Integration & Acceptance Test THD Analyzer

Bob Cordell's article (part 3) describes this as "Intermediate Check-Out" (page 57) and "Test and Calibration" (page 58-59). The system itself is tested slightly different from Bob's tests. This is because we use the µC board (PCB4) to control all switches.

Date test conducted:	18-2-'25
PCB1, PCB2, PCB3 hardware version:	V0.30 V0.21 V0.21
End-result of test	OK / ~~NOK~~

Intermediate Check-Out

Nr.	Description			
	Entry-criteria: - a tested and working µC control-board (PCB4) is needed for these tests. - Unit-tests for PCB1, PCB2 and PCB3 boards have been done and no errors were found. - Flat-cables (4) are connected between: • PCB1 and PCB4, PCB2 and PCB4 and between PCB3 and PCB4 • PCB2 and PCB3 inter-connect - Function-generator, oscilloscope, true-RMS multimeter.			
0	- For PCB1, PCB2, PCB3 and PCB4: Connect ±15 V and GND to **+15 V**, **GND** and **-15 V**.			
	Description	**Result**		**OK?**
		Expected	**Measured**	
1.1	- Connect **MAIN.OUT** (PCB1) to the **Input** on PCB2. - Use the Level potmeter on PCB1 to set PCB2 input-voltage to **1 V_{rms}**. Use a true-RMS multimeter to measure this value as accurate as possible. - Set **Frequency** to 2 kHz. ✓ - Set **Output-level** to 5V. ✓ - Set **Input-level** to 3V. ✓ - Set **Sensitivity** to 0.3%. ✓ - Adjust **R59** (freq.) and **R62** (ampl.) as necessary	- Analyzer has locked itself - **E8** between -1V and -4V - **E22** between -1V and -4V - **E23** between -1V and -4V - No oscillations 1,0029 V_{RMS}	-3.65 V -2.72V -3.34V	OK/~~NOK~~
1.2	- Inject a distortion signal (**6 kHz, 150 mV_{rms}**) from a 2nd function-generator through a 62 kΩ into PCB2 input. - Calibrate the 0.3% Sensitivity setting as follows: • UART: type 'c11' and write down the value. • c11_new = (x * c11) / (y * z), with: • x = 150 mV_{rms} (2nd function-generator output) • y = PCB1 output-value in mV_{rms} • z = value on SSD4 (e.g. 0.15) - Enter this new value by typing 'c11 c11_new', with c11_new being the number calculated. - Check that SSD4 now displays **0.150 %**.	- Distortion is 0.15 %, SSD4 reading should be close to this value. - Check signal at **E40 (DIST.OUT)**, this should be a clean 6 kHz signal ✓ **c11_new** = 0.315113 0.152% → 0.150%	0.152 % **c11** = 0.320241 120 mV_{PP}	OK/~~NOK~~
1.3	- Set **Sensitivity** to **1.0 %**. - Inject a distortion signal (**6 kHz, 500 mV_{rms}**) from a 2nd function-generator through a 62 kΩ into PCB2 input. - Calibrate the 1.0% Sensitivity setting as follows: • UART: type 'c10' and write down the value. • c10_new = (x * c10) / (y * z), with: • x = 500 mV_{rms} (2nd function-generator output) • y = PCB1 output-value in mV_{rms} • z = value on SSD4 (e.g. 0.500) - Enter this new value by typing 'c10 c10_new', with c10_new being the number calculated. - Check that SSD4 now displays **0.500 %**.	- Distortion is 0.5 %, SSD4 reading should be close to this value. - Check signal at **E40 (DIST.OUT)**, this should be a clean 6 kHz signal ✓ **c10_new** = 1.043566 0.465% → 0.499%	0.465 % **c10** = 0.977517 120 mV_{PP}	OK/~~NOK~~

1.4	- Set **Sensitivity** to **3.0 %**. - Inject a distortion signal (**6 kHz, 1.5 V_{rms}**) from a 2nd function-generator through a 62 kΩ into PCB2 input. - Calibrate the 3.0% Sensitivity setting as follows: • UART: type 'c9' and write down the value. • c9_new = (x * c9) / (y * z), with: • x = 1500 V_{rms} (2nd function-generator output) • y = PCB1 output-value in mV_{rms} • z = value on SSD4 (e.g. 1.500) - Enter this new value by typing 'c9 c9_new', with c9_new being the number calculated. - Check that SSD4 now displays **1.500 %**.	- Distortion is 1.5 %, SSD4 reading should be close to this value. - Check signal at **E40 (DIST.OUT)**, this should be a clean 6 kHz signal 120 mVpp **c9_new** = 3,155554 MANUALLY ADJUSTED TO 3.14 → 1.500 %	1.401 % **c9** = 2.932551 1500 * 2.932551 / 995 * 1.401	OK/~~NOK~~
1.5	- Set **Sensitivity** to **10.0 %**. - Inject a distortion signal (**6 kHz, 5 V_{rms}**) from a 2nd function-generator through a 62 kΩ into PCB2 input. - Calibrate the 10.0% Sensitivity setting as follows: • UART: type 'c8' and write down the value. • c8_new = (x * c8) / (y * z), with: • x = 5000 V_{rms} (2nd function-generator output) • y = PCB1 output-value in mV_{rms} • z = value on SSD4 (e.g. 5.000) - Enter this new value by typing 'c8 c8_new', with c8_new being the number calculated. - Check that SSD4 now displays **5.000 %**.	- Distortion is 5.0 %, SSD4 reading should be close to this value. - Check signal at **E40 (DIST.OUT)**, this should be a clean 6 kHz signal 124 mVpp **c8_new** = 10.612312 5.06 %	4.652 % VARIES TO 4.72 % **c8** = 9.774194 5000 * 9.774194 / 984 * 4.68	OK/~~NOK~~ VARIATION A BIT TOO MUCH.
1.6	- Set **Sensitivity** to **0.1 %**. - Inject a distortion signal (**6 kHz, 50 mV_{rms}**) from a 2nd function-generator through a 62 kΩ into PCB2 input. - Calibrate the 0.1% Sensitivity setting as follows: • UART: type 'c12' and write down the value. • c12_new = (x * c12) / (y * z), with: • x = 50 mV_{rms} (2nd function-generator output) • y = PCB1 output-value in mV_{rms} • z = value on SSD4 (e.g. 0.05) - Enter this new value by typing 'c12 c12_new', with c12_new being the number calculated. - Check that SSD4 now displays **0.050 %**.	- Distortion is 0.05 %, SSD4 reading should be close to this value. - Check signal at **E40 (DIST.OUT)**, this should be a clean 6 kHz signal 120 mVpp **c12_new** = 0.107652 0.051 %	0.046 % **c12** = 0.097752 50 * 0.097752 / 987 * 0.046	OK/~~NOK~~
1.7	- Set **Sensitivity** to **300 ppm**, increase **Input-level** to 10V and use the Level potmeter on PCB1 to increase the PCB1 output-voltage to **4.5 V_{rms}**. Use a true-RMS multimeter to measure this value as accurate as possible. - Inject a distortion signal (**6 kHz, 90 mV_{rms}**) from a 2nd function-generator through a 62 kΩ into PCB2 input. - Calibrate the 300 ppm Sensitivity setting as follows: • UART: type 'c13' and write down the value. • c13_new = (x * c13) / (y * z), with: * 10^4 • x = 90 mV_{rms} (2nd function-generator output) • y = PCB1 output-value in mV_{rms} • z = value on SSD4 (e.g. 200 ppm) - Enter this new value by typing 'c13 c13_new', with c13_new being the number calculated. - Check that SSD4 now displays **200 ppm**.	- Distortion is 200 ppm, SSD4 reading should be close to this value. - Check signal at **E40 (DIST.OUT)**, this should be a clean 6 kHz signal ±150 mVpp **c13_new** = 3,21 4.50 V_{RMS} 200.3 ppm	198.4 ppm **c13** = 3,185132 90 * 3,185132 / 4500 * 198.4 * 10^4	OK/~~NOK~~

NOTE: RE-DID TESTS 1.7, 1.8 & 1.9 WITH PPM-VALUES.

1.8	- Set **Sensitivity** to **100 ppm**. - Inject a distortion signal (**6 kHz, 30 mV_{rms}**) from a 2nd function-generator through a 62 kΩ into PCB2 input. - Calibrate the 100 ppm Sensitivity setting as follows: • UART: type 'c14' and write down the value. • c14_new = (x * c14 * 1E+4) / (y * z), with: • x = 30 mV_{rms} (2nd function-generator output) • y = PCB1 output-value in mV_{rms} • z = value on SSD4 (e.g. 67 ppm) - Enter this new value by typing 'c14 c14_new', with c14_new being the number calculated. - Check that SSD4 now displays **66.7 ppm**.	- Distortion is 66.7 ppm, SSD4 reading should be close to this value. - Check signal at **E40 (DIST.OUT)**, this should be a clean 6 kHz signal ±120mVpp, SHAKY **c14_new** = 1.018 ±66.5 ppm	61 ppm **c14** = 0.9315 $\frac{30 * 0.9315}{4500 * 61} * 10^4$	OK/NOK
1.9	- Set **Sensitivity** to **30 ppm**. - Inject a distortion signal (**6 kHz, 12 mV_{rms}**) from a 2nd function-generator through a 62 kΩ into PCB2 input. - Calibrate the 30 ppm Sensitivity setting as follows: • UART: type 'c15' and write down the value. • c15_new = (x * c15 * 1E+4) / (y * z), with: • x = 12 mV_{rms} (2nd function-generator output) • y = PCB1 output-value in mV_{rms} • z = value on SSD4 (e.g. 20 ppm) - Enter this new value by typing 'c15 c15_new', with c15_new being the number calculated. - Check that SSD4 now displays **26.7 ppm**.	- Distortion is 26.7 ppm, SSD4 reading should be close to this value. - Check signal at **E40 (DIST.OUT)**, this should be a clean 6 kHz signal SHAKY, BUT STILL 6 kHz **c15_new** = 0.31346 26.7 ppm	21 ppm **c15** = 0.246848 $\frac{12 * 0.246848}{4500 * 21}$	OK/NOK

WITHOUT 2ND FUNCTION-GENERATOR:

2 kHz: 11 ppm, 0.0011 %, -99.2 dB

NOTE: BUG RANGE 2 (2.5 kHz - 20 kHz): DOES NOT LOCK! (FHIGH).