



Electrostatic discharge
test generator
IGE 12m

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1. Product features.

1) Electrostatic discharge test generator IGE 12m (hereinafter – the generator) is manufactured by "PRORYV" Research and development enterprise.

1) The IGE 12m test generator is designed to provide rated test pulses for testing chips to static electricity (SE) discharge sensitivity.

2) Technical specifications.

• Output voltage, V	50 ÷ 12000
• accuracy of output voltage adjustment, %	± 5 max
• output voltage polarity	positive and negative
• capacity of the discharge capacitor, pF	100 ± 10
• resistance of the discharge resistor, Ω	1500 – 5%
• current pulse-rise time as of 0.1 ÷ 0.9 level, nsec	15 max
• current pulse-rise time as of 1.0 ÷ 0.368 level, nsec	150 ± 20
• operation mode	single, automatic
• pulse-repetition period, sec	5 minimum
• generator continuous work time, h	4 minimum
• dimensions, mm	450 x 434 x 169
• mass of the generator, kg	12 max
• import power, W	100 max
• service life	10 years



3. Packing contents.

The package includes:

- test generator IGE 12m 1 unit
- mains cable 1 unit
- blue switching cable 1 unit
- red switching cable 1 unit
- 5A fuse 1 unit
- technical passport 1 unit
- red high-voltage wire (25 kV) 1 unit

4. Feature and operation concept.

4.1 The functional chart of the test generator IGE 12m is shown in Figure 1.

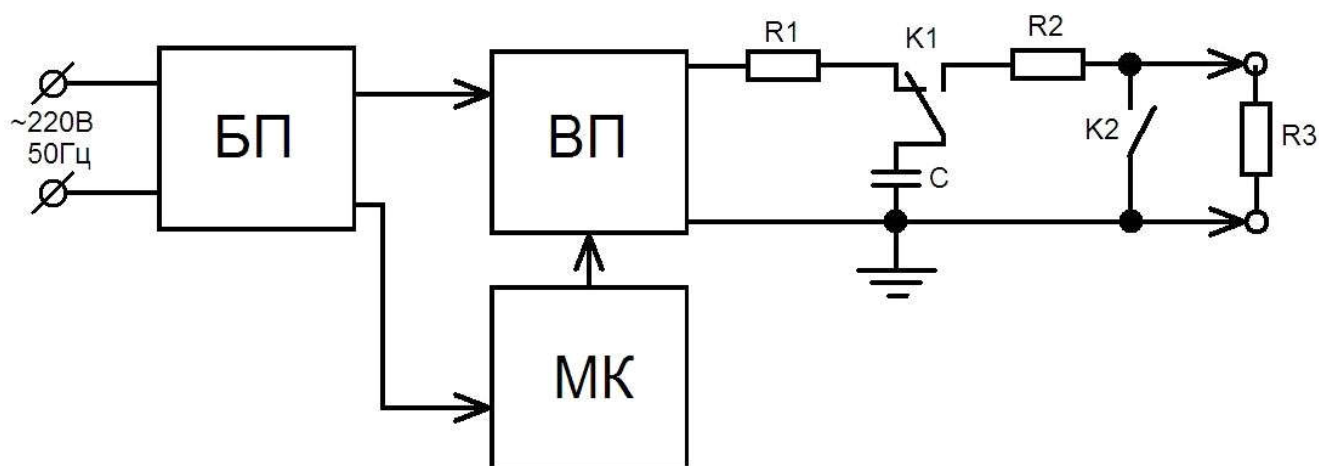


Fig. 1 The functional chart of the test generator IGE 12m

1. Power Unit (PU (БП in the chart)).
2. Microprocessor Controller (MC (МК)).
3. High Voltage Transducer (HVT (ВП)).
4. Current-limiting Resistor (R1).
5. Energy Discharge Capacitor (C).
6. Discharge Resistor (R2).
7. Discharge Relay Contacts (C1 (K1)).
8. Contacts of the Relay for Generator Output Closure (C2 (K2)).
9. Instrument Shunt (R3).

4.2 The power unit (PU) generates voltage supply for all generator units when it is powered by AC mains.

4.3 The microprocessor controller (MC) controls the operation of all generator units, changes the output voltage and generator pulse polarity.

4.4 The high voltage transducer (HVT) generates voltage ranging from 50 V to 12 kV, required for charging the energy discharge capacitor (C).

4.5 The current-limiting resistor (R1) is designed to limit the charging current of the energy discharge capacitor (C).

4.6 Energy discharge capacitor (C), discharge relay (C1), discharge resistor (R2), load resistor 50 Ω (R3) are designed to generate current impulse time with rated standard performance at the test generator output.

4.7. The closed contacts of the relay (C2) prevent the accumulation of stray wiring capacitance. The contacts (C2) are closed at breaks between pulses.

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.

5.5 Do not touch the switching cables when the test exposure is being taken.

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 5A 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 mm² 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 (CETb)**" switch.

7. Working sequence.

7.1 It is recommended that the tests are carried out 10-15 minutes after the generator is turned on.

7.2 After the generator is turned on by "**POWER (CETb)**" switch, text and an arrow cursor appear in "**Amplitude**" line (ref. Figure 2). The "**START (ИYCK)**" LED becomes green, indicating the generator is ready to start. The cursor is moved over lines by "↓" and "↑" keys.



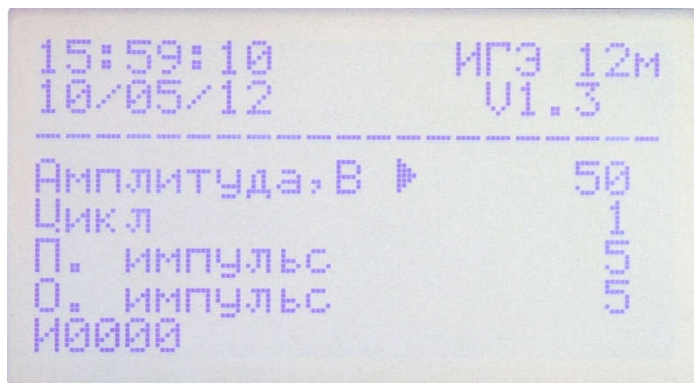


Figure 2

7.3 The output pulse amplitude is set by "+" and "-" keyboard keys. The cursor has to be in "Amplitude (Амплитуда)" line (ref. Figure 2). Values ranging from 50V to 12000V, and a voltage pulse amplitude setting increment ranges from 50V to 1000V 10V, from 1000V to 12000V – 50V can be selected.

7.4 The number of cycles for set pulses in "P. pulse (П. импульс)" and "N. pulse (О. импульс)" can be set in "Cycle (Цикл)" line by means of "+" and "-" keyboard keys. After "START (ПУСК)" button is pushed, positive polarity pulses with 5 sec (minimum) intervals are automatically generated at first, and then a negative ones. The sequence of pulses is repeated until all set loops are executed. The "I0000 (И0000)" line reflects that the pulse counter goes up by one (the counter is reset either when there are changes in "Cycle (цикл)" line or when the generator is turned off). The "C01 (Ц01)" line displays the current cycle, "P003 (П003)" – positive pulse counter, "O000" – negative pulse counter.

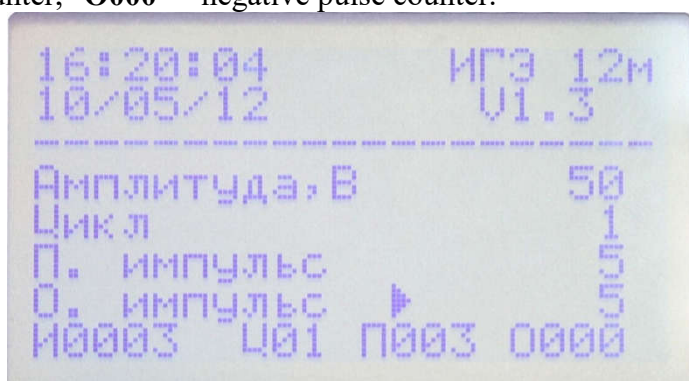


Figure 3

7.5 The number of positive polarity pulses is set in "P. pulse (П. импульс)". When the value 0 is set, positive polarity pulses are not brought at the output.

7.6 The number of negative polarity pulses is set in "N. pulse (О. импульс)". When the value 0 is set, negative polarity pulses are not brought at the output.

7.7 If the value 1 is set in "Cycle (цикл)", and "-" keyboard key is pushed, the generator switches to the manual control of pulse bringing mode (ref. Figure 4). The output pulse polarity is set by "+" and "-" keyboard keys. The cursor has to be set in "Polarity (Полярность)" line. There are two values to be selected – "positive (полож.)" - positive polarity and "negative (отриц.)" - negative one.

A single pulse is brought when "START (ПУСК)" button is pushed. The next pulse can be brought in 5 seconds (minimum).

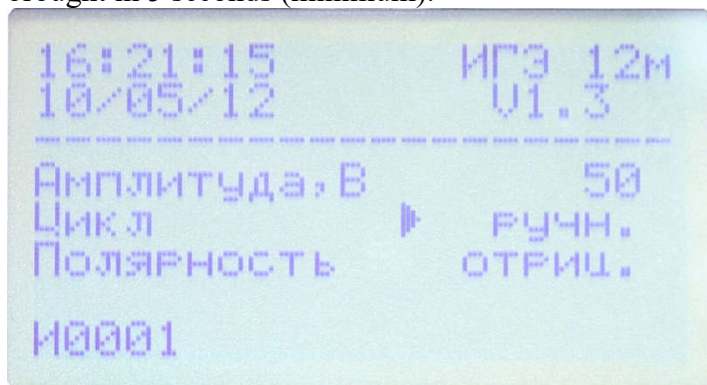


Figure 4

7.8 Green color of "START (ПУСК)" LED indicates that the generator is ready to start. The generator is started by pushing "START/STOP (ПУСК/СТОП)" button. A single pulse is brought to the output, "START (ПУСК)" LED shows red, and the "И0000 (И0000)" line reflects that the pulse counter goes up by one (the counter is reset either when there are changes in "Cycle (цикл)" line or when the generator is turned off). When the launch is made "START (ПУСК)" LED is turned off and then shows green in 1 second after "START/STOP (ПУСК/СТОП)" button is pushed. Green color of "START (ПУСК)" LED indicates that the generator is ready for a new start.

7.9 After the work is completed, the power of a technical equipment shall be switched off, the test generator is powered off and the technical equipment is disconnected from the generator "OUTPUT (ВЫХОД)" socket.

7.10 To install the internal clock of the generator in the clock setting mode when the generator is launched by "POWER (СЕТЬ)" button it is necessary to hold "" button. After that the generator is turned on in the clock setting mode (ref. Figure 5). To select the lines of hours, minutes, seconds, day, month and year setting use "" and "" buttons. Change the value in the selected line by using "+" and "-" buttons. To confirm the settings of the internal clock and turn to the operation mode of the generator, push "START/STOP (ПУСК/СТОП)" button. To cancel the setting turn the generator off by "POWER (СЕТЬ)" switch.

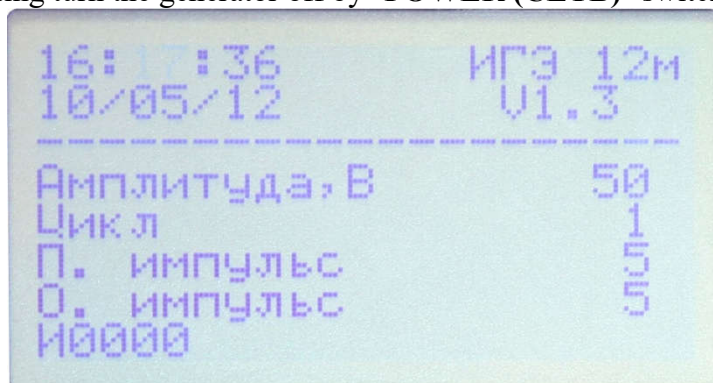


Figure 5

8. Maintenance.

- 8.1 The maintenance of the test generator 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 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
When "POWER (CETb)" switch is turned, LCD backlight does not work!".	5A fuse is missing or blown-out.	Change 5A fuse in the rear-panel holder.
	The network cable is out of service.	Replace the network cable.

9.2. Otherwise, contact the manufacturer.

10. Equipment qualification procedure

10.1 The qualification of IGM 12m test generator is carried out according to the methodology set out below in accordance with the technical passport.

The qualification frequency of the test generator during its operation and storage process is to be defined by an enterprise using the equipment in accordance with the conditions and intensity of its operation. It is recommended to conduct it biennially.

10.2. The qualification procedure of the IGE 12m shall be carried out under normal climate conditions

surrounding air temperature, $(293 \pm 5)K$; $(20 \pm 5) ^\circ C$;

relative air humidity, $(60 \pm 5)\%$;

atmospheric pressure $(84.0-106.0)$ kPa $(630-800)$ mm Hg;

AC supply voltage, $(220 \pm 10) V$;

mains frequency; $(50 \pm 0,5) Hz$.

10.3. The list of rated characteristics of the test generator is shown in Table 1.



Table 2.

№	Specification	Value
1	Output voltage, V	50 - 12000
2	Accuracy of output voltage adjustment, %	5.0 max
3	Output voltage polarity	Positive and negative
4	Current pulse-rise time as of 0,1 0,9I _{амп} level, nsec	15 max
5	Current pulse droop time as of 1.0 0.368I _{амп} level, nsec	150 20

10.4 The recommended measurement tools for testing the test generator are shown in Table 2.

Table 2.

Measurement tools	Technical specifications	Recommended type
Oscilloscope	Pass-band 400 Mmhz min	LeCroy WaveJet 354
Attenuator	Input resistance 50 O Attenuation 26 dB Maximum voltage 3 kV min Pass-band 400 Mmhz min	IAN 3.1
Kilovoltmeter	2-30 kV, Cl. 1.0	C196
Kilovoltmeter	0.6-3.0 kV, Cl. 0,5	C511
Multimeter	voltage measurement accuracy (0,000045U _{msr} + 0,00001 U _{end})V;	Agilent 34401A

Note: The usage of other measurement tools which are compatible with the required accuracy is permissible. But the arbitration tools are the ones specified in the given list.

All the control and measuring equipment has to be accepted (calibrated) and have the qualification certificate.

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 of the present passport.

10.5.2. Measure the output charge voltage and specify the accuracy of its adjustment. The results of the measurements are recorded in the protocol. The deviation of measured values from the rated is calculated using a formula (10.1):

$$\Delta U = \frac{U_{\text{ВЫХ}} - U_{\text{НОМ}}}{U_{\text{НОМ}}} \times 100\% \quad (10.1)$$

where $U_{\text{ВЫХ}}$ (output) – measured output voltage, V;

$U_{\text{НОМ}}$ (rated) – voltage rated value, V.

It is recommended to take measurements as follows:

ranging from 50 to 800 V by Agilent 34401A multiple-purpose meter;

ranging from 800 to 3000 V by C511 kilovoltmeter;

ranging from 3000 to 12000 V by C196 kilovoltmeter.



10.5.3. Turn the attenuator to the generator output and measure the amplitude of the pulses by means of the oscilloscope. The oscilloscope is set in waiting mode with internal triggering. The base of the oscilloscope is set in position $10 \div 20$ nsec/point. The current values for the all set values of the output voltage are calculated using a formula:

where: $I_{\text{ампл}}$ (ampl) – current pulse amplitude, A;

U_{att} (att)– measured output voltage of attenuator, V;

$R_{\text{нагр}}$ (input) – input resistance of attenuator, $R_{\text{att}} = 50$ O;

K - output ratio

Measured values for the all set values of the current amplitude are recorded in a protocol.

10.5.4. Current pulse-rise time is measured by oscilloscope as of

$(0.1 \div 0.9) I_{\text{ампл}}$ (ampl) for all set amplitude values. The results of the measurements are recorded in the protocol.

10.5.5. The pulse-fall time is measured at levels $(0.1 \div 0.368) I_{\text{ампл}}$ (ampl) by oscilloscope with all set amplitude values. The results of the measurements are recorded in the protocol. The deviation of measured values from the rated is calculated and recorded in the protocol.

The results of the measurements for the output voltage positive polarity.

Table 3

Set charge voltage, V		50	200	500	2000	5000	12000
Output voltage, V	rated	50	200	500	2000	5000	12000
	measured						
deviation, %	-						
Current pulse amplitude, A	calculation						
Current pulse-rise time, max, nsec	rated	15.0	15.0	15.0	15.0	15.0	15.0
	measured						
deviation, %	-						
Current pulse-fall time (as of 36.8% level), nsec	rated	150	150	150	150	150	150
	measured						
deviation, %	-						

The results of the measurements for the output voltage negative polarity.

Table 4

Set charge voltage, V		50	200	500	2000	5000	12000
Output voltage, V	rated	50	200	500	2000	5000	12000
	measured						
deviation, %	-						
Current pulse amplitude, A	calculation						
Current pulse-rise time, max, nsec	rated	15.0	15.0	15.0	15.0	15.0	15.0
	measured						
deviation, %	-						
Current pulse-fall time (as of 36.8% level), nsec	rated	150	150	150	150	150	150
	measured						
deviation, %	-						

11. Maintenance conditions

11.1. Climate conditions.

The generator shall be operated under normal climate conditions

- surrounding air temperature $(25 \pm 10) ^\circ C$;
- relative air humidity $45 - 80 \%$;
- atmospheric pressure $84.0 - 106.7 \text{ kPa}$ ($630-800 \text{ mm Hg}$).

11.2. General requirements of electric power.

The generator is powered by a single-phase AC network with a frequency of 50 Hz, nominal voltage of $220 \text{ V} \pm 10\%$.

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 carboodies used for shipment shall not have cement, coal, chemicals, etc.

The shipment of the generator shall be carried out at air temperature ranging from -25°C to $+55^\circ\text{C}$, relative air humidity up to 95% at $+55^\circ\text{C}$ 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°C) air temperature;
- there shall be no dust, acid vapor, grease alkali and corroding gases in the storage space;
- do not store unpacked generators on the top of one another;
- the storage of the packed generator is acceptable.

14. Certificate of acceptance.

Test generator IGE 12m, manufacturing number _____, meets the technical requirements and is approved as ready for service.

Production date

Head of Inspection Department

