

Tao Group Ltd, 62/63 Suttons Business Park,
Earley, Reading, Berkshire, RG6 1AZ
Tel: +44 118 901 2999
Fax: +44 118 901 2963

http://www.tao-group.com support@tao-group.com

## printf & tracef formatting

%<flags><width><"."precision><qualifier><conversion>

### Flags

| | |
|---|---|
| – | left justify |
| # | use alternate form |
| + | force signed prefix |
| 0 | display with leading zeroes |
| *space* | space prefix if positive |

### Qualifier

| | |
|---|---|
| h | 16 bit short integer |
| l | 64 bit long integer |
| L | long double (same as double) |

### Conversion

| Char | Type |
|---|---|
| % | output '%' |
| b | binary |
| c | char |
| d | Decimal |
| e,f,g,E,G | floating point |
| i | signed integer |
| o | signed octal |
| p | pointer |
| s | string |
| u | unsigned decimal |
| x,X | Hex |

### Structures

| | |
|---|---|
| structure <offset> | count := <offset> (default 0) |
| struct <name>,<size> | name=count; count += size |
| int32 <name> | name=count; count += 4 |
| float32 <name> | name=count; count += 4 |
| pointer <name> | name=count; count += 4 |
| int64 <name> | name=count; count += 8 |
| float64 <name> | name=count; count += 8 |
| size <name> | name = count |

## VT52 Emulation

| | |
|---|---|
| ESC A | Cursor up |
| ESC B | Cursor down |
| ESC C | Cursor right |
| ESC D | Cursor left |
| ESC E | Clear & home |
| ESC H | Cursor home |
| ESC I | Cursor up & scroll |
| ESC J | Clear cursor onwards |
| ESC K | Clear remainder of line |
| ESC L | Insert line |
| ESC M | Delete line |
| ESC Y r c | Position cursor, eg (0,0) r=32, c=32 |
| ESC b n1 | Select character colour |
| ESC c n2 | Select background colour |
| ESC d | Clear screen to cursor |
| ESC l | Clear line |
| ESC o | Clear from start |

## Standard Colours

| | | |
|---|---|---|
| 0 | TRANS | Transparent |
| 1 | BLACK | |
| 2 | WHITE | |
| 3 | RED | |
| 4 | GREEN | |
| 5 | BLUE | |
| 6 | YELLOW | |
| 7 | MAGENTA | |
| 8 | CYAN | |
| 9 | GREY | |
| 10 | DRED | Dark Red |
| 11 | DGREEN | Dark Green |
| 12 | DBLUE | Dark Blue |
| 13 | DYELLOW | Dark Yellow |
| 14 | DMAGENTA | Dark Magenta |
| 15 | DCYAN | Dark Cyan |