Unit Test PCB1 THD Analyzer

Bob Cordell's article (part 3) describes this as CP1 bench-testing. The PCB is mounted with components in a particular order to facilitate testing of all relays with resistance and capacitance values.

Date test conducted:	
PCB1 hardware version:	V0.30
End-result Test	OK / NOK

PCB1 signal-generator: mounting of components

Nr.	Description	
0	**Entry-criteria:** - a tested and working µC control-board (PCB4) is needed for these tests. - A host PC with USB-to-serial adapter is connected to **CON6 (RS232.5V)** of the µC control-board (GND-GND, RXD-TX, TXD-RX). - Set communication settings to **57600,N,8,1**. - Give the **s0** command, a response with version info is returned.	OK/NOK
1	- Mount resistors R5-R43, RKM4, RLN4, RE1-RE11, RF1-RF11, R205, R206, RLD and RS1-RS24. - Mount trim pots R1-R4.	
2	Mount all capacitors: C1-C16, C18, C21, C22, C1P-C11P, C1N-C11N, CKM1-CKM4, CLN1-CLN4, CN3 and CP3.	
3	Mount all diodes: D1-D3, DS1-DS24, LED1.	
4	Mount transistors QS1-QS24.	
5	Mount all relays: K1-K14 and K17-K24.	
6	Mount connector UC_IO.	
7	Mount the shift-registers (74HC595D): IC9, IC10 and IC11. Mount the voltage regulators: IC12 (7812) and IC13 (7805).	
8	Connect ±15 V and GND to **+15 V**, **GND** and **-15 V**.	
9	Measure the following DC voltages at the test-pins:	+15 V +12 V +5 V -15 V		OK/NOK
10	Connect a flatcable from PCB4 **CON10** to PCB1 **CON3 (UC_IO)**. Give the UART command **f10** or use the joystick buttons on PCB4 to select a frequency.	Some PCB1 relays are switched.		OK/NOK
11	Connect a multimeter between **E1** and **E2** and use the joystick-buttons on PCB4 to select a frequency or give a UART command (**f0** for 20 Hz up to **f10** for 200 Hz). Check every individual resistance-value between **E1** and **E2**:	20 Hz – 38440 Ω 25 Hz – 30940 Ω 30 Hz – 25320 Ω 40 Hz – 19130 Ω 50 Hz – 15300 Ω 65 Hz – 11820 Ω 80 Hz – 9670 Ω 100 Hz – 7710 Ω 130 Hz – 5930 Ω 160 Hz – 4830 Ω 200 Hz – 3830 Ω		OK/NOK
12	Connect a multimeter between **E3** and **E4** and use the joystick-buttons on PCB4 to select a frequency or give a UART command (**f0** for 20 Hz up to **f10** for 200 Hz). Check every individual resistance-value between **E3** and **E4**:	20 Hz – 38440 Ω 25 Hz – 30940 Ω 30 Hz – 25320 Ω 40 Hz – 19130 Ω 50 Hz – 15300 Ω 65 Hz – 11820 Ω 80 Hz – 9670 Ω 100 Hz – 7710 Ω 130 Hz – 5930 Ω 160 Hz – 4830 Ω 200 Hz – 3830 Ω		

Nr.	Description			
13	Connect a capacity-meter between **E2** and **E3** and use the µC control-board to set a frequency range. Check every capacitance-value between **E2** and **E3**:	Range 0 – 220 nF Range 1 – 22 nF Range 2 – 2.2 nF Range 3 – 220 pF		OK/NOK
14	Connect a capacity-meter between **E4** and **E5** and use the µC control-board to set a frequency range. Check every capacitance-value between **E4** and **E5**:	Range 0 – 220 nF Range 1 – 22 nF Range 2 – 2.2 nF Range 3 – 220 pF		OK/NOK
15	Connect a capacity-meter between **E7** and **GND** and use the µC control-board to set a frequency range. Check every capacitance-value between **E7** and **GND**:	Range 0 – 1 µF Range 1 – 470 nF Range 2 – 100 nF Range 3 – 10 nF		OK/NOK
16	Mount the remaining components: - transistors Q1 (PN4091) or Q1* (MMBF4091). - transistors Q2-Q4 (2N3904). - IC1 and IC2 (2xNE5534) **or** IC12* (1xOPA1612 or 1xLM4562) - IC3 and IC4 (2xNE5534) **or** IC34* (1xOPA1612 or 1xLM4562) - IC5-IC7 (LM318D) and IC8 (NE5534)			

PCB1 signal-generator: unit-testing

Nr.	Description		

20	Preparations: - Connect **E5** to **E9**.
	            - Center trim pot **R24**.
	            - Use the µC control-board to select a frequency of **2 kHz**.		

	Description	Result		OK?
		Expected	**Measured**	
21	Connect a scope to **E5**.	**4.5 V$_{pp}$** sine-wave of approx. **2 kHz**.		OK/NOK
22	Measure the following DC voltages:	OIC1: +2.9 mV OIC2: +0.8 mV +IC3: +0.1 mV OIC3: -4.3 mV OIC4: +1.0 mV OIC5: -4.6 mV BQ3: +602 mV EQ3: +2.2 V E7 : +2.2 V IC6-6: +13 mV E8 : -2.5 V GQ1 : -2.5 V		OK/NOK
23	Connect scope channel A to **E5** and channel B to **E9**.	V$_{E11}$ / V$_{E5}$ = 3 x	V$_{E11}$: V$_{E5}$:	OK/NOK
24	- Select a frequency of **200 Hz** on PCB4. - Connect scope channel A to test-pin **IC6.6**. Adjust **R24** for perfect symmetry: adjacent peaks are of equal level.	- 4.5 Vpp sine-wave of approx. **200 Hz**. - Signal is full-wave rectified		OK/NOK
25	Select a frequency of **20 Hz** on PCB4.	- 4.5 Vpp sine-wave of approx. **20 Hz**. - Stable level within 15 seconds		OK/NOK
26	Use the µC control-board and select every possible frequency. Connect scope channel A to **E5** and check for a stable sine-wave on **E5**.	Highest possible frequency ≥ **130 kHz**		OK/NOK