

Quartz Clock Voltages and Waveforms

Measurement data is presented here for the vacuum tube quartz clock covered in the article, “The Time Machine,” published at <http://www.tronola.com/>.

Voltmeter Measurements

These readings were taken with a digital multimeter (DMM). AC values are true RMS.

<u>Item</u>	<u>Value</u>
AC Line	121.1Vrms
+150VDC rail	153.1VDC
+250VDC rail	260.3VDC
6.3VAC heater	6.23Vrms
5.0VAC heater	4.90Vrms
V8-4 HVAC	276.1Vrms
V8-6 HVAC	277.2Vrms

Multivibrator Potentiometer Settings

<u>Pot</u>	<u>Value</u>	<u>Nom Max</u>
R8	2.66K	10K
R9	5.48K	10K
R13	24.34K	25K (set to max)
R14	37.14K	100K
R18	9.68K	10K (set to max)
R19	55.87K	100K
R22	224.70K	250K
R23	64.75K	250K

Tube Voltages

(The table is on the next page.) Due to the large AC signals present, one generally cannot rely on a DMM to show accurate average DC values for these circuits. Neither can a typical DMM measure the AC values well, since peak-to-peak values are needed and the waveforms are non-sinusoidal. The readings below were taken with a Tektronix 2014 digital scope and are therefore limited by the accuracy of the scope, probe and digitizing resolution. The scope was set for 16-averages to reduce noise. Note that resolution is relative to the vertical span needed to encompass the peak-to-peak voltage swing. I would generally expect accuracy of about 2.5% of the peak-to-peak swing, for both the DC and Pk-Pk values. To produce a valid DC average, the horizontal span must include at least two cycles of the waveform. Values shown as “~0.0” mean that the reading was insignificant relative to the vertical span.

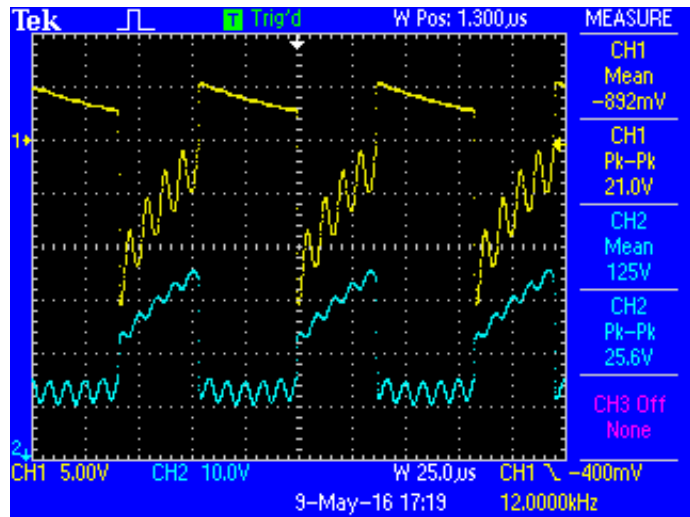
Tube	Pin	Avg VDC	Pk-Pk VAC
V1	4	-13.7	29.0
	6	110.0	~0.0
	8	88.4	14.7
V2	1	~0.0	12.2
	2	157.0	176.0
	3	5.62	~1.0
	4	-1.86	7.7
	5	80.2	90.0
	6	1.51	2.32
V3	1	-0.8	20.9
	2	127.0	24.8
	3	1.83	1.76
	4	-2.41	27.0
	5	127.0	28.6
	6	1.83	1.76
V4	1	-3.25	47.8
	2	135.0	45.2
	3	3.88	4.48
	4	-5.11	51.2
	5	139.0	41.4
	6	3.88	4.48
V5	1	-7.64	51.0
	2	54.2	104.0 (1)
	3	0.0	0.0
	4	-29.0	106.0 (1)
	5	62.0	78.8
	6	0.0	0.0
V6	1	37.2	135.0
	2	65.8	84.0
	3	0.0	0.0
	4	-14.2	81.6
	5	78.4	134.0
	6	0.0	0.0
V7	3	252.0	336.0
	4	266.0	10.2 (2)
	5	-2.97	58.0
	8	12.9	7.04
V8	4	0.0	780.9 (3)
	6	0.0	784.0 (3)
	8	270.0	17.8
V9	2	~0.0	~0.0
J1-H	5	154.0	3.12 (4)
		~0.0	330.0 (5)

Waveform Images

V3A, 12kHz Multivibrator

Yellow: V3-1, Grid-A

Blue: V3-2, Plate-A



V3B, 12kHz Multivibrator

Yellow: V3-4, Grid-B

Blue: V3-5, Plate-B

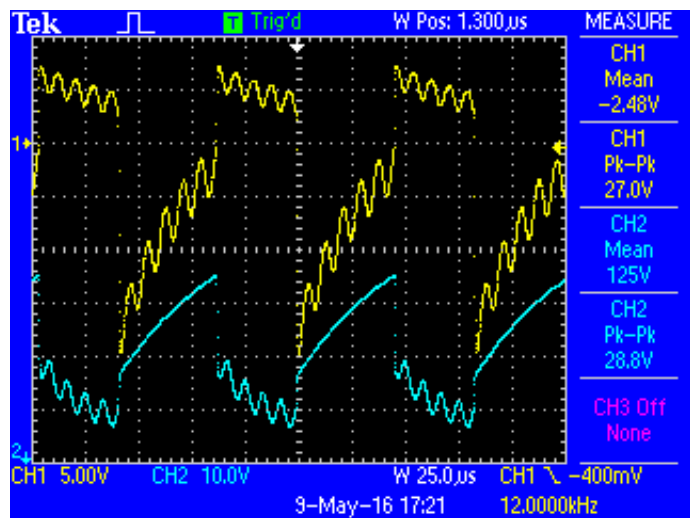


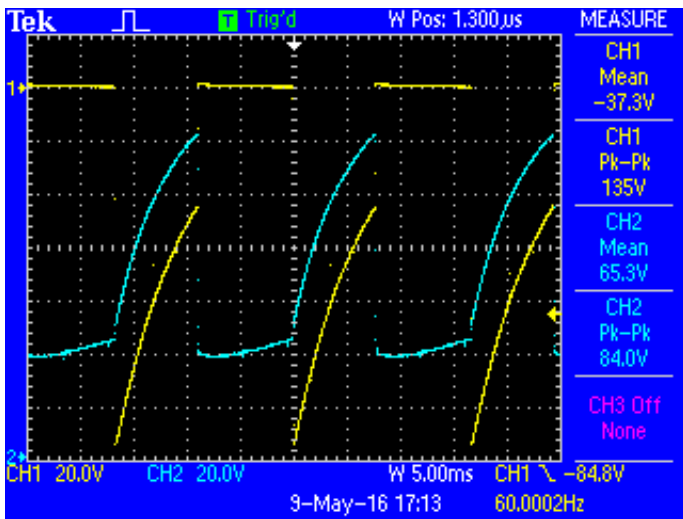
TABLE NOTES:

1. Presence of scope probe causes out-of-sync condition.
2. AC is 60Hz synced to the clock (not the AC line).
3. Calculated from RMS readings.
4. AC value is mostly "hash" from switching noise.
5. J1 is the outlet powering the clock.

V6A, 60Hz Multivibrator

Yellow: V6-1, Grid-A

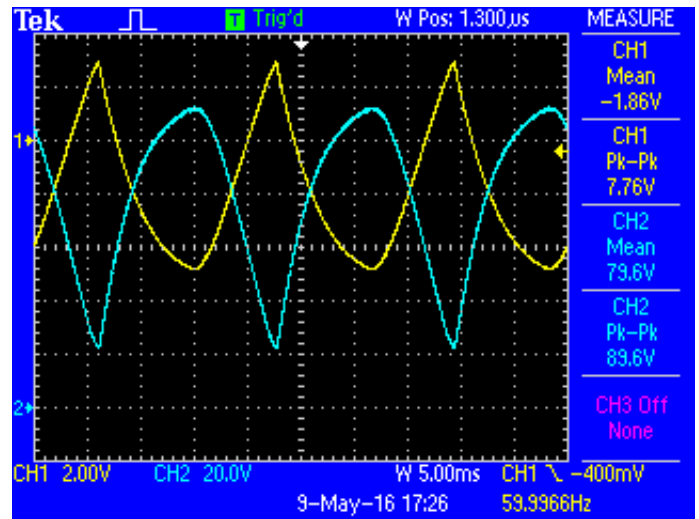
Blue: V6-2, Plate-A



V2B, Driver Amplifier

Yellow: V2-4, Grid-B

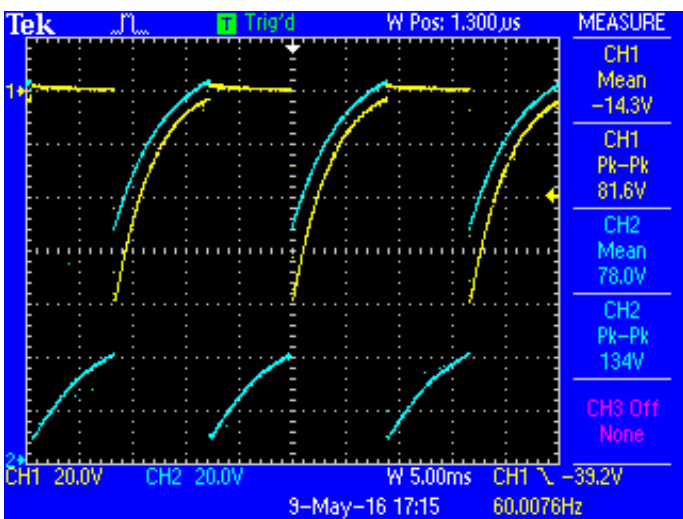
Blue: V2-5, Plate-B



V6B, 60Hz Multivibrator

Yellow: V6-4, Grid-B

Blue: V6-5, Plate-B



V7, Power Amplifier

Yellow: V7-5, Control Grid

Blue: V7-3, Plate

