

Unit Test PCB2 THD Analyzer

Bob Cordell's article (part 3) describes this as CP2 bench-testing. The PCB itself is tested in another way than Bob's bench-test. This is because we use the microcontroller board (PCB4) to control all the switches.

Date test conducted:	
PCB1 hardware version:	V0.21
End-result Test	OK / NOK

PCB2 Input amplifier and Bandpass filters

Nr.	Description			
0	Entry-criteria: - a tested and working μ C control-board (PCB4) is needed for these tests. - A host PC with USB-to-serial adapter is connected to CON6 (RS232.5V) of the μ C 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. - Mount all components. Since the board is large, we will be testing the relays with resistors and capacitors in another way than we did for PCB1.			OK/NOK
1	With no supply voltage present, measure the resistance between E16 and E17 and between E19 and E20 .	E16-E17: 38440 Ω E19-E20: 38440 Ω		OK/NOK OK/NOK
	Connect ± 15 V and GND to +15 V, GND and -15 V .			
2	Measure the following DC voltages at the test-pins:	+15 V +12 V +5 V -15 V		OK/NOK
3	Connect a flatcable from PCB4 CON11 to PCB2 CON2 (UC_IO) . Give the UART command f10 or use the joystick buttons on PCB4 to select a frequency.	Some PCB2 relays are switched.		OK/NOK
4	- Connect a sinewave (2 kHz, 2.82V_{pp}) to the PCB2 Input pin. - Connect E15 to the scope, channel 1. - Use the joystick-buttons on PCB4 to select the 100 V input-level or give UART command i0 . - Use the joystick-buttons on PCB4 to select the 30 V input-level or give UART command i1 . - Use the joystick-buttons on PCB4 to select the 10 V input-level or give UART command i2 . - Use the joystick-buttons on PCB4 to select the 3 V input-level or give UART command i3 . - Use the joystick-buttons on PCB4 to select the 1 V input-level or give UART command i4 .	E15: 84 mV _{pp} E15: 277 mV _{pp} E15: 856 mV _{pp} E15: 2.82 V _{pp} E15: 8.6 V _{pp}		OK/NOK
5	- Connect E22 (FCONT) and E23 (ACONT) to GND . - Connect E18 to the scope, channel 1. - Use the joystick-buttons on PCB4 to select the 3 V input-level or give UART command i3 . - Use the following procedure to check if a relay for the resistor-network is switched: <ul style="list-style-type: none"> Use the joystick-buttons on PCB4 to select a frequency of 20 Hz or give the UART command f0. No resistor-relays are switched. Start with relay K1: if the signal on pin 2 is different from the signals on pins 3 and 4 (use scope channel 2 for this), it is switched (on). If the signal is (almost) the same, it is not switched (off). 	20 Hz – all relays off 25 Hz – K1 is on 30 Hz – K2 is on 40 Hz – K3 is on 50 Hz – K4 is on 65 Hz – K5 is on 80 Hz – K6 is on 100 Hz – K7 is on 130 Hz – K8 is on 160 Hz – K9 is on 200 Hz – K10 is on		OK/NOK

	<ul style="list-style-type: none"> Select the next frequency up until 200 Hz (UART command f10) and check the relay. Repeat for every relay. 	Note: only 1 relay is on at the same time! Check that others are off.		
6	Use the following procedure to check if a relay for the capacitor-network is switched: <ul style="list-style-type: none"> Use the joystick-buttons on PCB4 to select a frequency of 25 Hz or give the UART command f1. No capacitor-relays are switched. Check for every relay (K11-K13) that the signal on pin 2 is (almost) the same as the signal on pins 3 and 4. Start with relay K11: if the signal on pin 2 is different from the signals on pins 3 and 4, it is switched (on). If the signal is (almost) the same, it is not switched (off). Select a frequency of 250 Hz or give the UART command f11. Select a frequency of 2.5 kHz or give the UART command f21. Select a frequency of 25 kHz or give the UART command f31. 	25 Hz – all relays off 250 Hz – K11 is on 2.5 kHz – K12 is on 25 kHz – K13 is on Note: only 1 relay is on at the same time! Check that others are off.		OK/NOK
7	- Remove the sinewave from the PCB2 Input pin. - Connect E15 to GND and measure the following DC voltages:	+IC9: -34 mV OIC9: -101 mV +IC10: -12 mV OIC10: +1.2 V OIC11: +1.2 V +IC12: 0.0 V OIC12: +4.3 mV OIC13: +0.9 V OIC14: -5.6 V OIC15: -27.5 mV		OK/NOK
8	- Connect E15 to the scope, channel 1. - Connect E18 to the scope, channel 2. - Use the joystick-buttons on PCB4 to select the 3 V input-level or give UART command i3 . - Connect a sinewave (2 kHz, 2.82V_{pp}) to the PCB2 Input pin and vary the frequency.	Bandpass characteristic with a center-frequency of approx. 2 kHz .		OK/NOK
9	- Adjust trimpot R59 for a center-frequency of 2 kHz. - Adjust trimpot R62 for a voltage-level on E18 of 1.15 V _{rms} (3.25 V _{pp}). - Adjust trimpot R59 again as necessary.	2 kHz output on E18 with a voltage-level of 3.25 V_{pp} .		OK/NOK
10	- Connect IC14 pin 6 to the scope channel 1. - Connect E19 to the scope channel 2.	Approx. 1 V_{pp} and in phase with E19 .		OK/NOK
11	- Remove the wire from E22 to GND and connect E22 temporarily to -15V . Check the multiplier (IC14 and Q5) if this test fails.	Approx. 1V_{pp} and inverted from that at E19 .		OK/NOK
12	- Connect IC16 pin 6 to the scope channel 1. - Connect E21 to the scope channel 2.	Approx. 1 V_{pp} and in phase with E21 .		OK/NOK
13	- Remove the wire from E23 to GND and connect E23 temporarily to -15V . Check the multiplier (IC16 and Q6) if this test fails.	- Approx. 1V_{pp} and inverted from that at E21 . - Sinewave of approx. 0.4 V_{pp} present at E24 .		OK/NOK

PCB2 Product amplifier and auto-set level circuit

Nr.	Description			
20	Use the joystick-buttons on PCB4 to select a sensitivity of 0.03% .			
	Description	Result		OK?
		Expected	Measured	
21	Measure the DC voltages with a 10 kΩ isolating resistor at the end of the meter probe to prevent oscillations.	E15: -53 mV OIC17: -521 mV +IC18: -15.3 mV OIC18: -153 mV OIC19: +5.0 mV IC20-1: -7.52 V IC20-2: -8.19 V IC20-3: -8.19 V IC20-5: -13.9 V IC20-12: +8.59 V OIC21: +92 mV IC22-12: +9.3 V E32: +102 mV D5-A: +450 mV E31: +48 mV		OK/NOK
22	- Note: The 1V_{rms} , 2 kHz signal is still connected to the input of PCB2. - Connect E26 to scope channel 1. - Sweep the input-frequency and observe the signal at the scope. - Adjust trimpot R62 for a deep notch (less than 10 mV_{rms}). - If R62 doesn't have enough range, connect E23 to - 15V instead of GND .	- A notch should be observed at the center frequency. - A deep notch (< 10 mV_{rms}) should be observed at the center frequency.		OK/NOK
23	- Change the frequency of the function-generator until a 100 mV_{rms} (280 mV _{pp}) is shown at E26 (typically a frequency change of a few Hz is sufficient for this). - Use the joystick-buttons on PCB4 to select a sensitivity of 3% .	- 280 mV_{pp} at E26 . - IC19 pin 6 = 100 mV_{rms} - IC19 pin 6 = 10 mV_{rms}		OK/NOK
24	- Connect E32 to the scope channel 1. - Connect E31 to a multimeter measuring DC-voltage. - Change the amplitude on function generator between +10 dB (* 3) and -10 dB (/ 3), the output reference VCA (E32) = 1.1 V_{rms} and is independent of the input-level.	- E32 = 1.1 V_{rms} - E31 = 0 V_{DC} at 1V_{rms} input - E31 = +3 V_{DC} at 3V_{rms} input - E31 = -3 V_{DC} bij 0.33V_{rms} input - E29 remains 100 mV_{rms}		OK/NOK
25	- Change to amplitude of the input-signal to 10 mV_{rms} (-20 dB). - Change amplitude back to 1 V_{rms}	E31 converges back to 0V_{DC} within 10 seconds.		OK/NOK