

1. Application.

1.1. A digital combined device SVG-5 is applied for:

- making a measures of voltage root mean squares for AC sine wave signals;
- making a measures of voltage frequency for AC sine wave signals;
- generation of AC sine wave signals;
- visual observing and investigation of a singals with various form;
- analysing a spectra of signals.

This device can be applied for technical maintenance and repair of devivces which are using in high-frequency channels applied for connection and data exchange.

1.2. SVG-5 comprises 5 main devices:

- Generator of sive wave singal – «GENERATOR»;
- Voltmeter with switch-selectable pass band for making a measures of AC voltage root mean squares – «VOLTMETER»;
- Frequency meter – «FREQMETER»;
- Indicator of signal wave form – «OSCILL.».
- Indicator of signal spectrum – «SPECTRUM».

2. Technical data.

2.1. Measuremenr units:

Indication of input and output voltage levels is given in Volts (V) and can be given in relative units (dB), in accordance with preliminary established measurement conditions. A level 0 dB corresponds to the voltage of 0.775 V. A connection between measurement units can be given by formula:

$$U = 0.775 \cdot 10^{\frac{A}{20}},$$

where A is the signal level measured in dB.

A measurement unit dB is additional unit and can be defined after some calculations.

2.2. Type of input and output:

- «S» - non-symmetrical (Single);
- «D» - symmetrical (Differential).

2.3. Generator of sine wave signal:

- | | |
|--|---|
| - Frequency band for output signal | 300 Hz ... 2.5 MHz; |
| - Step for setting the frequency | 1Hz, 10Hz, 100Hz, 1kHz, 10kHz; |
| - Roughness for setting the frequency | $\pm 1 \cdot 10^{-5} \% \pm 1\text{Hz}$; |
| - Relative instability of frequency | $\pm 1 \cdot 10^{-5} \%$; |
| - Level of output voltage for characteristic impedance termination | 8 mV...3.88 V
(от - 40 дБ до +14 дБ); |
| - Step for setting the level of output voltage | 1mV, 10mV, 100mV, 1V
(0,1dB, 1dB, 10dB); |
| - Output resistance for S type output | 50 Ω ; |
| - Output resistance for D type output | 100 Ω ; |
| - Relative roughness for setting the level | $\pm 5 \%$; |
| - Relative roughness for output resistances | $\pm 5 \%$; |

- Output voltage harmonic distortion factor for characteristic impedance termination 1 %;
- Output voltage offset, less than 2 mV;
- Level of output voltage without load is twice more than that for characteristic impedance termination.

2.4. Wide-band root mean square voltmeter:

- Range of levels for the voltage being measured 8 mV... 3.88 V
(- 40 dB... + 14 dB);
- Frequency band for input signal 300 Hz ... 2.5 MHz;
- Relative roughness for measuring the level within frequency band $\pm 5\%$ (300 Hz ...1 MHz);
 $\pm 10\%$ (>1 MHz);
- Input resistance for S type input 50 Ω ... ≥ 1 M Ω ;
- Input resistance for D type input 100 Ω ... ≥ 2 M Ω ;

2.5. Narrow-band (selective) root mean square voltmeter:

- Range of levels for the voltage being measured 8 mV... 3.88 V
(- 40 dB ... + 14 dB);
- Frequency band for input signal 300 Hz ... 2.5 MHz;
- Step for setting the frequency 1Hz, 10Hz, 100Hz, 1kHz, 10kHz;
- Relative roughness for measuring the level $\pm 5\%$;
- Pass band width for the level «-3dB» 40 Hz, 100 Hz, 1,7 kHz;
- Input resistance for S type input 50 Ω ;
- Input resistance for D type input 100 Ω .

Notice: for making preliminary estimations this voltmeter allows to connect the non-certified loads of 75 Ω , 100 Ω and 600 Ω for S type input as well as 150 Ω , 200 Ω and 1200 Ω for D type input.

2.6. Frequency meter (freqmeter)

- Measurable band 30 Hz... 2,5 MHz;
- Range for levels of the voltage being measured 15 mV... 3.88 V;
- Relative roughness of the frequency measurement $\pm 3,5 \cdot 10^{-4}\%$;

2.7. Oscilloscope indicator:

- Magnitude sweep range 10 μ V ... 100 V;
- Time sweep range 5 nsec ... 1 sec;
- Output signal frequency band 300 Hz... 2,5 MHz;
- Number of channels 1.

2.8. Spectrum analyser:

- Visual displaying frequency in accordance with freq. scale, max 4 MHz;
- Measuring sensitivity for frequency scale 5 kHz, 50 kHz and 400 kHz;
- Sudden dynamic range 60 dB;
- Full dynamic range 80 dB.

2.9. Saving the measurement conditions

10 sets of parameters

2.10. Memory of voltmeter

128 results of measurements

2.11. Ramp-up time	0,5 h.
2.12. Continious work time	8 h.
2.13. Supplying	AC, 220 V $\pm 10\%$, 50 Hz $\pm 2\%$
2.14. Power input, max	40 VA.
2.15. Average recovery time, less than	2 h.
2.16. Average mean time to failure, more than	18000 h.
2.17. Average life span	8 years.
2.18. Sizes of device, mm, less than	360 x 380 x 140
2.19. Net weight of device, kg, less than	6
2.20. Net weight of devices with transporting case, kg, less than	11

3. Completeness of set.

Digital combined device XXXXXXXXXX	1
Symmetrical cable XXXXXXXXXX	1
Non-symmetrical cable XXXXXXXXXX	1
Supplying cable 220 V $\pm 10\%$, 50 Hz $\pm 2\%$	1
Passport 4221-005-86866068-2015 PS	1
Operation manual 4221-005-86866068-2015 RE	1
Test code 4221-005-86866068-2015 I	1
Transporting case XXXXXXXXXX	1

4. Construction.

4.1. A device is constructed as a desk-top, which should be installed on the horizontal surface. A possibility to install a device upon a tilt is permitted. For realizing this possibility it is necessary to use the especial turning shaft and to fix it in requiring position with the aid of two buttoms which are placed at the left and at the right of device, respectively.

4.2. This device can be installed vertical, a face panel should be top. For this, it is necessary to use the especial support feets. They are placed on rear panel of a device.

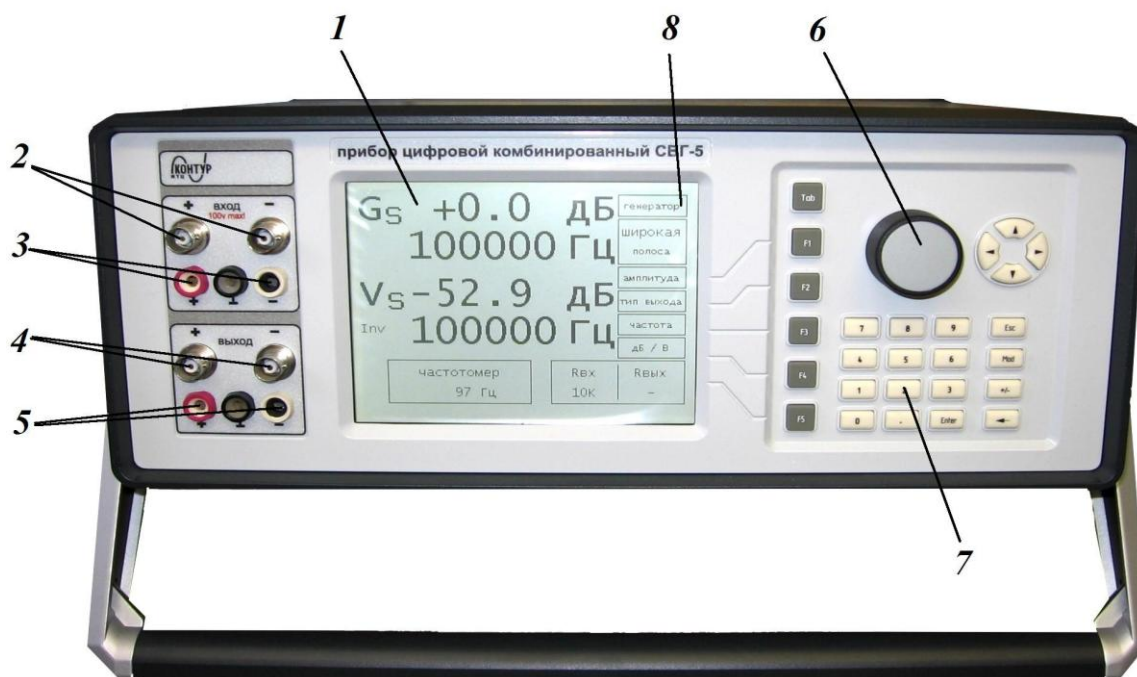


Fig.1 Face panel of a device.

4.3. Face panel of a device (Fig.1).

- 1** – Graphic indicator for displaying the results of work of a device as well as information menu with conditions of measurement;
- 2** – Input for voltmeter, freqmeter, indicator of signal wave form, indicator of signal spectrum;
- 3** – Additional (doubling) input of voltmeter, freqmeter, indicator of signal wave form, indication of signal spectrum;
- 4** – Generator output;
- 5** – Additional (doubling) generator output;
- 6** – Encoder shaft;
- 7** – Keyboard;
- 8** – Area for selection the functional device (generator, voltmeter, indicator of signal wave form, indicator of signal spectrum);

4.4. Rear panel of a device (Fig. 2).

- External connector $\sim 220\text{ V} \pm 10\%$, $50\text{ Hz} \pm 2\%$;
- Switch $\sim 220\text{ V} \pm 10\%$, $50\text{ Hz} \pm 2\%$;
- Ground connector;
- «**ETHERNET**» connector. Out of use.



Fig.2 Rear panel of a device.

5. Marking, sealing and packing.

5.1. Marking of SVG-5 device is placed on rear panel of a device and contain:

- Name of a device;
- Trademark and name of manufacturer;
- Number of technical conditions for a device (sign of National Register);
- Number of the device in accordance with numbering system accepted by manufacturer;
- Year of manufacturing this device.

5.2. Sealing takes place in three points (Fig.2 and 3).

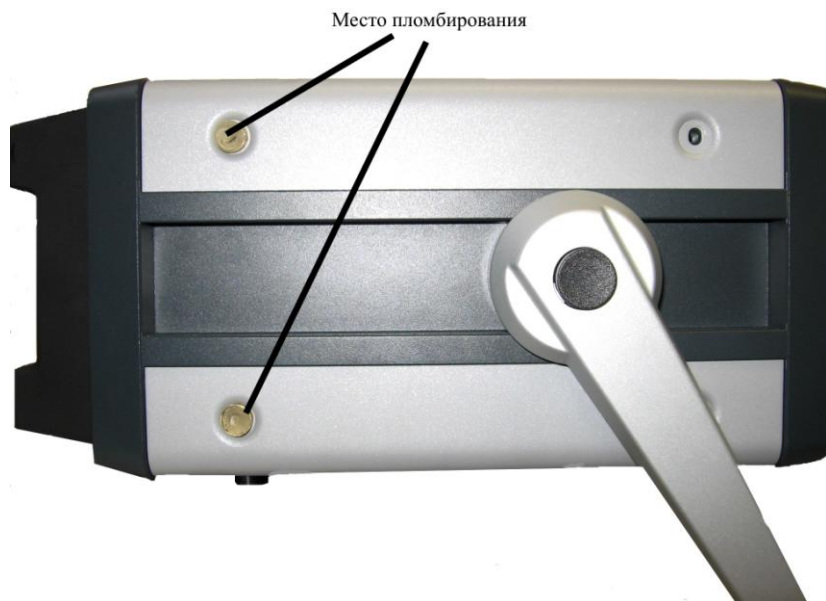


Fig.3 Sealing of the device.

5.3. SVG-5 device together with technical documentation and connecting cables is packing into the especial transporting case, which provides a storage and transportation of a device (Fig.4).



Fig.4 Transporting case for SVG-5 device.

6. General instructions for installation

- 6.1. Before starting the work please study this operation manual and understand the functions of connectors and control elements.
- 6.2. Eject a device from the transporting case, remove the packing materials, observe a device for absence a mechanical defects and a traces of influence of any aggressive environment.
- 6.3. If a device was stored in the climate conditions other than in accordance with necessary storage conditions, it is necessary to store this device under the conditions of his exploitation without ejecting from the transporting case during at least 1 hour.
- 6.4. If a ejected device was stored in climate conditions other than in accordance with necessary storage conditions, it is necessary to store this device under the condition of his exploitation at least 2 hours.
- 6.5. Normal work of this device can be provided if the conditions of his exploitation are in accordance with this manual. A device should be protected against shocks asnd vibrations.
- 6.6. Verify the work of all control elements. They should have the soft motion and positive fixing action.
- 6.7. Establish a device on the workplace, provice the comfort for using a device and conditions of natural ventilation.

- 6.8. Verify that the button of switching the supply is in start position (it should be switched off).
- 6.9. Supply a device with a network $\sim 220\text{ V} \pm 10\%$, $50\text{ Hz} \pm 2\%$.
- 6.10. Press the button of switching the power supply. After some seconds which are necessary for self-testing, the device is ready to work. However, this device need 0.5 hour to achieve all necessary metrological parameters.

7. Safety rules

- 7.1. During whole period of work with this device it is necessary to perform all safety rules established in Your country for exploitation the electrical devices.
- 7.2. A personnel allowed to make the technical maintenance and exploit the device with removed panels must be qualified and instructed for making this kind of work.

8. Operation of SVG-5 device

8.1. Operation of digital combined device SVG-5 is realising with encoder (Fig.1 pos.6) and keyboard (Fig.1 pos.7) via the information menu which is placed vertical in right part of graphic indicator (Fig. Управление прибором цифровым комбинированным СВГ-5 осуществляется энкодером (Рис.1 pos.1)).

8.2. Application of elements for control, supplying and indication placed on face panel.

8.2.1. Graphic indicator is applied for visual displaying the results of work of the device as well as information menu of measurement conditions.

8.2.1.1. Indicator can be conditionally divided into three areas:

1 – area for displaying the information menu with measurement conditions, this area is situated in the right part of indicator and partially in his right bottom part.

2 – area for displaying the values related to the generator, this area is marked with the symbol G and display the row with voltage, row with frequency and sign of the output type (S or D).

3 – area for displaying the values related to the voltmeter, this area is marked with the symbol V and display the row with voltage, row with frequency and sign of the output type (S or D).

8.2.1.2. A window for displaying the frequency is situated in the left bottom part of the screen.

8.2.1.3. After changing the operation mode to the mode «SPECTRUM» or «OSCILL.» an appropriate windows are opened.

8.2.2. Connectors placed on the face panel.

8.2.2.1. «**Input+**» 1. Main input for **voltmeter**, **frequer** as well as **indicators** when S type input is used.

2. Positive input for **voltmeter**, **frequer** as well as **indicators** when D type input is used.

8.2.2.2. «**Input –**» 1. Out of use for S type input.

2. Negative input for **voltmeter**, **frequer** as well as **indicators** when D type input is used.

Notice: input connectors G4 (Fig.1 pos.3) are doubling the connectors SR50-73 (Fig.1 pos.2).

8.2.2.3. «**Output +**» 1. Forward **generator** output for S type output.

2. Positive **generator** output for D type output.

- 8.2.2.4. «**Output** →»
1. Antiphased **generator** output for S type output.
 2. Negative **generator** output for D type output.

Notice: input connectors G4 (Fig.1 pos.5) are doubling the connectors SR50-73 (Fig.1 pos.4).

8.2.3. Keyboard buttons.

- 8.2.3.1. «**Tab**»
- This button for selection a device (operation mode) have two manners of work:

1. **Generator** (GENERATOR);
 2. **Voltmeter** (VOLTMETER);
 3. **Spectrum analyser** (SPECTRUM);
 4. **oscilloscope** (OSCILL.).
- short press is selection in forward directoion;
 - long press is selection in backward direction/

- 8.2.3.2. «**F1**»
- Functional button 1.

1. In operation mode GENERATOR it activates the option «**Amplitude**» to set the necessary value of the level of signal. This setting can be performed with the aid of numerical buttons or encoder shaft, or using the buttons «**▲**, **▼**».
2. In operation mode VOLTMETER it allows to set the pass band in accordance with frequencies:
 - **40 Hz**
 - **100Hz**
 - **1,7kHz**
 - **Band full**
3. In operation mode SPECTRUM is out of use.
4. In operation mode OSCILL.:
 - In main menu is out of use;
 - In menu «**Input**» it switches the input type:
 - **S** – non-symmetrical;
 - **D** – symmetrical;
 - In menu «**Sync**» (synchronization) it switches the time-base type:
 - **Auto** – automatic;
 - **Normal** – waiting;
 - **Single** – single;

- 8.2.3.3. «**F2**»
- Functional button 2.

1. In operational mode GENERATOR it switches the input type:
 - **S** – non-symmetrical
 - **D** - symmetrical
2. In operational mode VOLTMETER it switches the input type:
 - **S** – non-symmetrical
 - **D** - symmetrical
3. In operational mode SPECTRUM it switches the frequency measuring sensitivity:
 - **5 kHz/div**

- **50 kHz/div**
- **400 kHz/div**

4. In operational mode OSCILL.:

- In main menu it activates the window of switching the measuring sensitivity along horizontal axis from 25 nsec/div to 1sec/div. This switching is realising via using the encoder shaft or with the aid of buttons «▲, ▼»;
- In menu«**Input**» it switches the input resistance **R in** for:
 - non-symmetrical input «**S**»:
 - «**50**» - 50 Ω;
 - «**75**» - 75 Ω;
 - «**100**» - 100 Ω;
 - «**600**» - 600 Ω;
 - «**1M**» - ≥1 MΩ;
 - symmetrical input «**D**»:
 - «**100**» - 50 Ω
 - «**150**» - 75 Ω
 - «**200**» - 100 Ω
 - «**1200**» - 600 Ω
 - «**2M**» - ≥2 MΩ
- In menu «**Sync**» it switches the polarity of timebase starting
 - **Rise**
 - **Fall**

8.2.3.4. «**F3**»

Functional button 3.

1. In operation mode GENERATOR this button activates the menu option «**Frequency**» for setting the necessary value of the signal frequency. This setting can be realised via using the buttons with numerical symbols of keyboard or using the buttons «▲, ▼».
2. In operational mode VOLTMETER this button activates the menu option «**Frequency**» for adjusting the voltmeter in accordance with the signal frequency. This possibility is necessary for making measurements in narrow-band mode «**40 Hz**», «**100 Hz**» and «**1,7kHz**». In operation mode «**Band full**» the established frequency can not affect onto the result of measurement. An adjusting of frequency can be realised via using the buttons with numerical symbols of keyboard, as well as encoder shaft or buttons «▲, ▼».
3. In operation mode SPECTRUM it switches the measurement unit for displaying the level of output voltage:
 - **dB**
 - **V**
4. In operation mode OSCILL.:
 - In main menu it activates the window for switching the value of measuring sensitivity for vertical scale from 10μV/div to 100 V/div. This switching can be realised with the encoder shaft or via using the buttons «▲, ▼»;
 - In menu «**Input**» it returns to the main menu of oscilloscope;

- In menu «**Sync**» it activates the window for setting the level of synchronization with step 10 mV. This setting can be realised with the encoder shaft of via using the buttons «**▲**, **▼**».

8.2.3.5. «**F4**»

Functional button 4.

1. In operation mode GENERATOR it switches the measurement unit for displaying the level of output voltage:

- **dB**
- **V**

2. In operation mode VOLTMETER it switches the measurement unit for displaying the level of output voltage:

- **dB**
- **V**

3. In operation mode SPECTRUM it switches the input type:

- **S** – non-symmetrical;
- **D** – symmetrical.

4. In operation mode OSCILL.:

- In main menu it opens the menu **Input**;
- In menu «**Sync**» it returns to the main menu of oscilloscope.

8.2.3.6. «**F5**»

Functional button 5 have two manners of using.

Short press.

1. In operation mode GENERATOR it switches on/off the output of generator.

2. In operation mode VOLTMETER it allows to switch on/off the input resistance «**Rin**» for:

Non-symmetrical input «**S**»:

- «**50**» - 50 Ω;
- «**75**» - 75 Ω;
- «**100**» - 100 Ω;
- «**600**» - 600 Ω;
- «**1M**» - ≥1 MΩ;

Symmetrical input «**D**»:

- «**100**» - 100 Ω;
- «**150**» - 150 Ω;
- «**200**» - 200 Ω;
- «**1200**» - 1200 Ω;
- «**2M**» - ≥2 MΩ.

3. In operation mode SPECTRUM it allows to switch the input resistance «**Rin**» in the order of increasing only and can be applied to:

Non-symmetrical input «**S**»:

- «**50**» - 50 Ω;
- «**75**» - 75 Ω;
- «**100**» - 100 Ω;
- «**600**» - 600 Ω;

- «1M» - $\geq 1 \text{ M}\Omega$;

Symmetrical input «D»:

- «100» - 100Ω ;
- «150» - 150Ω ;
- «200» - 200Ω ;
- «1200» - 1200Ω ;
- «2M» - $\geq 2 \text{ M}\Omega$;

4. In operation mode OSCILL.:

- In main menu it opens the menu «Sync».

Long press.

1. In operation mode VOLTMETER it allows to switch the input resistance «Rin» in the order of decreasing;

2. In operation mode SETTING it allows to remove the results of measurement from the memory of device.

8.2.3.7. «0...9»

1. It is a buttons for selection the numerical values after the activation of any menu entry in operation modes:

- GENERATOR – it allows to set the frequency and magnitude of output signal;
- VOLTMETER – it allows to set the frequency for adjusting the narrow-band (selective) voltmeter.
- SETTING – it allows to set the time and date;

2. In operation modes GENERATOR and VOLTMETER when menu entries are inactive:

- Short press of one of buttons allows to load the set of measurement conditions which had been saved previously in the memory of device. The numerical symbol of the button being pressed corresponds to the number of selected set of measurement conditions;
- Long press allows to save the set of measurement conditions in the memory of device. The numerical symbol of the button being pressed corresponds to the number of selected set of measurement conditions.

8.2.3.8. «.»

It is a button allowing to enter the floating point between integral and fractional parts of the number.

8.2.3.9. «Enter»

This button have two manners of using:

- Short press allows to enter the data typed with the aid of keyboard;
- Long press allows to save the results of measurement obtained from the voltmeter.

8.2.3.10. «Esc»

This escape button have two manners of using:

- Short press allows to cancel the action or returns to the menu of upper level;
- Long pressure allows to open the menu «Setting» in operation modes GENERATOR and VOLTMETER.

8.2.3.11. «+/-»

This button allows to enter the negative values.

8.2.3.12. « ← »

This button allows to remove the signs in a row when they were entered incorrect.

8.2.3.13. « ▲, ▼ »

Buttons for discrete establishing:

1. In operation mode GENERATOR it allows to set the level and frequency of the output signal via changing it with definite step after multiply press.
2. In operation mode VOLTMETER it allows to set the frequency of voltmeter for bringing into the accordance with the frequency of input signal. Multiply press of these buttons allows to change the value with definite step.
3. In operation mode SPECTRUM it allows to set the initial frequency of the spectrum being analysed in Hz. A step for changing the frequency can be defined as a value 5 times more than measuring sensitivity for the frequency scale.
4. In operation mode OSCILL. It switches the value of measuring sensitivity along horizontal axis from 25 nsec/div to 1sec/div or along vertical axis from 10 μ V/div to 100 V/div depending on the option selected in main menu.

8.2.3.14. «Mod»

1. In operation mode GENERATOR it switches on the menu for selecting the step of changing of the voltage and frequency.
2. In operation mode VOLTMETER it activates the menu for selecting the step of changing of the frequency.

8.2.3.15. « ◀, ▶ »

These buttons are out of use.

8.2.4. Encoder shaft.

1. In operation mode GENERATOR it allows to set the level and frequency of output signal via changing it with a step which had been established previously.
2. In operation mode VOLTMETER it allows to perform the correction of frequency to the frequency of input signal via changing it with a step which had been established previously.
3. In operation mode SPECTRUM it allows to set the initial frequency of the signal being analysed in Hz with a step which can be defined as a value 5 times more than measuring sensitivity for the frequency scale.
4. In operation mode OSCILL. it switches the value of measuring sensitivity along horizontal axis from 25 nsec/div to 1 sec/div or along vertical axis from 10 μ V/div to 100 V/div depending on the option selected in main menu.
5. After press this button the values will be entered into device like You will make short press of ENTER button.

8.3. Application of control elements and connectors situated on rear panel.

8.3.1. Switch «Power ~220V 50Hz».

This switch is applied for the voltage supply switching on/off. Placing this button into the position «I» leads to switching on whereas placing it into the position «O» leads to switching off this device.

8.3.2. An external connector.

This connector is applied to insert the supplying cable ~220V 50Hz.

8.3.3. Ground connector \perp .

This connector is applied to connect with a ground for the case of absence of such connection via supplying cable.

8.3.4. Connector «ETHERNET».

This connector is out of use.

8.4. Some buttons have two manners of using. Short press should be approximately 0.5 sec whereas long press should be more than 1 sec.

During the short press of the button the action takes place in a moment of removing the finger from the button. A short sound signal bells.

After long press of the button the action takes place approximately 1 second after removing the finmger from the button.

Staying the button in the pressed state do not lead to any actions.

Short press is a main mode for using the buttons. If long press does not anticipated for this button, then long press of this button will be ignored.

8.5. An entrance of the information after typing the values of necessary parameters with the aid of keyboard should be performed with short press of «Enter» button. Instead of this, a short press of encoder shaft can be used as well.

8.6. A button «Esc» should be used for jumping to the upper level of information menu as well as for cancelling an activation of any option in the information menu which had been selected incorrectly.

9. Measurements procedure.

9.1. Independent adjusting and working sequence for various blocks of device.

9.1.1. Voltmeter and generator have the independent external connectors and can work independently from each other. This feature permits an application of this device to built various measurement circuits under the condition of external commutation between inputs and outputs of this device.

9.1.2. An adjustment of operation modes of functional blocks are performing separately for each block and do not depend from each other.

9.1.3. Freqmeter, analyser and oscilloscope have the internal connection with an input signal with the aid of especial program and using of these devices do not require any additional external commutation.

9.2. Service adjustment of the device.

9.2.1. This operation mode allows:

- setting the current time;
- setting the current date;
- observing the results of measurements contained in a memory;
- removing the results of measurements contained in a memory;
- switching between Russian and English languages.

9.2.2. Open the window «Setting» with long press of «ESC» button.

A rows of measurement conditions and control menu are arisen on the screen of indicator.

9.2.2.1. A row for setting the time as **hours:minutes:seconds** is situated in upper part of the screen.

9.2.2.2. A row of setting the date as **day-month-year** is situated in the middle part of screen. A year is displayed as two last numerical symbols of the year.

9.2.2.3. A row for switching the language is situated in the bottom part of the screen.

9.2.2.4. A control menu is situated in right part of the screen.

A control menu contains the indicators:

- «**Time**» indicator shows that activation of time setting can be performed after press the button F1;
- «**Date**» indicator shows that activation of date setting can be performed after press the button F2;
- «**Results**» indicator shows that opening the window for observing the results of measurements saved in the memory of device can be performed after press the button F3;
- «**Language**» indicator shows that switching between Russian and English language can be performed after press the button F4;
- «**Erase**» indicator shows that to remove all records from the memory of device can be performed after press the button F5.

9.2.3. To set the time activate the appropriate row after press the button F1.

Using the numerical buttons please set the necessary values of hours, minutes and seconds. Jump to following position takes place automatically after completing the previous position. Entrance of new value of a time should be performed after press the button «**Enter**» or after short press the shaft of encoder.

9.2.4. To establish the date activate the appropriate row after press the button F2.

Using the numerical buttons please set the necessary values of a day, month and two last numerical signs of the year. Jump to following position takes place automatically after completing the previous position. Entrance of new value of a time should be performed after press the button «**Enter**» or after short press the shaft of encoder.

9.2.5. To change the language for displaying all legends please press the button F4.

9.2.6. To observe the saved results of measurement open the appropriate window after press the button F3. Any results can be removed using two manners:

- 1 – in the window of observing the results of measurement please make the long press of the button F5, the jump to the menu «**Setting**» will be performed;
- 2 – in menu «**Setting**» please make the long press of the button F5.

9.2.7. Leave this operation mode after the short press of the button «**Esc**».

9.3. Working in operation mode VOLTMETER.

9.3.1. This operation mode is necessary to measure the level of sine signal under the conditions defined by the operator.

9.3.2. Jump to this operation mode after press the «**Tab**» button.

A rows with values of parameters of the signal as well as control menu with service information will be shown on the screen of indicator.

9.3.2.1. An area for displaying the values of established levels of voltage and frequency of the signal as well as output type (S or D) and measurement units (V, dB, Hz). In the operation mode VOLTMETER this area is necessary for additional information.

9.3.2.2. An area for displaying the results of measurement of the level of signal as well as frequencies of setting, input type (S or D) and measurement units (V, dB, Hz) are situated in the middle part of the screen.

9.3.2.3. The window of freqmeter is situated in the bottom part of the screen.

9.3.2.4. A control menu is situated in the right part of the screen and partially in the bottom part of the screen.

Control menu contain the indicators:

- «**Voltmeter**» indicator shows that operation mode VOLTMETER is active.

- «**Band**» indicator shows the frequency band (40 Hz, 100 Hz or 1.7 kHz), which is active currently. To change this band please press the button **F1**;

- «**In type**» indicator shows that changing the output type (S or D) can be performed after press the button **F2**;

- «**Frequency**» indicator shows that selection of work frequency of the voltmeter under the frequency band of 40 Hz, 100 Hz or 1,7 kHz can be activated after press the button **F3**. Activation of this operation mode is indicated with the aid of flashing numerical symbols in the row of frequency of the area **V**. Setting the value of frequency can be performed with the aid of numerical buttons or encoder shaft or buttons «**▲**, **▼**» which have the previously defined step. For wide band this option is ignored;

- «**dB/V**» indicator shows that changing between measurement units (dB or V) of the level of output voltage can be performed after press the button **F4**;

- «**Rin /Rout** » indicator displays the internal resistance connected to the input of voltmeter as well as the state of generator (switched on/off). Setting the value of resistance connected to the input of voltmeter can be performed after press the button **F5**. Indication of the state of generator is given as additional information;

9.3.3. Set the frequency band, input type, measurement unit associated with the level of input signal as well as input resistance as You need.

9.3.4. When narrow-band operation mode is used please select the frequency where the measurement of level of the signal is performing. When wide-band mode is used this selection does not need.

9.3.5. Enter the signal wishing to be measured to the symmetrical or non-symmetrical input of the voltmeter and measure his level.

9.3.6. If the required level of the signal is achieved, the frequency will be measured automatically.

9.4. Work in operation mode GENERATOR.

9.4.1. В этом режиме устанавливаются параметры генерируемого синусоидального сигнала при заданных условиях.

9.4.2. Jump to this operation mode after press the «**Tab**» button.

A rows with values of parameters of the signal as well as control menu with service information will be shown on the screen of indicator.

9.4.2.1. An area for displaying the established values of level and frequency of the signal of generator as well as output type (S or D) and measurement units (V, dB, Hz) is situated in the upper part of the screen. In operation mode VOLTMETER this area provides an additional information.

9.4.2.2. An area for displaying the results of measurement and the values of frequency of setting as well as input type (S or D) and measurement units (V, dB, Hz) are situated in a middle part of the screen.

9.4.2.3. A window of freqmeter is situated in the bottom part of the screen.

9.4.2.4. A control menu is situated in the right part of the screen and partially in the bottom part of the screen.

Control menu contain the indicators:

- «**Generator**» indicator shows that the operation mode GENERATOR is active;

- «**Band**» indicator shows the frequency band where the voltmeter is active. In the operation mode GENREATOR this information is additional;

- «**Amplitude**» indicator shows that activation of the operation mode for setting the level of output voltage of the generator should be performed after press the button **F1**. Activation of this operation mode is indicated with the aid of flashing numerical symbols showing the value of level in the area **G**. Setting

the value of frequency can be performed with the aid of numerical buttons or encoder shaft or buttons «▲, ▼» which have the previously defined step;

- «**Out type**» indicator shows that the input type (S or D) can be switched after press the button **F2**;
- «**Frequency**» indicator shows that that activation of the operation mode for setting the frequency of output signal of the generator should be performed after press the button **F3**. Activation of this operation mode is indicated with the aid of flashing numerical symbols showing the frequency in the area **G**. Setting the value of frequency can be performed with the aid of numerical buttons or encoder shaft or buttons «▲, ▼» which have the previously defined step;

- «**dB/V**» indicator shows that switching between measurement units (dB or V) for the level of output voltage of generator should be performed after press the button **F4**;

- «**Rin /Rout** » indicator shows the state of output of the generator as well as internal resistance connected to the input of voltmeter. Activation of output of the generator should be performed after press the button **F5** and displayed as a value of output resistance of of generator. An indication of internal resistance connected to the input of voltmeter is given for additional information.;

9.4.3. Set the required level of output signal, frequency of signal, output type and unit for displaying the level.

9.4.4. Switch on the signal after press the button **F5**. After that the legend «**Switch off**» in the area Rout of the menu option «**Rin /Rout** » will be changed to the legend «**50**».

9.4.5. Enter the signal from the output of generator to the input of device (load) being tested. An input resistance of this tested device should be equal to the output resistance of generator. In this case the generator will provide the maximum power for the load and the value of level of the signal on the output connectors of generator will be equal to the value displayed on the indicator in the area «**G**».

9.4.6. The level of signal on the load rather than optimum load is defining after some calculations. As well, this level can be defined with the aid of high-resistance voltmeter with appropriate frequency band.

9.5. Work in operation mode SPECTRUM (indicator).

9.5.1. This operation mode is necessary to define the presence of the harmonic which have the definite frequency and should be measured. A Amplitude of this harmonic should be measured with narrow-band voltmeter.

9.5.2. Jump to this operation mode after press the «Tab» button.

A work area for building the spectrum graph as well as control menu with service information will be shown on the screen of indicator.

9.5.3. An area with a scale grid for building the spectrum graph of the signal cover the whole screen of indicator without the right part of the screen.

9.5.3.1. A control menu is situated in a right part of the screen.

This menu have the indicators:

- «**Spectrum**» indicator shows that operation mode SPECTRUM is active;
- «**Begin frequency**» indicator shows the value of frequency in Hz, which is initial for building the spectrum graph. This frequency can be set via turning the encoder shaft or using the buttons «▲, ▼», a step can be defined as a value 5 times more than the measuring sensitivity for frequency scale;
- «**kHz/div**» indicator shows the measuring sensitivity in kHz. This value can be selected after press the button **F2** as one of possible values 5 kHz, 50 kHz or 400 kHz;
- «**dB**» or «**V**» indicator shows the active unit for measuring the level of voltage of the signal. To change the measurement unit please press the button **F3**;

- «**S**» or «**D**» indicator shows the active input type. To change the input type please press the button **F4**;

- «**Rin**» indicator shows the value of internal input resistance connected to the input. To change the value of resistance please press the button **F5**;

9.5.4. Set the values for measuring sensitivity along the frequency axis, initial frequency, input type as well as the measurement unit for measuring the voltage of input signal and the input resistance.

9.5.5. Enter the signal wishing to be analysed into the input connectors and analyse its spectrum.

9.5.6. Before starting, it is recommended to perform the general estimation of the spectrum in a whole frequency band of the device. For this, please set the most value of the measuring sensitivity for the frequency scale, set the initial frequency equals to zero and perform the general estimation of the spectrum of signal. If the detail analysis of definite part of this spectrum is required, use the analyser for setting the initial frequency and measuring sensitivity for the frequency scale.

9.5.7. To measure the level of any harmonic please define its frequency, jump into the narrow-band voltmeter operation mode with definite required frequency band, adjust the frequency in accordance with required frequency and make the measurement.

9.5.8. As an additional information, an oscillographic view of the signal being measured is given on the screen. To observe this oscillogram more detail please jump to the operation mode «**OSCILL.**».

9.6. Work in operation mode OSCILLOSCOPE (indicator).

9.6.1. This operation mode is necessary for the visual investigation of the form of input signal.

9.6.2. Jump to this operation mode after press the «Tab» button.

A work area for building the oscillogram as well as control menu with service information will be shown on the screen of indicator.

9.6.3. A scale grid for building an oscillogram covers the whole screen of indicator without the right and the bottom parts.

9.6.3.1. Two rows informing about established parameters of work of the oscilloscope are situated in the bottom part of the screen.

9.6.3.2. A control menu is situated in the right part of the screen.

This menu has the indicators:

- «**Oscill.**» indicator shows that operation mode OSCILLOSCOPE is active;

- «**Time**» indicator displays the active value of measuring sensitivity along horizontal axis (time/div). This indicator can be activated after press the button **F2**. Setting the value of measuring sensitivity along horizontal axis (time/div) can be performed with encoder or buttons «**▲**, **▼**».

- «**Amplitude**» indicator shows the active value of measuring sensitivity along vertical axis (V/div). This indicator can be activated after press the button **F3**. Setting the value of measuring sensitivity along vertical axis (V/div) can be performed with encoder or buttons «**▲**, **▼**»

- «**Input**» option/indicator shows the input type and the value of input resistance. Jump to the menu for setting the parameters of input can be performed after press the button **F4**.

- «**Sync**» option/indicator shows that jump to the menu for setting the parameters of time-base can be performed after press the button **F5**.

9.6.3.3. Option/indicator «**Input**» contains the indicators:

- «**In type**» indicator shows the input type being active (S or D.). To change the input type please press the button **F1**.

- «**R in**» indicator shows the value of input resistance connected to the input depends on the input type. To change the state of this indicator please press the button **F2**.

- «**Back**» indicator shows that jump to the main control menu of oscilloscope can be performed after press the button **F4**. As well, this jump can be performed after press the button **Esc**.

9.6.3.4. Option/indicator «**Sync**» contain the indicators:

- «**Auto/ Normal/ Single**» indicator shows the active type of time-base. To change the type please press the button **F1**.

- «**Rise/ Fall**» indicator shows the active polarity for starting the time-base. To change a state of this indicator please press the button **F2**.

- «**Level**» indicator shows the established value for the level of synchronization. To activate this indicator please press the button **F3**. To set the values of level and time-base please use the encoder shaft or buttons «**▲**, **▼**».

- «**Back**» indicator shows that jump to main control menu of oscilloscope can be performed after press the button **F4**.

9.6.4. Set the required rates for time-base and level, input type, input resistance and parameters of synchronization.

9.6.5. Enter the signal wishing to be measured to the input of device and make his visual investigation.

9.7. To write the result of measurement into a memory please jump to operation mode GENERATOR or VOLTMETER and make the long press of the **Enter** button.

To observe the result saved in a memory please jump to the operation mode GENERATOR or VOLTMETER and after the long press of the **Esc** button please select the option «**Results**» of menu «**Setting**».

9.8. To save the settings for generator or voltmeter (measurement conditions) please jump to the operation mode GENERATOR or VOLTMETER respectively, please verify that all other menu options are inactive and make the long press of appropriate numerical button. A set of measurement conditions will have the number corresponding to the numerical button pressed before.

A device allows to save up to 10 sets of parameters in operation mode GENERATOR and 10 sets of parameters in operation mode VOLTMETER.

To activate the appropriate saved set of parameters please verify that all other menu options are inactive and make the short press of the numerical button which is necessary to You.

10. Conditions for device storage and application

10.1. Conditions for exploitation:

- environment temperature +5 ... +40°C;
- relative air humidity up to 90% under the temperature +25°C;
- air pressure 7 kPa (537 – 800 mm.Hg.).

10.2. Climatic conditions for storage and transporting the device are defining by the National Russian Standard GOST 22261-94:

- air temperature 0 ... +40°C;
- relative air humidity up to 80% under the temperature +35°C;
- air pressure 7 kPa (537 – 800 mm.Hg.).

10.3. Extreme conditions for transporting in the part of mechanical effects are defining by the National Russian Standard GOST 22261-94, group 3.