THE SET FOR THE ULTIMATE DISTORTION MEASUREMENTS

VK-1 Ultra-Low Distortion Oscillator

1.Two quadrature sinewave outputs with independent level control (up to 2V) and common frequency control (from 16Hz to 63kHz).
2. Distortion of each output at frequencies within 20Hz-20kHz:
   total harmonic distortion (THD) – less than 0,0002%;
   separate harmonics of distortion – less than –125dB each harmonic.
3. Level control:
   output 1 – continuously variable up to 2V (+6dB) plus attenuated in 10dB steps from 0dB (1V) down to –60dB (1mV);
   output 2 – only continuously variable within 0-2V.
4. Amplitude stability of both outputs:
   long-term, when varying temperature, frequency – better than 0,3%;
   low-frequency microfluctuations – less than –120dB.
5. Output impedance:
   of attenuator's output – exactly 600-Ohm; of other outputs – less than 200-Ohm.
6. Noise component of each output – less than –110dB in a 20Hz-100kHz noise measurement bandwidth.
7. Noise reference button 2V/0,5V – provides, when pressed, 4 times lower level of outputs, their noise component remaining unchanged.
8. Main frequency control:
   10 selectable basic frequencies – 20Hz, 40Hz, 80Hz, 160Hz, 315Hz, 630Hz, 1,25kHz, 2,5kHz, 5kHz, 10kHz, 20kHz.
9. Two additional frequency controls:
   first – frequency variation in accurate (1%) 1/6, 1/3 or 1/2 octave steps;
   second – the above stepped or continuous (0-1) octave variation.
   Joint action of these additional controls gives resulting variation from the selected basic frequency.
10. Total number of all possible spot frequencies – 70 (from 16Hz to 44,8kHz).
11. Internal power supply: +15V, -15V stabilized.
12. Dimensions: 200by 180by65mm.

VK-2 Distortion Meter

1. The measured total harmonic distortion (THD):
   from 1% down to 0,0002% (1%; 0,1%; 0,01%; 0,001% ranges).
2. Input signals: level – 0,1-30V; frequency – 20Hz-20kHz.
3. Input normalization in front of the rejection filter:
   manual, at a 1V level (1,5% accuracy), with the help of normalization knob, input selection button and two (less and more) led indicators.
4. The meter's rejection filter:
   active, with Q=2 (5% loss of second and 2% loss of third harmonics of distortion);
   automatic indication of frequency range to be selected (10 octave ranges);
   fully automatic (in 4sec) fine tuning;
   130dB suppression of the fundamental frequency;
   maximum +80dB gain of the residuals (THD+Noise).
5. Output signal:
   1V RMS in the top of the ranges, 20Hz-100kHz band limited (for further RMS measurement and displaying).
6. Internally generated noise in the set 20Hz-100kHz bandwidth:
   reffered to the meter's input – 3μV, reffered to its output – 0,0003%.
7. Internally generated distortion at frequencies within 20Hz-20kHz:
   THD – less than 0,0001%;
   separate harmonics of distortion – less than –130dB each harmonic.
8. Internal power supply: +15V, -15V stabilized.
9. Dimensions: 200by180by65mm.

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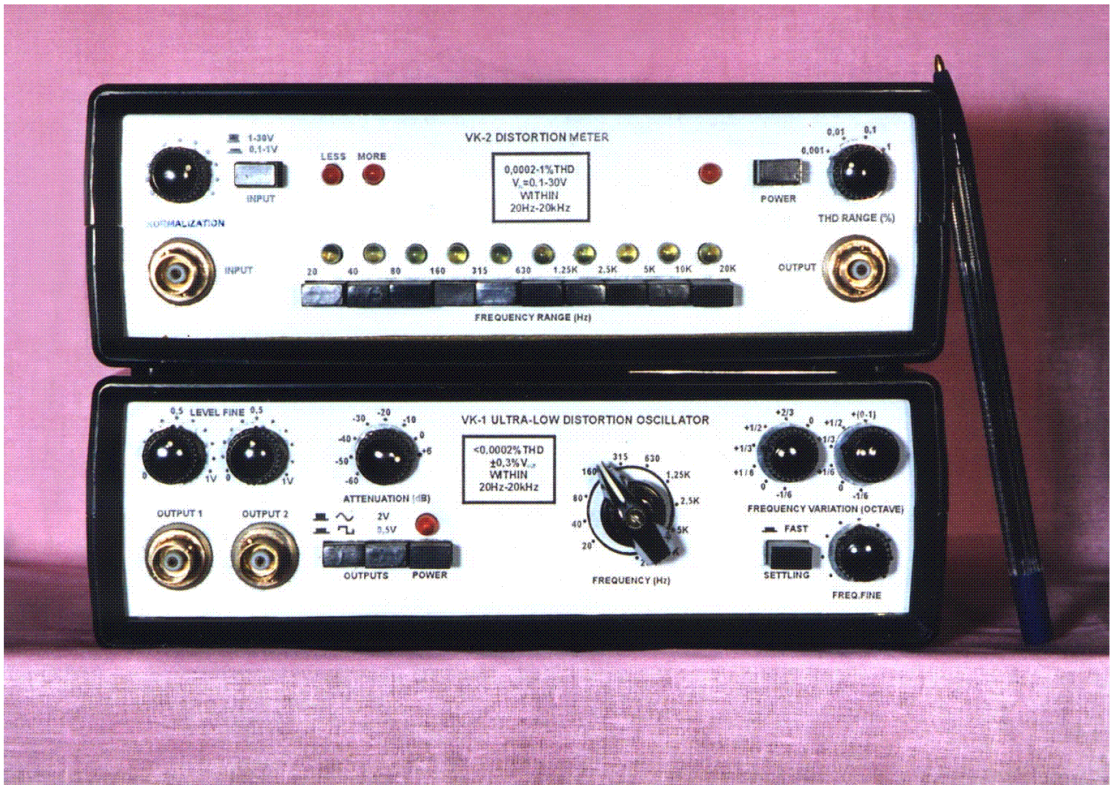
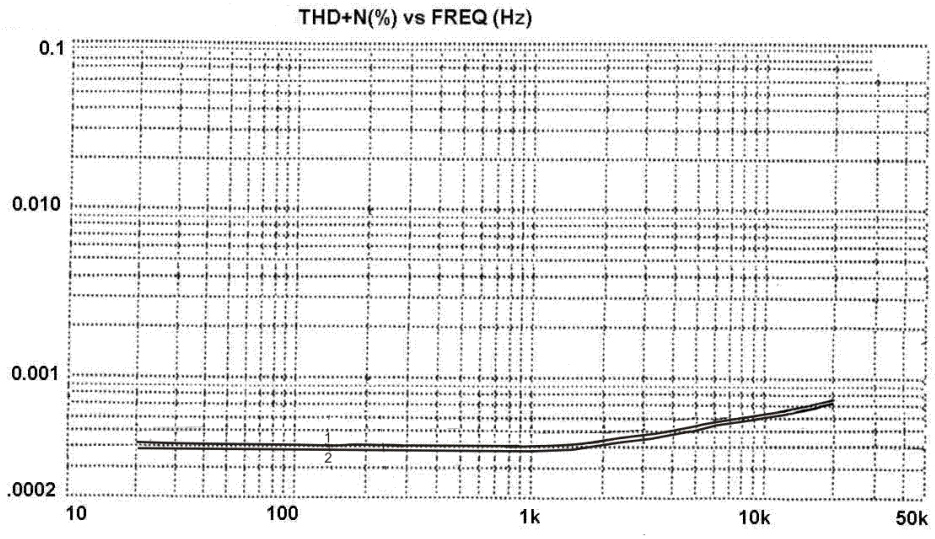
When using the VK-1,2 combination for accurate measurements of distortion below 0,001%, two measurements are necessary.
First of them gives the basic THD+Noise reading and the second, carried out with the VK-1 noise reference button 2V/0,5V pressed, gives the reading (Noise) representing practically only the unchanged noise of the whole measurement chain “VK-1 oscillator – device under test – VK-2 meter” – the distortion produced in the presense of 4 times smaller signals is buried well under the noise. The root – square difference between these readings gives the exact THD value.

For the VK-1,2 combination itself, the absolute difference between the above two readings doesn’t exceed 0,00002% at any frequency within 20Hz-20kHz, for example (0,00041 – 0,00040)% at 1kHz, that gives less than 0,0002% THD.

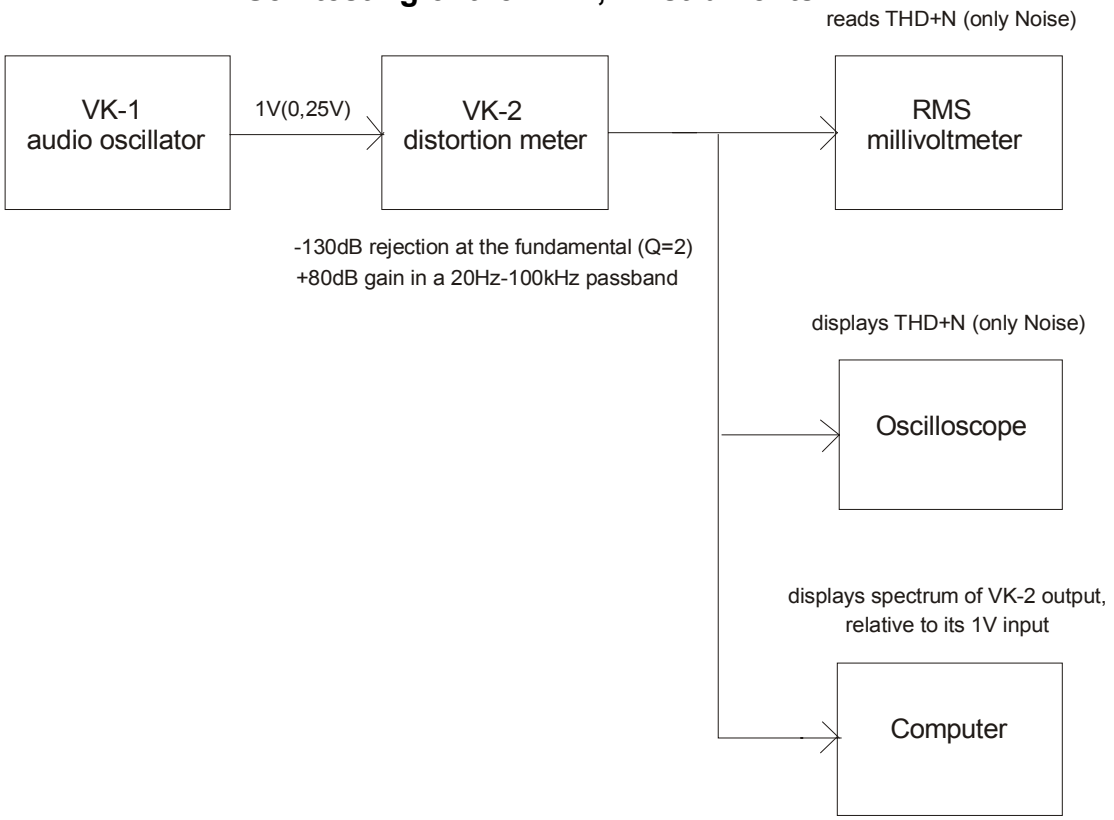
$$THD = \sqrt{(THD+Noise)^2 - (Noise)^2}$$



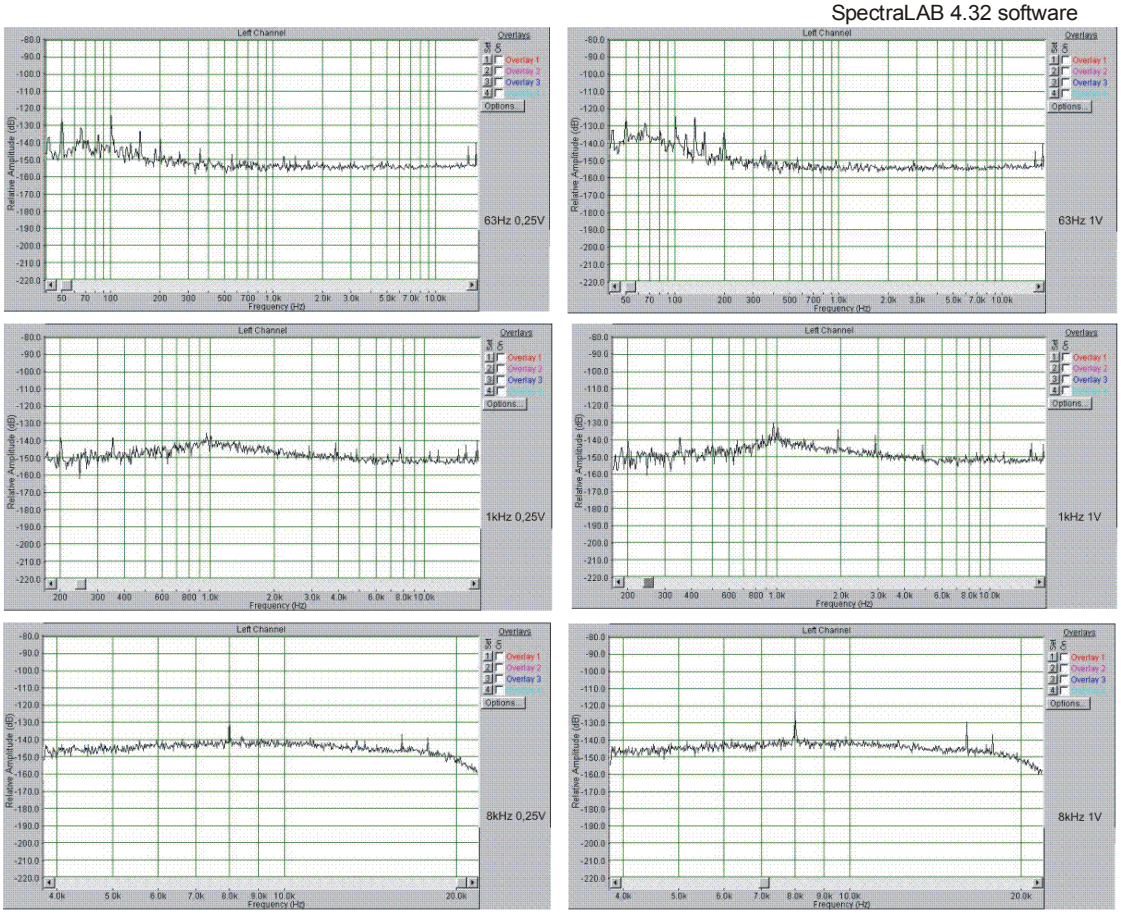


Distortion plot of the VK-1 oscillator / VK-2 distortion meter combination:
1 – THD+Noise (%) for measurement bandwidth of 100kHz (0,00041% at 1kHz);
2 – only Noise (%) for measurement bandwidth of 100kHz (0,00040% at 1kHz).

Self-testing of the VK-1,2 instruments

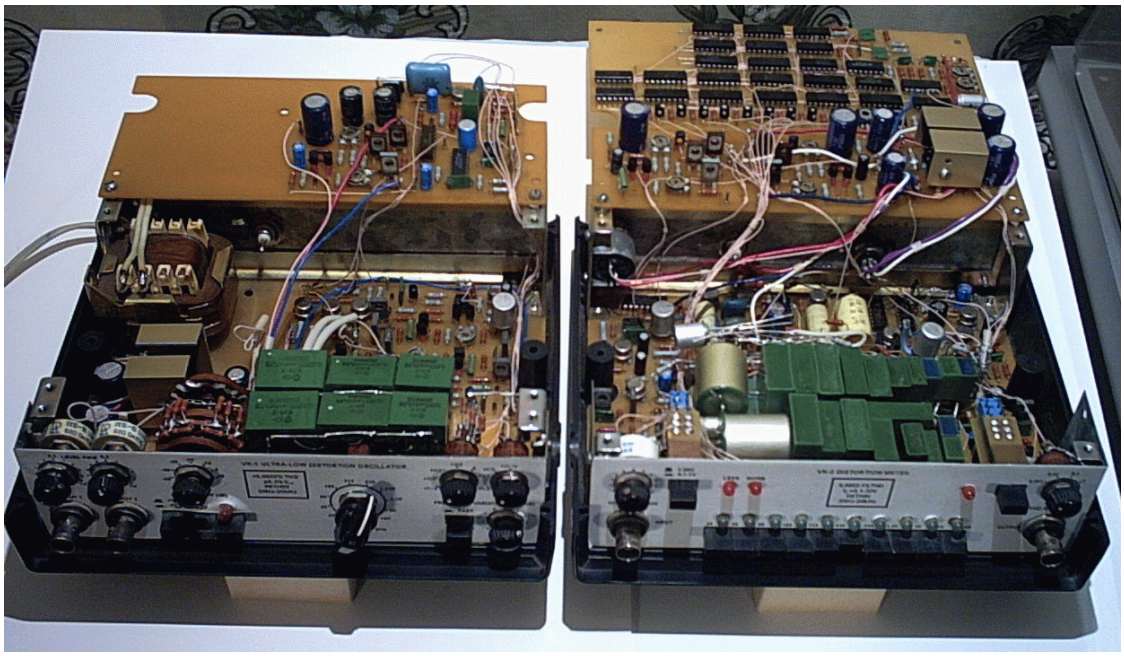


Creative Vibra 128 soundcard
SpectraLAB 4.32 software



Spectrums of the VK-1 oscillator / VK-2 distortion meter combination output, obtained with the help of SpectraLAB 4.32 software: left – VK-1 output is set 0,25V, right – VK-1 output is set 1V

Components and construction of the VK-1,2 instruments



VK-1 Ultra-Low Distortion Oscillator

1. Transistors small signal: BC546 – 6; BC556 – 17; 2N5461 – 1; paired 159HT1B – 3;
   power: BD139 – 9; BD679 – 1; BD680 – 1.
2. Diodes: 1N4148 – 16; BZX79 – 3; led(red) – 1; W02G(bridge) – 1.
3. Integrated circuits: op-amplifiers AD509 – 3; TL081 – 1; OP07 – 1;
   switches SD5000 – 1; digital C-MOS CD4001B – 1.
4. Resistors: 0,25W metal film – 72; precision(±0,5%) metal film – 31;
   adjustable cermet – 7; wirewound potentiometers – 3.
5. Capacitors: ceramic – 16; electrolytic – 11; precision(±0,5%) polystyrene – 25.
6. Optocoupler: photoresistor+led – 1.
7. Switches high quality: rotary, 1-pole, 11-way, 2 wafers – 2;
   rotary miniature, 1-pole, 11-way – 2; pushbutton, 2-pole – 1.
8. Output sockets: 2.
9. Mains trasformer: 15W – 1.

VK-2 Distortion Meter (main)

1. Transistors small signal: BC546 – 7; BC556 – 16; 2N6483 – 2.
   power: BD139 – 11; BD679 – 2; BD680 – 2.
2. Diodes: 1N4148 – 9; BZX79 – 3; led(red) – 3; W02G(bridge) – 1.
3. Integrated circuits: transistor matched pair 159HT1B – 1; switches HI5043 – 3;
   op-amplifiers AD509 – 5; TL081 – 1; OP07 – 4; LM324N – 1.
4. Resistors: 0,25W metal film – 103; precision(±0,5%) metal film – 22;
   adjustable cermet – 6; wirewound potentiometer – 1.
5. Capacitors: ceramic – 23; electrolytic – 14; precision(±0,5%) polystyrene – 33.
6. Optocouplers: photoresistor+led – 2.
7. Relays: hermetically sealed, gold clad contacts, 2-pole – 8.
8. Switches high quality: rotary miniature, 1-pole, 11-way – 1; pushbutton, 4-pole – 12.
9. Input, output sockets: 2.
10. Mains transformer: 15W – 1.

VK-2 Distortion Meter (automatic tuning)

1. Transistors small signal BC546 – 10; power darlington BD679 – 4.
2. Diodes: 1N4148 – 4; BZX79 – 1; led(green) – 10.
3. Integrated circuits: op-amplifiers LM324N – 1;
   digital C-MOS CD4001B – 1; CD4002B – 1; CD4011B – 4; CD4013B – 2;
   CD4028B – 2; CD4029B – 4; CD4035B – 4; CD4051B – 2; CD4516B – 3.
4. Resistors: 0,25W metal film – 33; precision(±0,5%) metal film – 2; adjustable – 2.
5. Capacitors: ceramic – 5; precision(±0.5%) polystyrene – 2.