TECHNO-AC®

Arc Discharge Generator

GI-TA

User Manual

ATTENTION!

This device produces a voltage that is life-threatening.

Strictly forbidden:

1. **Work with the device for persons who do not have access to equipment with a voltage of more than 1000 Volts.**
2. **Work with the device to persons who have not studied this manual.**
3. **Open the device or use it not for the intended purpose specified in this manual.**

The manufacturer does not bear any responsibility for the consequences that have arisen in connection with the non-fulfillment of these conditions.

The manufacturer also assumes no responsibility for the direct or indirect consequences caused by the use of this device at facilities that do not allow the use of 10 kV voltage and the presence of open arc discharges.

Summary

1. Purposes of the GI-TA

The arc discharge generator GI-TA is designed to search for high-resistance breakdown points of a high-voltage cable and to determine the distance to these points in combination with TDRs RI-407 or TDR-107, TDR-109 reflectors in three possible ways:

- Time Domain Reflectometry - TDR;
- Arc-reflection method – ARM, in two modes – manual and auto;
- Wave method (oscillatory discharge, ICE).

Attention! **Applying the GI-TA doesn't assume the burning mode. It can occasionally appear with low-resistance conditions (in AUTO mode). The device maintenance during more than 15 sec in that conditions will cause the GI-TA failure. (Please note, that's not a guarantee point.)**

Please read carefully this manual and guarantee text on page 21.

2. Fault prelocation methods principles.

2.1. Time Domain Reflectometry method

TDR operates in usual mode as a conventional cable reflectometer with a direct cable connection. This mode is designed to obtain a preliminary picture of the investigated line, which is stored in the memory of the device. Operational sequences are described in the user manual of the corresponding devices.

If there is an open or short in the cable fault point, TDR determines a distance to the fault points with high accuracy. In that case, the described methods are not used.

2.2. ARM – Arc reflection method

This is the preferred method of high-resistance fault location. Arc reflection method is using the non-destructive cable breakdown in the fault point. When applied in case of the insulation high resistance (100 KOhm or more) at the failure point, but high voltage breakdown can occur.

GI-TA creates a short breakdown arc in the fault zone, and the TDR identifies received waveform as a short-circuit. Synchronization systems allow the TDR to be launched in time, and some arc tightening done at the GI-TA source will allow measurement at a distance from the damage point up to several tens of kilometers.

The accuracy of the distance measurements doesn't differ from the TDR method.

2.3. Wave (Oscillatory discharge) method.

The Wave method purposed to a breakdown that isn't evident or localized, however, the reflected wave from the point of damage can appear. Often encountered when the cable is wet, or if there is a high-resistance coaled bridge appears in the fault point (10-1000 MOm) can cause the running front of the reflected voltage (or current) from the damage point returning to the source (ADG) with high resistance input. It cause the secondary

reflection running to the fault point, etc. There is an oscillatory process, the period of which is:

$$T = 2\frac{L_x}{V},$$

L_x – the distance to the fault point, V – pulse running speed.

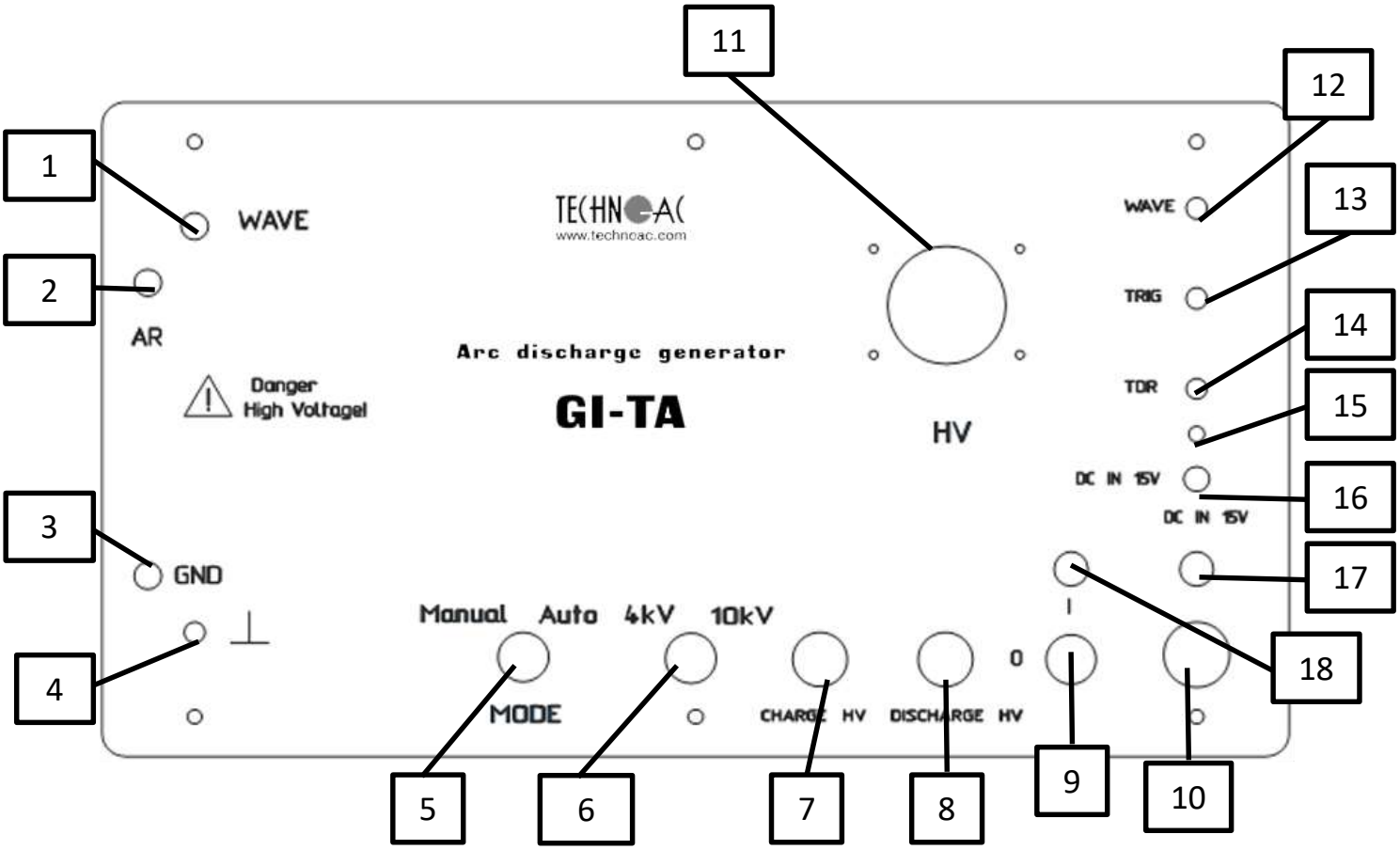
This process is displayed on the TDR screen operating in oscilloscope mode with the waiting external synchronization provided by the corresponding ADG source block. Cursor measurements on the TDR screen allow you to measure the signal period, and the known signal propagation speed allows you to translate the measurement results directly into a distance. The accuracy of this method is less than that of the previous two; Often parasitic oscillatory processes are superimposed on the basic oscillation, which distort the period of the fundamental oscillation. Nevertheless, in a number of cases, the wave method is the only possible one.

3. Overview of the GI-TA controls

The GI-TA functionally consists of a high voltage source, an arc-tightening circuit, matching and protective circuits for communication with the TDR, as well as switching and indication systems.

Structurally, the GI-TA is has the hermetically sealed plastic case of sufficient electrical and mechanical strength, provided with handles for carrying.

Access to controls appears when the top cover of the unit is opened.



Picture 1

Picture 1. GI-TA controls

1. High-voltage socket for the cable connection in WAVE mode

2. High-voltage socket for the cable connection in AR mode

3. High-voltage socket to the cable ground connection cable in All modes

4. Protective grounding

5. Cable charging mode toggle switch: MANUAL/AUTO

6. Output voltage limiter switch toggle: 4 kV - 10 kV

7. CHARGE button: starts charging cable or internal high-voltage capacitor (blue LED)

8. DISCHARGE HV button: discharge the internal high-voltage capacitor to the cable (red LED)

9. Key-lock (0-off, I-on)

10. Car battery supply, 12V

11. Output voltage indicator, kV;

12. Reflectometer connection socket (items 5.1.7, 5.1.8) (WAVE method)

13. Reflectometer connection socket (items 5.1.7, 5.1.8) (external synchronization in the AR mode)

14. Reflectometer connection socket (items 5.1.7, 5.1.8) – (TDR and AR modes)

15. LED (Battery status)

16. Charger input, DC IN 12V

17. Power-on indicator

18. Battery charging indicator

Overview of the GI-TA controls

4. Specifications

- Maximum output voltage: 10 kV
- Output voltage limiter threshold: 4 kV, 10 kV
- Supported prelocation methods:
  - Arc Reflection Method (ARM) with internal or external (TRIG output) synchronization;
  - Oscillatory discharge method (WAVE, ICE);

Arc (breakdown) creation modes:

- Direct charging the capacity of the cable (AUTO mode) until breakdown occurs;
- Charge the built-in capacitor followed by discharge it to the cable (MANUAL mode)

Other specifications

- Maximum stored energy: 200 J;
- Arc tightening time - from 1 to 10 ms (depends of external conditions);
- The minimum time interval between consecutive discharges is determined by the operator, but not less than 20 s;
- The maximum voltages on all low-voltage device inputs and outputs:
  on the TDR connector - 60 V,
  on the WAVE connector - 120 V,
  on the TRIG connector - 20 V;
- Power source: internal battery 12 V, 12 A*h;
- Overall dimensions: 570x350x200 mm;
- Weight: 29 kg

5. Working with GI-TA

ATTENTION! The GI-TA source can be operated only by the persons authorized to work with high-voltage devices (more than 1000V). Please search carefully this manual.

ATTENTION! Connection insulation of the high-voltage connecting cables is not designed for 10 kV. All operations with connection cables are possible only without the voltage.

5.1. Connecting the GI-TA to the cable

5.1.0. Open the cover of GI-TA and make sure that power is off (key switch 8 is off, all indicators are off, the HV indicator shows 0 V).

5.1.1. Connect the terminal 4 to the ground object (if possible).

5.1.2. Make sure that voltage on the cable is off.

5.1.3. Remove the residual static voltage by shorting the cable cores to each other and cable armor using a special high-voltage wire or other device.

5.1.4. Connect high-voltage connecting cables to the testing pair cable cores.

5.1.5. Insert high-voltage connecting cables into the slots 1, 2 and 3 (Fig. 1), **according to the selected operating mode (AR or WAVE)**. Combinations of 3-2 inputs (for AR mode) and 3-1 for WAVE mode are available. When examining two cable cores, cables can be connected arbitrarily, when examining the "conductor-armor" pair, the armor of the cable should be connected to the socket 3 **(GND)** and the cable core to the socket (1 or 2), according to selected operating mode (AR or WAVE)

Connect the TDR to the GI-TA, according to the following rules:

If working with **TDR-TA1.7, TDR-TA1.9** then make sure:

- TDR slot of the GI-TA is connected to the L1 slot of the TDR;
- TRIG slot of the GI-TA is connected to a similar (by name) slot of the TDR;
- WAVE slot of the GI-TA is connected to the U/I slot of the TDR (for TDR-107 only).

If you work with the reflectometer **TDR-TA4.7**, slots with the same names should to be connected.

5.1.6. Switch on the TDR on and select the operational mode and operating parameters (see TDR User Manual).

5.1.7. Connect high-voltage connecting cables in accordance with the selected TDR operating mode. In the ordinary TDR operating mode, it is optimal to use the outputs 2-3 **(AR)** by setting the switch to **AUTO**. Highly recommended to start high-voltage analysis of the fault point from the **AR** mode.

5.1.8. Power on of a high-voltage source for operations using ordinary reflectometric (TDR) method **is strictly prohibited**.

5.2. Working with a high-voltage (AR and Wave methods)

5.2.0. Before switching on the device, perform all necessary manipulations with the high-voltage connecting cables (see 5.1).

5.2.1. **Set the MODE switch to MANUAL.**

5.2.2. Insert the key into the switch 8 and turn it to the position I. The LED 16 should light up.

5.2.3. With a 4/10 kV switch, set the voltage limiter to the maximum permitted value for the cable line being examined.

5.2.4. With the MODE switch select the high voltage supplying method.

The AUTO mode is possible only with a cable leak <= 3 - 5 mA.

In this mode, the storage capacitor is permanently connected to the output terminals. Pressing the **CHARGE HV** button will supply high voltage to the capacitor and the cable at the same time. The voltage will rise to the point of breakdown or (if the of breakdown absence) to the maximum possible voltage.

The following options are possible:

- **A) When the voltage rises in the interval up to 10 kV, a breakdown occurs** (as can be seen as the throw down the HV indicator). In this case, you should start the trace analysis, and if the result is not clear, you should repeat the measurement by pressing the **CHARGE HV** button, but not earlier than 20 seconds after the discharge. This procedure can be done as many times as necessary (perhaps changing the TDR settings) to achieve clear result. After the measurements are finished disable the device with the **key 8**.
- **B) Voltage reaches the maximum value (10 kV on the HV indicator), but the breakdown does not occur.** In this case, you should turn off the device with the **key 8**. Further work in AR mode is useless, and the device consumes a significant battery current.

- **C) The voltage reaches an intermediate value, but the breakdown does not occur, or the voltage does not increase at all.** This situation indicates a significant leak on the cable (usually more than 8 mA).

  In this case, AUTO mode is impossible and dangerous for the device systems, because It works with unacceptable overload, trying to charge the cable with an unacceptably high leakage or to make a burn.

  In both situations (B and C) are STRICTLY PROHIBITED for operation (due to the inadmissibly large power dissipated on the circuit power elements) and in a short time will damage the device.

  During no more than 10-15 s, turn toggle switch 5 (MODE) to MANUAL. After waiting for the capacitor full charge (up to 10 kV), discharge it to the cable by pressing the **DISCHARGE HV** button once. Never keep the button pressed.

  If a breakdown occurs, disable the device with the key 8 and proceed to the trace analysis.

  If a breakdown does not occur, but the capacitor rapidly discharges to some intermediate value or even to zero, this means the situation described above occurs, although in **MANUAL** mode the device will not suffer. Nevertheless, this indicates a significant leakage and ineffectiveness of the **AR method in this case**. **The device should be switched off with a key 8** and, further, you should try using the **WAVE** method.

After completing the operation using any method (due to any of the reasons), be sure to disconnect the high voltage source (**key 8** in position **O**), but do not forget that the static voltage remains on the tested cable.

5.2.5. When unsuccessful attempts to use the **AR** method try to use the **Wave** method

5.2.6. Make sure that the TDR is in **WAVE** mode with appropriately selected scales and other parameters (according to the TDR user manual).

5.2.7. Ensure that the device is deenergized.

5.2.8. Move the high-voltage plug from the **AR** slot to the **Wave** slot**.**

5.2.9. Move the **MODE** switch to **MANUAL**.

5.2.10. Switch on the device with **key 8**, moving it to position **I.**

5.2.11. With a **4 kV/10 kV** switch, set the voltage limiter to the maximum permissible value for the testing cable line.

5.2.12. Press and release the **CHARGE HV** button. Allow the voltage to rise to the maximum value, then press and release the **DISCHARGE HV** button once.

5.2.13. Observe the result picture on the reflectometer screen. Perhaps you need to edit the scale and amplification, or the level of synchronization. **Never use a synchronization level close to 0.**

5.3. Switching off the GI-TA

If emergency shutdown is required:

- turn switch key **8** to position **0** and **remove the key.**

The source is completely off, there is no voltage at the output terminals.

However:

- It is possible presence of static charge on the test cable; It should be removed with a special discharge wire;
- the residual charge on the storage capacitor retains for a long time, although the capacitor is not connected to the output sockets;
- **Pay special attention** to the fact that with the unit switched off, the zero kilovoltmeter readings take place with any voltage on the capacitor. This is important if you are going to open the source.

The source is safe when the capacitor is discharged to a voltage close to 0 volts. To monitor the voltage of the battery (via the HV indicator), you can turn on the device with a **key 8,** previously set the **MODE** switch to **MANUAL**, no further actions with the device needed. When the battery is discharged to voltage 0, turn off the device with a key 8 and remove the key. It is then possible to open the device, **but it should only be carried out by a specialist with an appropriate admission.**

When the device is opened, the warranty is terminated.

5.4. Switching the GI-TA to another wires pair

- Switch on the device with the key **8**, **previously make sure that the MODE toggle switch is in the MANUAL position**.
- Move the **MODE** switch to the **Auto** position and observe the discharge of the capacitor by HV indicator. In this case, both the cable and the capacitor are being discharged, so the zero readings of the HV indicator indicate that the cable and capacitor are discharged. To speed up the process, it is allowed to make a short-circuit of the investigated cable cores using a special discharger or with a high-voltage insulated piece of wire.
- Return the **MODE** switch to the **Manual** position, turn **key 8** to position **0** and remove it. This will prevent accidental actions by unauthorized persons.

  Now it is possible to remove the high-voltage connecting cables from the testing pair and connect them to the other pair, taking care about the other pair can be under voltage or residual static charge. After that start actions specified in 5.1

6. Additions

6.1 The most correct waveform of the tested pair can be obtained by connecting the TDR directly to the cable pair when the GI-TA is disconnected. If you want to obtain such waveform, please pay special attention to the cable for the presence of a residual voltage, **because residual voltage presence can completely damage the TDR**.

6.2 If in **Manual** mode the high voltage does not rise sufficiently, this indicates the discharge of the internal battery. This is indicated by the LED 14 red glow. You must stop using the device and charge the battery. The normal state of the battery charge is confirmed by the green light of the LED 14. As noted above, an insufficient level of high voltage in the **Auto** mode indicates a significant leakage in the cable and necessity for fast change of operation mode.

6.3 All the details of the test methods and corresponding waveforms are quoted in corresponding TDRs user manuals.

6.4 The device of the GI-TA may not be effective in the following cases:

- the breakdown in the place of damage occurs at a voltage more than 10 kV;
- Spatially distributed moisture in the cable; A similar situation can be detected by a strong change in the cable velocity factor V/2 (by 10-30%), if this coefficient is known or it's possible to compare value with a similar, knowingly dry cable;
- **Local leakage on the cable is too high (resistance is tens of kilohms or less, voltage on the HV-indicator in the AUTO mode "gets stuck" at an intermediate value or even at zero); In this case, it is strictly forbidden to work in AUTO mode for more than 10-15 seconds, because this will damage the device. If it is not possible to obtain the result using the WAVE method, it is advisable to use a line locator search fault point using voltage step mode (current leakage to the ground).**

If there is any doubt about the operation of the GI-TA itself, you should calibrate it (see Appendix 1).

7. Components and delivery set

GI-TA package includes:

- Arc Discharge Generator GI-TA - 1 item
- Battery charger with an output voltage of 12 V and an allowable current of 2 A or more - 1 item
- Connecting high-voltage cable – 2 item
- GI-TA start keys – 2 items
- User manual 341499-014-233133822 – 1 item
- Calibration discharger – 1 item

Optional accessories (on request):

- a special cable for removing the charge from the investigated lines
- cable for supplying power to the GI-TA from the car cigarette lighter socket

8. Certificate of acceptance

The output control is carried out in accordance with the document: "Instruction for factory tests of the GI-TA" dated 10.02.2014.

The GI-TA, factory number _____ Is manufactured in accordance with the specifications and is approved for testing.

Release date "____"_____ 20___ year.

L.S.

Company representative _____ _____

(Signature) (Full Name)

According to the results of factory tests, the source of GI-TA, serial number _____ is recognized by the relevant specifications and ready to use.

Testing date "____"_____ 20___ year.

Inspector signature: _____ _____

(Full Name)

L.S.

9. Information about conservation and packaging

Packing certificate

Source GI-TA serial number _____ Packed by the manufacturer according to the requirements specified in the packing and preservation instructions.

Packing date: "____"_____20___year.

Packing produced by: _____ _____

(Signature) (Full Name)

The product after packing accepted by: _____ _____

(Signature) (Full Name)

L.S.

Conservation certificate

Source GI-TA serial number _____ conserved in accordance with the requirements of the packing and conservation instructions.

Conservation date: "____"_____20___year.

Conservation period:

Conservation produced by: _____ _____

(Signature) (Full Name)

The product after conservation accepted by: _____ _____

(Signature) (Full Name)

L.S.

10. Warranty

10.1 The manufacturer guarantees compliance of the GI-TA source with the requirements of the technical conditions provided, **in case of consumer keeps the operating, transportation and storage conditions established in this User Manual.**

10.2 **The device failure is not a guarantee for a prolonged (more than 15 seconds) operation on a cable with a significant leak in the AUTO mode (see the description of the work above).**

10.3 The warranty period is 12 months from the date of the GI-TA delivery, but no more than 18 months from the date of its manufacture. The warranty period of storage is 6 months from the date of manufacture of the GI-TA.

10.4 The manufacturer undertakes to eliminate the identified defects free of charge or replace the defective parts of the GI-TA or the entire GI-TA within the warranty period; Also during the warranty period, the cost of shipment for repair and repair is taken by the manufacturer.

10.5 For all questions of warranty and after-sales service, contact the manufacturer at:

Mailing address:

Office 6, 10A (bl.2),1-Vladimirovskaya Str, Moscow, 111123, Russia

Phone: +7 (495) 258-86-49

e-mail: info@technoac.com

11 Information on complaints

Information on complaints should be recorded in Table 1.

Table 1

Date	Number of operational hours of the GI-TA from the beginning of operation to the malfunction occurrence	Malfunction summary	The date of the complaint and the number of the letter	Measures taken to the complaint	Notes

Annex 1.
Calibration instructions for the GI-TA

It is strictly forbidden to check the operability of the GI-TA "on a spark", bringing clips closer to each other. Insulation of the clips is not designed for a voltage of 10 kilovolts and any manipulations with live crocodiles can cause electric shock.

To check the device functionality, a calibration discharger is included.

Calibration is carried out in the following sequence:

1. Open the generator and make sure it is off.
2. Connect the high-voltage connecting cables to the device.
3. Connect the clips of high-voltage cables to the calibration discharger in an arbitrary manner (without considering the clips color marking).
4. Place the discharger with the cables connected to it in the GI-TA flip cover. Eliminate the possibility of discharger dropping out during testing.
5. Turn on the following modes:
   - High-voltage cables are connected to the sockets 3 and 1 **(AR);**
   - **MODE** switch in the **MANUAL** position**.**
6. Insert the key into the lock and move it to position **I.**
7. Turn the **MODE** switch to **AUTO** and turn on high voltage by pressing and releasing the **CHARGE HV** button.
8. Observe the HV-indicator. When voltage will be in the range from 4 to 6 kilovolts, a discharge with a drop in voltage on the HV-indicator should occur.
9. Disconnect the installation with a key **8**. Remove the key from the device.
10. Disconnect the high-voltage connection cables from the GI-TA and short them
11. Disconnect the clips from the calibration discharger.
12. Turn the **MODE** switch to **MANUAL** and then turn on the device with key **8**. After 20 seconds, press and release the **CHARGE HV** button.
13. Ensure that within a few seconds the voltage on the pointer indicator has reached 10 Kv +/- 500V. Turn off the device with key **8** and remove the key.

14. **Remember,** that despite the zero HV-indicator readings, a charge remains on the capacitor, which discharges a considerable amount of time. It is not jointed to the output connectors. But all further manipulations with the device should be started after making sure that the **MODE** switch is in the **MANUAL** position.

If all the manipulations have been completed in accordance with this instruction, the device is ready for work.

Note.
The discharger is reckoned on a limited number of triggerrings (100-300). With further operation of the discharger, the discharge voltage decreases until the discharger breaks down. If necessary, there is an opportunity to purchase a new calibration discharger in AO "ERSTED".