TECHNICAL PASSPORT

ELECTROSTATIC DISCHARGE TEST GENERATOR

IGE Smart Card

MANUAL
EQUIPMENT QUALIFICATION PROCEDURE

CONTENTS

P.

1. Product features.

1.1 Electrostatic discharge test generator (hereinafter – IGE Sc generator) is manufactured by "PRORYV" Research and development enterprise.

1.2 The test generator IGE Sc is designed to generate rated test pulses for electrostatic discharge immunity testing of electronic cards, in particular 6 and 8-pin cards (in accordance with ISO 7816-1, ISO / IEC 10373).

2. Technical specifications.

• discharge capacity value	100 pF ± 10%
• discharge resistance	1500 Ohm ± 5%
• rated output (test) voltage	1500 V ± 15%
• short-circuit current pulse-rise time at 1.5 kOhm load as of 0.1-0.9 level	15 nsec max
• current pulse-fall time at 1.5 O load up to 0.368 level	300 nsec ± 10 %
• short-circuit current pulse-fall time up to 0.368 level	150nsec ± 10%
• output voltage polarity	positive and negative
• output pulse time	1 sec / 5 sec
• dimensions	450 x 434 x 169 mm
• device mass	5 kg max
• import power	10 W max
• service life	10 years

3. Packing contents.

The package includes:

• test generator IGE Sc	1 unit
• pulse voltage divider	1 unit
• instrument shunt	1 unit
• mains cable	1 unit
• 1A fuse	2 units
• technical passport	1 unit

4. Feature and operation concept.

4.1 The functional chart of the test generator IGE Sc is shown in **Figure 1.**

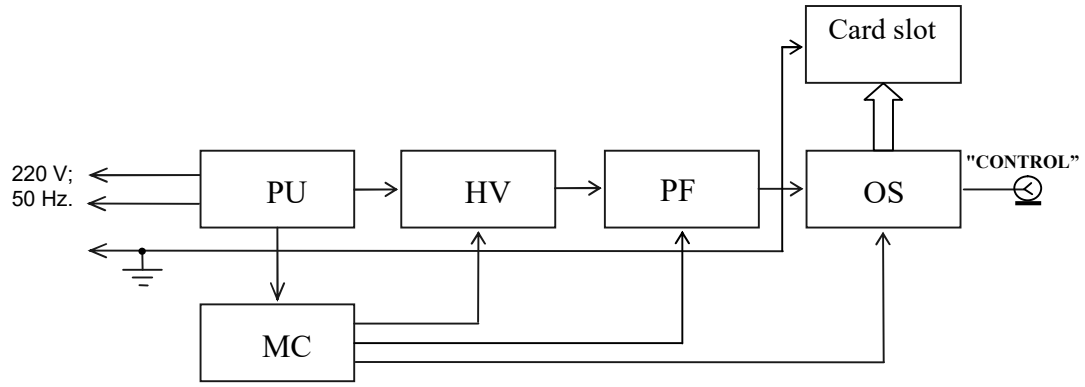

Fig. 1 The functional chart of the test generator IGE Sc
1. Power Unit (PU)
2. Microprocessor Controller (MC)
3. High Voltage Transducer (HVT)
4. Pulse Former (PF)
5. Output Switch (OS)

4.2. The power unit (PU) generates + 5V, + 12V, which are required for appropriate functioning of the microprocessor controller, the high voltage transducer, and the output switch.

4.3. The high voltage transducer (HVT) generates 1.5 kV of positive or negative polarity, which is required for charging the pulse former storage capacitor.

4.4. The microprocessor controller (MC) generates start pulses for the pulse former, and controls the operation of the high voltage transducer and the output switcher, a keyboard, and a LCD display.

4.5. The pulse former (PF) is designed to generate pulses of an appropriate form and amplitude.

4.6. The output switch (OS) connects the pulse former output to the GND contact and to one of the other card pins, or to the generator's "**CONTROL (КОНТРОЛЬ)**" output.

5. Safety precautions.

5.1. Only persons who have read and understood "The rules of technical operation of electric installations of consumers", have an approved group-based electrical safe work practices (not less than level 3), have been instructed on safety measures for work with electronic test equipment, and have examined technical specification and the manual, are permitted to use the test generator.
5.2. The repair of the generator shall be done only by the manufacturer's representatives.

5.3. Do not cut the test generator into mains when the upper cap is removed.

5.4. A protective ground connection is required.

6. Preliminary starting procedure.

6.1. After transfers in winter or high humidity conditions, the product should be kept under normal conditions 2 hours minimum before using.

6.2. Check 1A fuse is inserted in the rear panel holders.

6.3. Connect the protective ground to the connecting device ⏚ on the rear panel by a wire sections of 1.5 mm ^{2} min.

6.4 Connect the power cable to the socket on the rear panel and to the power outlet 220 V ; 50 Hz. Turn on the test generator by "**POWER (СЕТЬ)**" switch. The message shown in Figure 2 should be displayed. If the message "**MISCONNECTION! (НЕПРАВИЛЬНОЕ ПОДКЛЮЧЕНИЕ!)**" is displayed, turn off the generator and upturn the plug. If the same message is shown when you turn it on again, check the existence and integrity of the power ground.

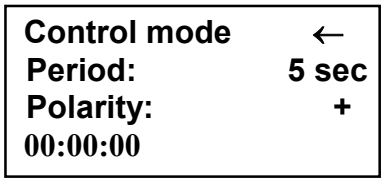

Figure 2

7. Working sequence.

7.1. After the generator is turned on by "**POWER (СЕТЬ)**" switch, text and an arrow cursor appear in the top line (ref. Figure 2). When enabled, the generator is set to output pulse control mode (ref. item 7.3). When inserting an electronic card into the special slot, the generator is transferred to test mode (ref. item 7.2).

7.2. Test mode.

7.2.1. To make tests, insert the card into the special slot. The text as shown in Figure 3 is displayed. Without a card inserted, the test mode is locked. The card is inserted by the pins upward in the direction indicated by the arrows on the top side of the card. It is possible to test cards with eight and six pins in accordance with ISO 7816-1 and ISO/IEC 10373.

7.2.2. The generator is started by pushing "**START/STOP (ПУСК/СТОП)**" button. By doing so, the generator generates the required number of pulses with positive and negative polarity in the period of 5 sec, bringing them one by one to card pins with numbers 1, 2, 3, 4, 6, 7, 8 (1, 2, 3, 6 – for 6-pin card). The output with number 5 (GND) is skipped because test pulses are given line-to-ground.

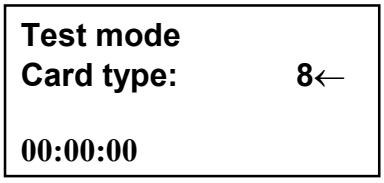

Figure 3

7.2.3. When started, the high voltage transducer is turned on and "**START (ПУСК)**" LED shows red when the test pulse is brought. The number of the currently exposed pin and the polarity of the current pulse is shown on the screen. The counting of pauses between pulses is indicated in the lower-right corner of the screen.
After the test cycle ends, "**START (ПУСК)**" LED shows green and the message as shown in Figure 4 appears on the display.

Figure 4

7.3. Control mode of output pulse parameters.

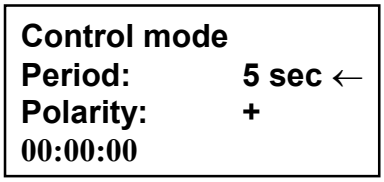

Figure 5

7.3.1. The period and the polarity of the output pulses can be set in the control mode. The pulse period is selected when the cursor is moved to "**Period (Период)**" line. This allows to set the values 1 sec and 5 sec. When the cursor is moved to "**Polarity (Полярность)**:" by means of "+" and "**-**" buttons, a positive "+" or negative "**-**" polarity of generator's output pulses can be set. The cursor is moved over lines by "↓" and "↑" keys. The generator is started by pushing "**START/STOP (ПУСК/СТОП)**" button. By pushing "**START/STOP (ПУСК/СТОП)**" button, the pulse generation process is terminated. The generator blocks other buttons during an operation cycle.

8. Maintenance.

8.1. The maintenance of the test oscillator after the end of the warranty period shall be performed by the manufacturer under a particular contract.

8.2. The manufacturer shall provide warranty service for the generator over 24 months after work acceptance is made in accordance with the contract.

8.3. The warranty obligations shall not apply to equipment with clear mechanical or other damage caused by malfunctioning, mistreatment or accidents.

8.4. The warranty period is terminated if the repair is to be completed by the Customer or any third party.

8.5. Biennially at a minimum, the test generator shall be checked in accordance with periodical qualification procedure.

9. Problems and solutions.

9.1.Possible problems and solutions of fixing them are indicated in Table 1.

Table 1.

Kind of malfunction	Probable cause	Solutions
1. When "**POWER (СЕТЬ)**" switch is turned, LCD backlight does not work.	1A fuse is missing or blown-out.	Change 1A fuse in the rear-panel holder.
2. The "**MISCONNECTION! (НЕПРАВИЛЬНОЕ ПОДКЛЮЧЕНИЕ!)**" message is shown on the display.	Phase and zero wires of the supply outlet and generator are mismatched.	Upturn the plug in the outlet.
	Protective ground does not connected or damaged	Connect the ground connector to ground bus of a room.
3. The "**DAMAGED (НЕИСПРАВЕН)**" message is shown on the display.	there is reduced voltage in the power network	Turn off the generator, wait for the rated voltage to be restored in the power network. Reactivate the generator.
	failure of the high voltage transducer	Contact the manufacturer

9.2. Otherwise, contact the manufacturer.

10. Acceptance information

10.1. Testing and certification of the test generator shall be carried out at least biennially in accordance with the procedure described below.
10.2. When making the certification observe the following conditions:

- surrounding temperature, 20 ± 5°C
- relative air humidity 60 - 80 %
- atmospheric pressure 750 ± 30 mm Hg.

Note: It is permitted to carry out the certification in other operating conditions of the test center if they are not exceed the limits of generator's working conditions and the measurement tools.

10.3. The list of standardized accuracy characteristics of the test generator is shown in Table 2.

Table 2.

Parameter name	Rated value
Amplitude of the pulses at 1.5 kO load, V ± 15%	750
Current pulse-rise time at 1.5 kO load as of 0.1-0.9 level, nsec, max	15
Current pulse-fall time at 1.5 O load up to 0.368 level, nsec ± 10%	300
Short-circuit current pulse-rise time as of 0.1-0.9 level, nsec, max	15
short-circuit current pulse-fall time up to 0.368 level, nsec ± 10%	150

10.4. The recommended measurement tools for testing the generator are shown in Table 3.

Table 3.

Measurement tools	Technical specifications	Type
Oscilloscope	Pass-band 200 Mmhz min	TDS 2022
Pulse voltage divider	Ratio 1:30 Dividing ratio error at DC ± 2% Input resistance 1.5 kOhm ± 2% Output resistance 50 Ohm ± 2% Pass-band 200 Mmhz Maximum pulse voltage (with pulse time not above 1 μs) 1 kV minimum	Standard №.0807369.1
Instrument shunt	Input resistance 10 Ohm ± 2% Output resistance 50 Ohm ± 2% Pass-band 20 Mmhz Maximum pulse current (with pulse time not above 1 μs) 2 A minimum	Standard №0807369.2

10.5. Generator qualification and measurement of main metrological characteristics

10.5.1. The pre-starting procedure of the test generator shall be conducted in accordance with item 6 and 7.3 of the present passport.

10.5.2. The pulse amplitude at 1.5 kO load operation is measured at the output of the test generator by the oscilloscope connected via the standard pulse voltage divider with the output resistance 1.5 kO to the "**CONTROL (КОНТРОЛЬ)**" output of the generator. The oscilloscope is set in waiting mode with internal triggering. The results of the measurements are recorded in the protocol (ref. Passport, table 4).
The deviation of measured values from the rated is calculated using a formula (10.1):

$$\Delta U = \frac{U_{амп} - U_{ном}}{U_{ном}} \times 100\%. \qquad (10.1)$$

Where Uамп – Uamp, Uном - Urated
The results of the measurements are recorded in the protocol (ref. Passport, table 4).

10.5.3. The pulse-rise time is measured by the oscilloscope at levels (0.1 ÷ 0.9) U_{max}. The results of the measurements are recorded in the protocol (ref. Passport, table 4).

10.5.4. Pulse-fall time at 1.5 O load is measured by oscilloscope from pulse maximum up to 0.368 level U_{max}. The results of the measurements are recorded in the protocol (ref. Passport, table 4). The deviation of measured values from the rated is calculated and recorded in the protocol.

10.5.5. Short-circuit pulse-fall time is measured by oscilloscope from pulse maximum up to 0.368 level U_{max} when the current transducer with 10 O maximum resistance is connected to "**CONTROL (КОНТРОЛЬ)**" generator output. The results of the measurements are recorded in the protocol (ref. Passport, table 4). The deviation of measured values from the rated is calculated and recorded in the protocol.

10.5.6. The pulse-rise time is measured by the oscilloscope at levels (0.1 ÷ 0.9) U_{max}. The results of the measurements are recorded in the protocol (ref. Passport, table 4).

10.5.7. Negative polarity of the output pulses is set, and actions as indicated in items 10.5.2 – 10.5.6 are repeated.

Table 4.

Parameter name	Pulse polarity	
	+	-
Amplitude of the pulses at 1.5 kOhm load, V		
Deviation, %		
Current pulse-rise time at 1.5 kOhm load as of 0.1-0.9 level, nsec		
Current pulse-fall time at 1.5 Ohm load up to 0.368 level, nsec		
Deviation, %		
Short-circuit current pulse-rise time as of 0.1-0.9 level, nsec		
Short-circuit current pulse-fall time up to 0.368 level, nsec		
Deviation, %		

11. Maintenance conditions

Climate conditions

The generator shall be operated under normal climate conditions**:**
- surrounding air temperature ***(25 ± 10) ^{o} C;***
- relative air humidity ***45 - 80 %;***
- atmospheric pressure ***84.0 – 106.7 kPa (630-800 mm Hg).***

General requirements of electric power.

The generator is powered by a single-phase AC network with a frequency of 50 Hz, nominal voltage of 220 V ± 10%. The sections of the wires should correspond to the maximum loads of the test equipment. The workplaces shall have euro sockets with the connected grounding pins. The sockets and protective ground connected devices shall be located in close proximity to the generator. The connection of the protective ground to the "ground" connecting device located on the rear panel of the generator require a flexible wire having sections of 1,5 mm minimum.
Do not use dividing transformers to power the generator.

12. Shipment

The packed device is transported by all kinds of transport, provided that it is protected against precipitation.

When the device is transported by an air plane, it shall be placed in a heated sealed compartment.

The holds of ships and carbodies used for shipment shall not have cement, coal, chemicals, etc.

The shipment of the device shall be carried out at air temperature ranging from -25 °C to + 55 ° C, relative air humidity up to 95% at +55°C temperature

13. Storage precautions

The device shall be stored in heated space under the following conditions:
air temperature from 283 to 308 K (from 10 to 35 °C);
relative air humidity 80% at 298 K (25 ºC) air temperature;
There shall be no dust, acid vapor, grease alkali and corroding gases in the storage space;
do not store unpacked devices on the top of one another.
The storage of the packed device is acceptable.

14. Certificate of acceptance.

Test generator IGE Sc, manufacturing number , meets the technical requirements and is approved as ready for service.

Production date

Head of Inspection Department	