

GAUNTLET

HARDWARE + OPERATING SYSTEM DESC.

COMPANY CONFIDENTIAL

DIST.

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GAUNTLET HARDWARE DESCRIPTION

CREATED: May 14, 1985
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I. Microprocessors:

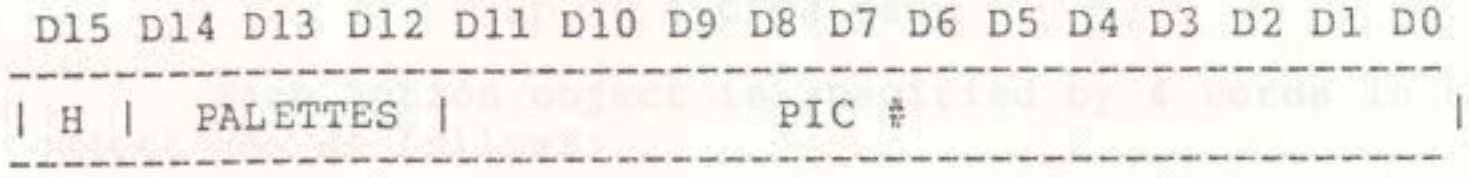
- A. 68010 running @ 7.16 MHZ.
- B. Program ROM:
 - 176K words max. including 32K word of OS and 16k word of SLAPSTICK (see ROM map below.)
- C. Program RAM:
 - 4K word fixed, plus 2K word spare video RAM
- D. Interrupt:
 - Sound port (from 6502) - level 6
 - Vblank - level 4.
- E. 6502 runs at 1.78 mhz
 - IRQ from hardware. (Note. Not the YAMAHA)
 - NMI from the 68010.
- F. Input/output:
 - There are 4 bytes worth of inputs. This allows up to 4 switch joysticks and 16 buttons.
- G. EEPROM:

A 512 byte EEPROM is used as a nonvolatile memory for the 68010. You can read or write the EEPROM just as a RAM, however, after a write to the EEPROM, you should wait a minimum of 10 msec. before accessing (read or write) the EEPROM again (For more info. read the EEPROM data sheet & application notes.)

Before writing to the EEPROM, you should enable the write by writting (any data) to UNLOCK (@ 803150). You can not read the EEPROM after you UNLOCK until you have written something somewhere (any data, any location.)

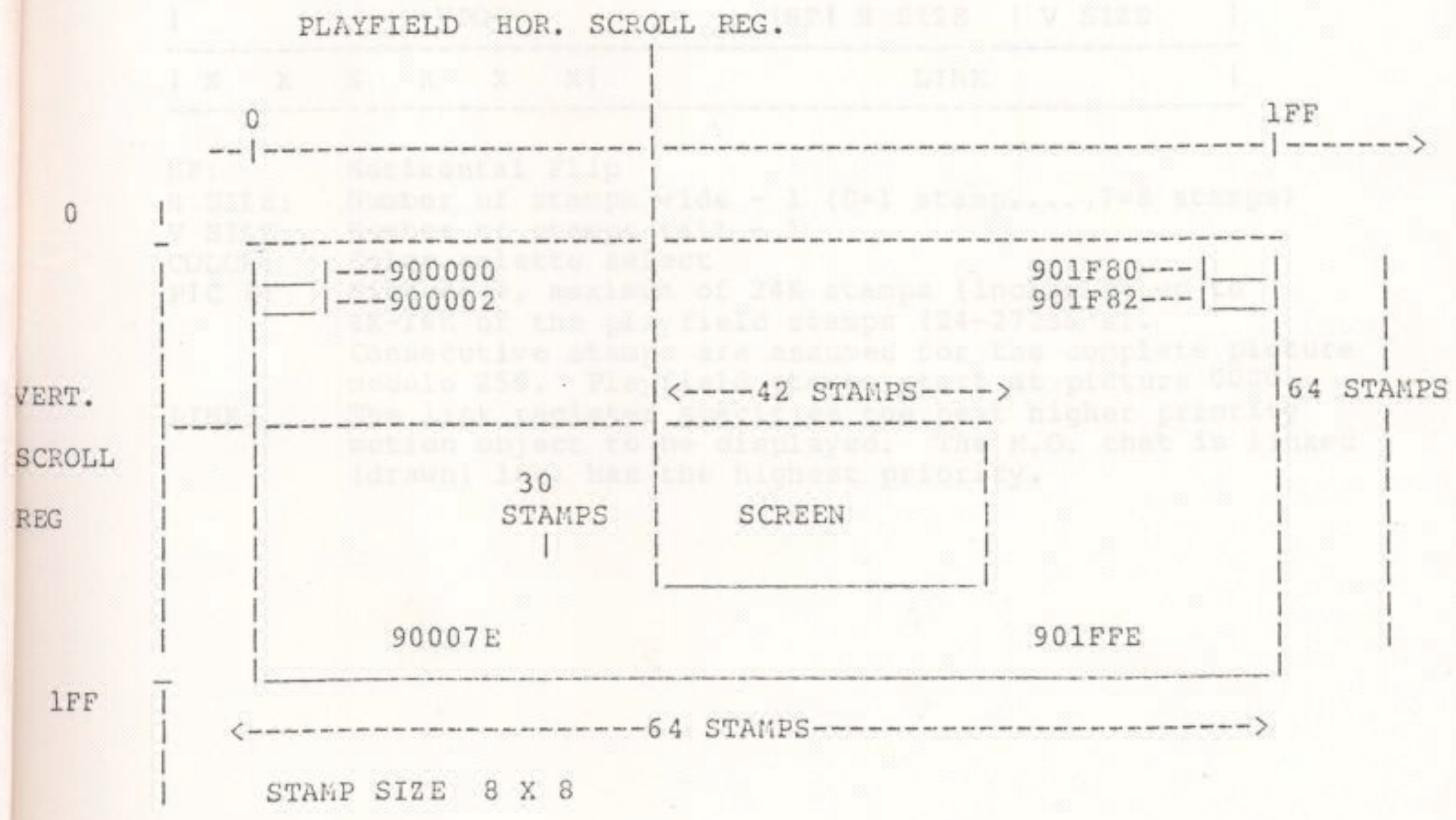
II. Graphics:

- A. Display: - 336 x 240 pixels - standard res. monitor.
- B. Playfield:
 - Size: 64 stamps x 64 stamps
 - Visible screen: 42 stamps x 30 stamps
 - Stamp size: 8 pixels x 8 pixels
 - Independent smooth scrolling horizontally & vertically (wrap-around).
 - Vertical scroll register does not need to be refreshed.
 - Max capacity: up to 4 banks.
 - Each bank = 12_bits = 4K stamps 4 bits deep.



H: Horizontal flip
 PALETTES: Palette select (3 bits)
 PIC: Picture number

PLAYFIELD COORDINATES:



V. Priority:

- Alpha-numerics have the highest priority.
- If the "BG" bit in the alpha parameter is set, the background color or alpha will have priority over all other graphics.
- Motion object colors 2 thru \$F are next in priority.
- If motion object color 1 is specified then the shadow ram colors are used with the playfield color palettes and picture bits.
- Playfield has the lowest priority.

7. COLORAM:

The coloram gets graphics information from three sources: ALPHA, PLAYFIELD, and MOTION OBJECT

$$\text{ALPHA COLORAM} = 910000 + \text{Pictures bits} * 2 + \text{C3-C0} * \$8 + \text{C4} * \$100$$

where C4 to C0 are the color pallete bits specified in the alpha RAM.

$$\text{MOTION OBJECT COLOR RAM} = 910200 + \text{Picture bits} * 2 + \text{Color palette} * \$20$$

$$\text{PLAYFIELD COLOR RAM} = 910500 + \text{Picture bits} * 2 + \text{Color palette} * \$20$$

$$\text{SHADOW COLOR RAM} = 910400 + \text{Playfield bits} * 2 + \text{Playfield color palette} * \$20$$

Coloram data interpretation:

- <D15:D12> Intensity
- <D11:D8 > Red
- <D7 :D4 > Green
- <D3 :D0 > Blue

In all cases, 0000=OFF
1111=highest intensity.

VI . NOTES:

1. Graphics pixel data is low true!!!
PBconvert in the PPS utilities will automatically do a 1's complement for you.
2. All motion object pictures using more than one "stamp" must be in the same page. The PB utilities have features that let you blank fill EPROM's.

SAUNTLET 68010 MEMORY-MAP	ADDRESS	R/W	DATA
Program ROM OS	000000~00FFFF	R	D15~D0
Program ROM SLAPSTICK	038000~03FFFF	R	D15~D0
Program ROM Main	040000~07FFFF	R	D15~D0
Spare RAM	800000~801FFF	R/W	D15~D0
EEPROM	802001~802FFF	R/W	D7~D0
Player 1 Input	803001	R	D0~D7
Player 2 Input	803003	R	D0~D7
Player 3 Input	803005	R	D0~D7
Player 4 Input	803007	R	D0~D7
:			D7 Joystick-up
:			D6 Joystick-down
:			D5 Joystick-left
:			D4 Joystick-right
Player inputs			D3 Spare
:			D2 Spare
:			D1 Fire
:			D0 Magic/Start
BLANK	803009	R	D6 Active lo
Output-Buffer Full (@ 803170)	803009	R	D5 Active hi
Input-buffer Full (@ 80300F)	803009	R	D4 Active hi
Self-test	803009	R	D3 Active lo
Read Sound Processor (6502)	80300F	R	D7~D0
Watch Dog	803100	W	xx (128 msec. timeout)
LED-1	803121	W	D0 Low ON
LED-2	803123	W	D0 Low ON
LED-3	803125	W	D0 Low ON
LED-4	803127	W	D0 Low ON
Sound Processor Reset	80312F	W	D0 Low Reset
Blank Acknowledge	803140	W	xx
Unlock EEPROM	803150	W	xx
Write Sound Processor (6502)	803171	W	D7~D0
Playfield RAM	900000~901FFF	R/W	D15~D0
Motion Object Picture	902000~9027FF	R/W	D15~D0
Motion Object Horizontal Pos.	902800~902FFF	R/W	D15~D0
Motion Object Vertical Pos.	903000~9037FF	R/W	D15~D0
Motion Object Link	903800~903FFF	R/W	D15~D0
Spare RAM	904000~904FFF	R/W	D15~D0
Alpha-Numerics RAM	905000~905FFF	R/W	D15~D0
Playfield Vertical Scroll	905F6E,F	R/W	D15~D7
Playfield ROM bank select	905F6F	R/W	D0,D1
SLIP pointers	905F80	R/W	M.O. link pointers
Color RAM Alpha	910000~9101FF	R/W	D15~D0
Color RAM Motion Object	910200~9103FF	R/W	D15~D0
Color RAM Playfield Shadow	910400~9104FF	R/W	D15~D0
Color RAM Playfield	910500~9105FF	R/W	D15~D0
Color RAM (spare)	910600~9107FF	R/W	D15~D0
Playfield Horizontal Scroll	930000,1	W	D8~D0 (word mode only)

Note: All addresses except 930000 can be accessed in byte or word mode.

6502 MEM-MAP	ADDRESS	R/W	DATA	
Program RAM	0000~0FFF	R/W	D7~D0	
Write 68000 Port	1000	W	D7~D0	Output buffer
Read 68000 Port	1010	R	D7~D0	Input buffer
Audio mix	1020	W	D7~D5	Speech mix
	1020	W	D4,D3	Effects mix
	1020	W	D2~D0	Music mix
Coin 1 (left)	1020	R	D3	
Coin 2	1020	R	D2	
Coin 3	1020	R	D1	
Coin 4 (right)	1020	R	D0	
Data available (@ 1010)	1030	R	D7	Hi active
Outbuf full (@ 1000)	1030	R	D6	Hi active
Speech ready	1030	R	D5	Low active
Self Test	1030	R	D4	Low active
Music reset	1030	W	D7	Low Reset
Speech Write	1031	W	D7	Low Active
Speech reset	1032	W	D7	Low Active
Speech Squeak	1033	W	D7	Low=650KHz clk
Coin Counter Right	1034	W	D7	Hi active
Coin Counter Left	1035	W	D7	Hi active
Effects	1800~180F	R/W	D7~D0	
Music	1810~1811	R/W	D7~D0	
Speech	1820	W	D7~D0	
Interrupt acknowledge	1830	R/W	xx	
Program ROM	4000~FFFF	R	D7~D0	48k bytes.

Notes: NO 6502 watchdog (see 68010)
 NO NMI mask for the NMI coming from the 68010. NMI is automatically acknowledged when the 6502 reads the input data buffer at location 1010


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2.5V      : 2.5 volt audio amplifier reference
+5AUD     : 5 volt audio amplifier reference
10.3V    : Power-on-reset control voltage
+12V     : +12 volts regulated
+15V     : +15 volts unregulated
-15V     : -15 volts unregulated
-5V      : -5 volts regulated
1H ~ 256H : screen horizontal address counter chain
1V ~ 128V : screen vertical address counter chain
/4H      : inverted 4H signal
4HD3, /4HD3 : 4H signal delayed 3 clock cycles
/4HDD    : 4H signal delayed 2 clock cycles
/4HDL    : 4H signal delayed one clock cycle
68KBUF   : 68010 output buffer full (to 6502)
A1~A23   : 68010 address bus unbuffered
/ACS     : 'A' line buffer RAMs chip select
ALC3, ALC4 : alphanumerics pallet data bits 3 & 4
/ALHI, /ALLO : alphamumerics RAM chip selects
APIX0, APIX1 : alphamumerics pixel data
/AS      : 68010 address strobe
AUDIO-L, AUDIO-R : left & right audio outputs (5v pk-pk)
E02      : 6502 buffered phase 2
BAS      : buffered address strobe (see /AS)
/BCS     : 'B' line buffer RAMs chip select
BLU0 ~ BLU3 : blue color RAM data
BLUE     : blue analog video output
BOUT0 ~ BOUT3 : blue latched digital video output
BR//W    : 68010 read/write control, buffered
/BUFCLR  : swap 'A' & 'B' line buffers, clear LB counter chain
BW//R    : 68010 read/write inverted, buffered
CA5, CA7 : color RAM address bits 5 & 7
CCTR1, CCTR2 : coin counter outputs 1 & 2
/CLRA    : clear line buffer 'A' address counters
/CLRB    : clear line buffer 'B' address counters
/COIN    : coin input buffer chip select
COIN1-L, COIN2, COIN3, COIN4-R : 4 coin switch inputs
/COMPSYNC : negative composite sync output
CRA0 ~ CRA9 : Color RAM address
/CRAM, CRAM : 68010 address decode for color RAM
/CRAMWR  : Color RAM write enable
D0 ~ D15 : 68010 data bus, unbuffered
DOWN-1 ~ DOWN-4 : joystick down switch inputs, player 1-4
EEPROM   : electrically erasable PROM chip select
/END     : current motion object finished
FCLOCK   : system clock inverted phase
FIRE-1 ~ FIRE-4 : fire switch inputs, player 1-4
/FLBA    : line buffer 'A' fill control
/FLBB    : line buffer 'B' fill control
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GCS0 ~ GCS5      : graphics ROMs chip select
/GLD             : graphics load (to SLAGS chips)
GND             : system ground
GOUT0 ~ GOUT3   : green latched digital video output
GP0 ~ GP14      : graphics picture address
GP1V, GP2V, GP4V : graphics picture stamp sub-address
GPEN           : graphics picture enable
GREEN          : green analog video output
GRH/L          : graphics ROM hi/lo select (A14 on a 27256)
GRN0 ~ GRN3    : green color RAM data
H03           : alphanumeric load (to shift registers)
HFLP          : graphics stamp horizontal flip
/HORZ         : latch motion object horizontal data and pallet data
HORZDL, /HORZDL : HORZ delayed one clock cycle
HPOS0 ~ HPOS8  : motion object horizontal position data
/HSCRLD       : latch playfield horizontal scroll data
HSIZ0 ~ HSIZ2  : motion object horizontal size
HSYNC, /HSYNC  : horizontal sync output
/INPUT        : 68010 miscellaneous inputs buffer select
INT0 ~ INT3    : intensity color RAM data
IOUT0 ~ IOUT3  : intensity latched digital video output
/LATCH        : 68010 miscellaneous latched outputs chip select
LAUD          : summed left channel audio
LBA0 ~ LBA8    : line buffer 'A' address bus
LBB0 ~ LBB8    : line buffer 'B' address bus
LBCKF         : line buffer clock inverted phase
LBCKR         : line buffer clock
LBDA0 ~ LBDA7  : line buffer 'A' data bus
LBDB0 ~ LBDB7  : line buffer 'B' data bus
/LDA          : load line buffer 'A' address counters
/LDAB         : load line buffer 'A' or 'B' address counters
/LDB          : load line buffer 'B' address counters
/LDS          : 68010 lower data strobe
LED1 ~ LED4    : LED outputs, player 1-4
LEFT-1 ~ LEFT-4 : joystick left switch inputs, player 1-4
/LINK         : latch motion object link data
/LMPD        : stop motion object processing for line buffer changeover
LNK0 ~ LNK9    : motion object link data
MA1 ~ MA14    : 68010 address bus buffered
MATCH        : motion object H & V data matches current
               playfield position
MATCHDL      : previous MATCH state
MBUS         : 68010 'M' data bus buffers enable
MCO, MCL     : motion object parameter control select
/MCEN        : motion object parameter control enable
MCKF         : master clock, inverted phase
MCKR         : master clock
MDO ~ MD15   : 68010 'M' data bus
NFLP        : motion object horizontal flip parameter
/MIX         : latch audio mix data
MO//PF       : 'motion-object' or 'playfield' picture select
/MOHI, /MOLO : motion object RAM chip selects

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MOSR0 ~ MOSR3 : M.O. pixel data, before the line buffers
MOSR4 ~ MOSR7 : M.O. pixel pallet data, before the line buffers
MPIC0 ~ MPIC7 : the lower 8 bits of M.O. picture adress
MPX0 ~ MPX7 : M.O. pixel data, after the line buffers
MREFL : motion object stamp horizontal flip state
MUSIC : music chip select
/NEWMO : start a new motion object
NXL, /NXL : next line
(/NXL*) : NXL one clock cycle early
NXLDL : NXL delayed one clock cycle
/PF1LD ~ /PF256LD : latched playfield horizontal scroll data
PF1V ~ PF256V : playfield vertical address counter chain
PF8H ~ PF256H : playfield horizontal address counter chain
PFBANK0, PFBANK1 : playfield picture bank select
/PFHI, /PFLO : playfield RAM chip selects
/PFHST : playfield scroll control
PFSR0 ~ PFSR3 : playfield pixel data, before PFHS
PFSR4 ~ PFSR6 : playfield pixel pallet data, before PFHS
PFX0 ~ PFX6 : playfield pixel data after PFHS
PICST0 ~ PICST7 : motion object picture start address
/PICT : latch motion object picture data
PICTDL : PICT delayed one clock cycle
PKAUD : effects chip audio
/PL1 ~ /PL4 : player inputs chip selects, players 1-4
PM0 ~ PM2 : effects audio mix control bits
POKEY : effects chip select
PR1 ~ PR6 : pullup resistors
R//W : 68010 read/write control, unbuffered
RAM0, RAM1 : 68010 working RAM chip selects
RAUD : summed right channel audio
RCLOCK : system clock
RD0 ~ RD15 : 68010 ROM data bus
/RD68K : 6502 read 68010 output buffer
RED : red analog video output
RED0 ~ RED3 : red color RAM data
RIGHT-1 ~ RIGHT-4 : joystick right switch inputs, player 1-4
ROM : 68010 ROM data bus enable
/ROM0 ~ /ROM4 : 68010 program ROM chip selects
ROMH/L : 68010 program ROM hi/lo select (A14 on a 27256)
ROUT0 ~ ROUT3 : red latched digital video output
SA0 ~ SA15 : 6502 address bus unbuffered
SBA0 ~ SBA13 : 6502 buffered address bus
SBD0 ~ SBD7 : 6502 buffered data bus
SBR//W : 6502 buffered read/write control
SBW//R : 6502 buffered read/write control inverted
SD0 ~ SD7 : 6502 data bus unbuffered
/SELFTST : self-test switch input test pad
SID : serial in data
/SIORD : 6502 miscellaneous inputs read control
/SIOWR : 6502 outputs latch control
/SIRQACK : 6502 interrupt acknowledge
SLAPSTK : slapstick chip select
SM0 ~ SM2 : speech audio mix control bits

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SNDBUF      : 6502 output buffer full (to 68010)
/SNDINT     : 68010 interrupt from 6502
/SNDIRQ     : 6502 4 millisecond interrupt
/SNDNMI     : 6502 non maskable interrupt
/SNDRD      : 68010 read buffer from 6502
/SNDRES     : 6502 master reset (controlled by 68010)
/SNDWR      : 68010 write to output buffer (to 6502)
SOD         : serial output data
/SPHRDY     : speech chip ready
/SPHRES     : speech chip reset
/SPHWR      : speech chip write
SQUEAK      : speech chip operating frequency control
/SRD        : 6502 read phase
START-1 ~ START-4 : start switch inputs, player 1-4
STEST       : self-test switch input
/SWR        : 6502 write phase
/SYSRES     : system reset (power up)
/UDS        : 68010 upper data strobe
/UNLOCK     : EEPROM write enable control
UP-1 ~ UP-4 : joystick up switch inputs, player 1-4
VAS0, VAS1  : video RAM address control
(VASC*), (VAS1*) : VAS0&1 before being latched
VBD0 ~ VBD15 : video RAM buffered data bus
/VBKACK     : vertical blank interrupt acknowledge
/VBKINT     : vertical blank interrupt
/VELANK     : vertical blank
VBUS        : 68010 'V' bus enable (for video RAM)
VCC         : system VCC (5 volts regulated)
VCPU        : 68010 to video RAM synchronisation control
/VERT       : latch M.O. vertical data and size data
VERTDL, /VERTDL : VERT delayed one clock cycle
/VIDBLANK   : video blank (horizontal and vertical blank mixed)
/VMATCH     : motion object vertical parameter matches
              current playfield vertical position
VOICE       : speech chip select
VPOS0 ~ VPOS8 : motion object vertical position data
VRA0 ~ VRA11 : video RAM address bus
/VRAM       : 68010 address decode for video RAM
/VRAMRD     : 68010 read from video RAM
/VRAMWE     : 68010 write to video RAM
VRD0 ~ VRD15 : video RAM data bus, unbuffered
VRDTACK     : video RAM to 68010 data acknowledge
VSIZ0 ~ VSIZ2 : motion object vertical size parameter
VSYNC, /VSYNC : vertical sync
/WDOG       : watchdog control
/WH         : 68010 write hi byte
/WL         : 68010 write lo byte
/WR68K      : 6502 write to output buffer (to 68010)
/YMRRES     : music chip reset
YM0 ~ YM2   : music audio mix control bits
ZREF        : intensity reference for video output.

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