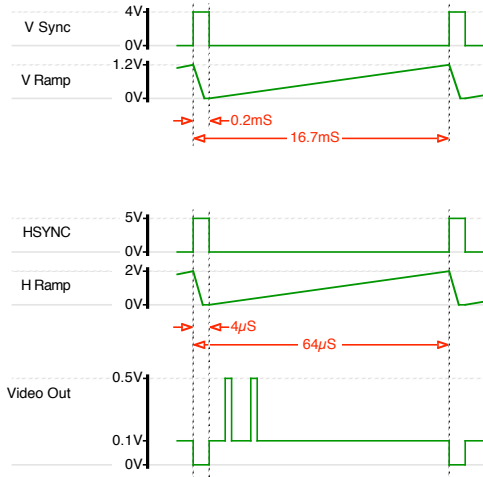


Pongtronics Videogame

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Timing

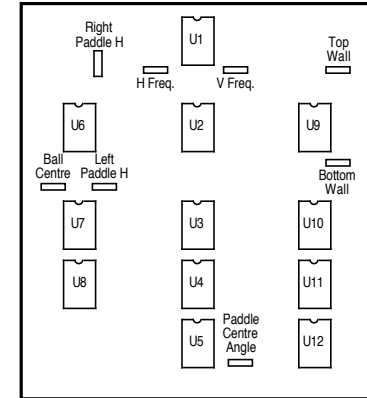
Time values shown are approximate to RS-170 specifications.
Vertical timing values shown require resistors in vertical oscillator to be adjusted from those specified in original design.



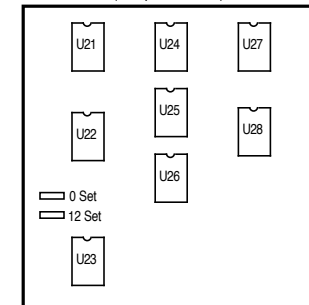
List of Integrated Circuits

IC	Type	Function
Board 1:		
U1	34001	NOR, 2-in, quad
U2	LM3900	Norton Amp, quad
U3	4081	AND, 2-in, quad
U4	4013	D FF, dual
U5	4016	bilateral switch, quad
U6	34001	NOR, 2-in, quad
U7	4001	NOR, 2-in, quad
U8	4002	NOR, 4-in, dual
U9	34001	NOR, 2-in, quad
U10	4030	XOR, 2-in, quad
U11	4011	NAND, 2-in, quad
U12	4001	NOR, 2-in, quad
Board 2:		
U21	4023	NAND, 3-in, triple
U22	4001	NOR, 2-in, quad
U23	4007	dual comp.pair & inverter
U24	4024	counter, binary, 7-stage ripple
U25	4011	NAND, 2-in, quad
U26	4520	counter, binary, dual
U27	4001	NOR, 2-in, quad
U28	4025	NOR, 3-in, triple
Additions to original:		
U31	4013	D FF, dual

Main Board (component side)



Scoring & Sound Board (component side)



Notes

- The symbol ▼ indicates V+.
- Capacitance in microfarads unless otherwise indicated.
- This is a redrawing of the schematic presented in articles in the April and May 1976 issues of Popular Electronics magazine.
- 1997 Aug: Initial drawing / bhilpert.
- 2008 Feb: Revised, circuit modifications added.
- 2015 Jul: Converted to single document form.

Modifications

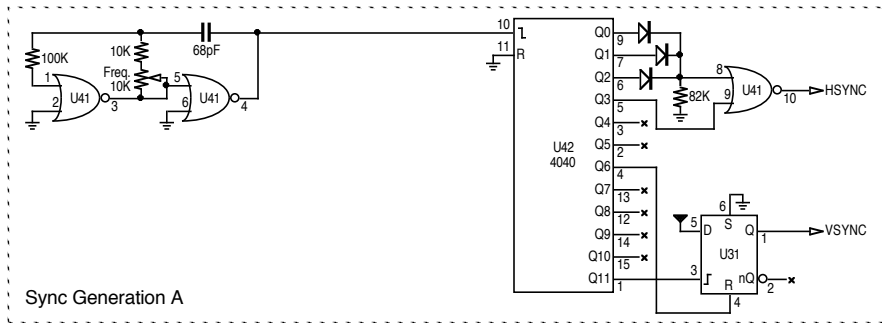
This schematic includes several modifications to the original design:

- 1) U31 added to synchronise the top and bottom borders to the horizontal sync. This ensures the borders are composed of full horizontal lines.
- 2) 3 resistors changed in the vertical oscillator to bring the vertical sync pulse width down to ~0.2 mS. Original resistor values resulted in a pulse width of ~1.5mS which is excessive.
- 3) A new sync generation circuit is presented which derives both horizontal and vertical sync from a single oscillator, so the phase relationship between the two is constant. This significantly reduces jitter in the display.
- 4) 1M resistor in ground level 'miss' comparator reduced to 680K to increase hysteresis. Previously, glitches could result in multiple triggering of the left score counter.

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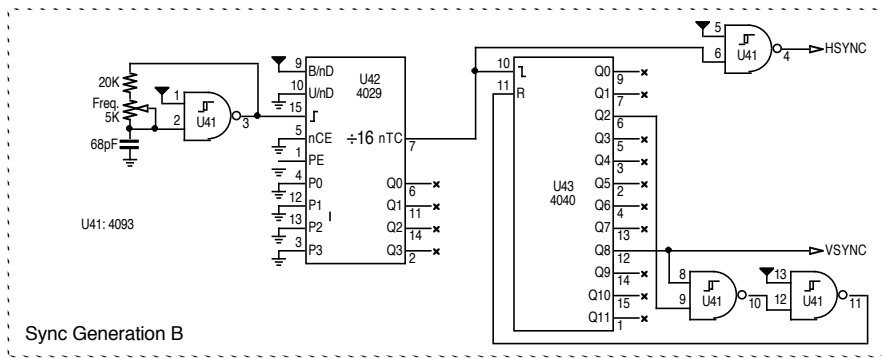
Section: Notes
Page: 2

Rendered: 2015 Jul 27



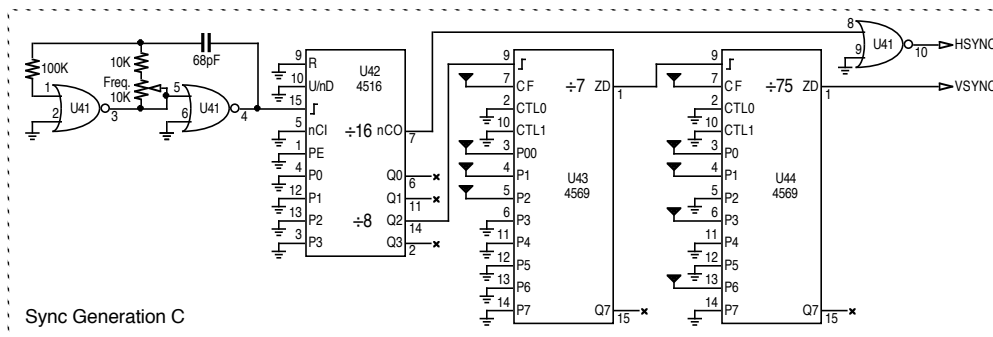
Sync Generation A

R KOhms	C uF	period uS	freq KHz
26.526	68	3.97	252.00
18.037	100	3.97	252.01
8.199	220	3.97	252.00
10	180	3.96	252.53



Sync Generation B

Circuits A, B, C	Clock Horizontal H Sync	252,000 Hz	
	Vertical V Sync Lines	15,750 Hz	63.49 μ S
Circuit A	Vertical V Sync Lines	61.52 Hz	16.25 mS
		256	0.25 mS
Circuit B	Vertical V Sync Lines	60.58 Hz	16.51 mS
		260	0.25 mS
Circuit C	Vertical V Sync Lines	60.00 Hz	16.67 mS
		525	0.22 mS



Sync Generation C

Notes

- Circuit A can be accomplished with various combinations of D flip-flops or OR gates at the outputs.
- The 4029 and 4516 are nearly identical, either may be used for the div-by-16 function.
- Circuit C could be adapted to use 40102 or 40103 ICs instead of 4568 ICs.
- RC values in oscillators may need to be altered from that shown, depending on layout. A more stable oscillator may be desirable.

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