

HZ-501B

Cable Fault location system

Huazheng Electric Manufacturing(Baoding) Co.,Ltd

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I. Analysis of malfunction nature of electric cables

1. Type of electric cables

1.1 Classification according to withstand voltage level:

- LV cable: 6kV and lower voltage level:
- MV cable: 6KV to 35kV voltage level
- High voltage level: 66kV and above voltage level

1.2 Classification according to insulation medium:

- Oil impregnated paper cable: cable for medium high voltage level
- Non drip paper dielectric cables: most is medium and high voltage cables
- Cross linked polyethylene (XLPE) dielectric cables: most is medium and high voltage and low voltage levels of cables
- Other media for cable rubber cable, most is medium, high voltage and low voltage level
- Oil filled cables: most cables with high voltage levels

1.3 Classification according to structural model:

- Cable without outer metal shield layer: most is low voltage cable
- Cable with outer metal shield cables: most is medium and higher voltage levels.
- Metallic sheathed cables: most is high voltage levels

2. Malfunction type of electric cables

2.1: Malfunction classification of electric cables

Classification according to wave measurement theory

Connector fault ; body fault

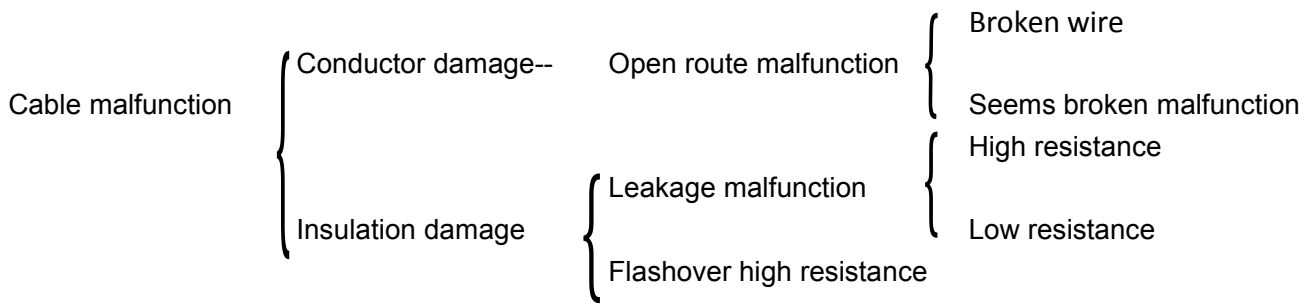
Classification according to display type:

Closed faults; exposed faults

Classification according to structure

Main insulation fault; Internal and external fault

Classification according to wave measurement theory:



2.2 Analysis of cable malfunction nature

Open route malfunction: Once the cable insulation is under normal condition, yet it can not transmit voltage due to conductor, it refers to open route malfunction such as seemingly broken core wire or ground wire, large wire resistance in a certain area of core wire and broken core. The pure open route malfunction is seldom seen; it is often co-existent with low or high resistance malfunction.

Low resistance malfunction: The phase-to-phase or phase-to-ground malfunction featuring that cable insulation medium is damaged and can be directly tested through “low voltage pulse method” is called leakage low resistance malfunction – generally, it is called low resistance malfunction. The resistance is below several hundred ohms. Once the resistance is zero, it is called short circuit malfunction – it is an exception of low resistance malfunction.

Leakage high resistance malfunction: The malfunction featuring that cable insulation medium is damaged and has formed fixed resistance tunnel, yet it can not be directly measured through “low voltage pulse method” of cable malfunction tester is called leakage high resistance malfunction – generally, the resistance is above several hundred ohms. During DC leakage voltage resistant test to cables, the leakage current increases continuously with the increase of added DC voltage and can exceed the required standard value of cable. The leakage high resistance malfunction is relative to the low resistance malfunction and there is not any strict difference.

Flashover high resistance malfunction: Once the cable pre-test voltage is increased to a certain value within the pre-test voltage scope, the leakage current will suddenly increase and greatly exceed the required standard value of test cable – it is

called flashover high resistance malfunction. Although the cable insulation is damaged in the malfunction point, yet it has not formed fixed resistance tunnel.

2.3 Judgment methods of malfunction nature of electric cables

Generally speaking, there are 3 methods to judge the cable malfunction nature:

- (1) Through MΩ meter;
- (2) Through cable pre-test result;
- (3) Through “HZ-501B series cable malfunction flash tester”.

Generally speaking, the low resistance and open route malfunction can be directly judged through “resistance test” function or “pulse method” test wave shape of “HZ-501 series cable malfunction flash tester”; the leakage high resistance and flashover high resistance malfunction can be judged through megameter or pre-test result; the malfunction can also be judged through “resistance test” function of “HZ-501 series cable malfunction flash tester”.

2.4 Test methods and equipment preparation of cable malfunction

Brief introduction of test methods

- (1) Analysis of the fault characteristics of the cable and know the voltage level of the fault cable and insulation medium
- (2) By pulse method to test all phase length of fault cable and the calibrate the wave transmission speed of fault cable.
- (3) Select the appropriate test method, using the "HZ-501B cable malfunction flash tester " for cable fault pre-location.
- (4) Pin-pointing the cable faults, and tracing the direction and the depth of the buried cable.
- (5) Analysis of cable fault test results error(measurement error, transmission speed error, interpretation error, instrument error).

3 The main technical parameter

- 1) SCM operation, button operation mode, micro printer integrated design, can be printed the test waveform and related content at any time;
- 2) System function: measure the distance of fault, fault location, transmission speed test,

fault resistance and cable route search and buried depth detection;

3) Test methods: low voltage pulse, flashover method, audio frequency method, acoustic magnetic synchronous method, the valley value method, the peak method, the electromagnetic induction method and so on;

4) Display control: HZ-501B: 5.7" industrial grade LCD, built-in 24V/7Ah DC power supply, can work continuously for 6 hours;

5) Test range: test distance: 60km, detection depth: 6-7m;

6) Measurement accuracy: Pre-location accuracy: + 10m (absolute value) or 1% (relative value), precision measurement accuracy: + 0.2m (pin-pointing, path, depth);

(7) Sampling frequency: 100MHz, minimum resolution 0.5m (100m/us)

8) Sampling methods: automatic continuous sampling, never miss any discharge waveform

9) Low voltage pulse: width: 0.1uS and 2uS amplitude: 100Vpp

10) Output power: path power: 100W, impact power: 0 ~ 400W

11) Surge high voltage: 0 ~ 35kV

12) Short circuit current: 0 ~ 320mA

13) Surge energy: 0 ~ 1225J

II.Cable Fault Flash Tester(Cable fault pre-locator)

Measure the power cable of different sections, different media of various materials, can detects the low resistance faults, short, open faults, high resistance leakage and high resistance flashover faults of underground power cables, high frequency Coaxial cable, Street light cables.

1、 Main technical parameters

- 1) Industrial grade 5.7 "LCD display---Angle view>160,Working conditions: temperature: -10 °C ~ +45 °C
- 2) 2,SCM centralized control, push button operation mode, with strong anti -interference ability;.
- 3) 3. With distance, speed and resistance measurement function.

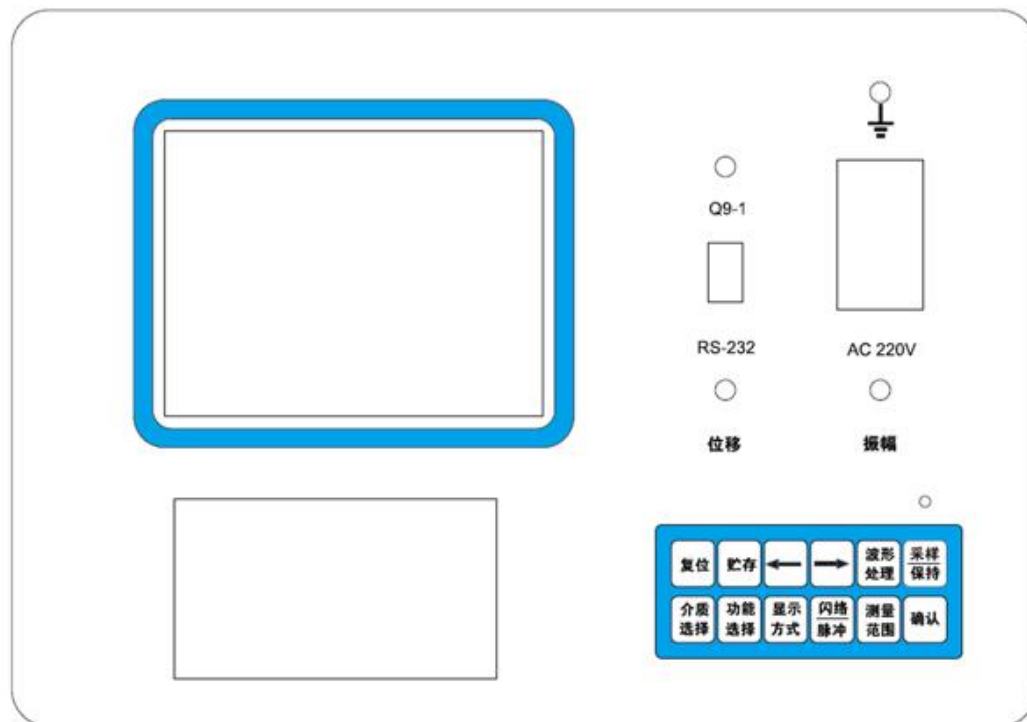
- 4) 4. With Micro-printer can print out the wave form and measuring results
- 5) 5. Automatic continuous sampling and never lose any discharge waveform.
- 6) 6. Testing method: flashover sampling, low-impulse method.
- 7) 7. Pulse amplitude: about 100VP-P.
- 8) 8. Impulse Width:0.1/2us
- 9) 9. Measure distance: Smax:60km.....Smin:15m.
- 10) 10. Pre-locating accuracy: $\pm 1\%$;

DL/T849.1-2004 provides no more than $+ (1\%L+20)$ m ,of which: L for the length of the cable

11).Built-in DC power 24V/7Ah, can continuous working 6 hours.

also with an external AC 220V $\pm 10\%$ power supply

2、Panel display

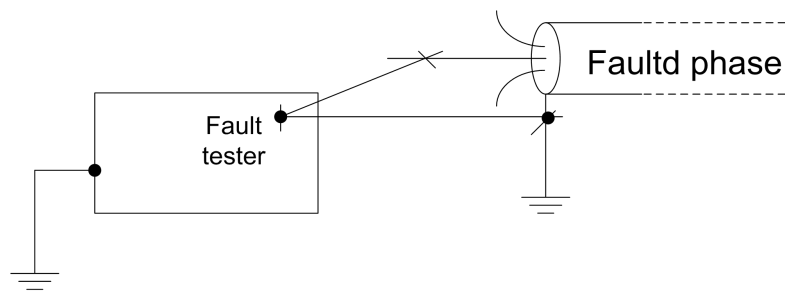


Panel display

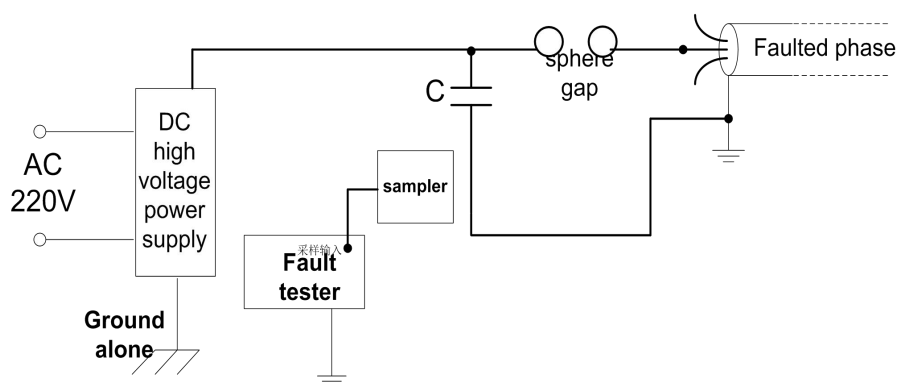
- ①_x0001_ **Display:** all the operation of the instrument display on LCD
- ②_x0001_ **Printer:** The displaying contents and test report can be printed at any time.
- ③_x0001_ **Keyboard:** 12 function keys, complete the basic operation of the instrument;

- ④_x0001_ **The amplitude adjustment:** adjust the test waveform amplitude on LCD;
- ⑤_x0001_ **The vertical displacement:** adjust the test waveform display in the upper and lower position;
- ⑥_x0001_ **The brightness adjustment:** according to the need to adjust the display brightness;
- ⑦_x0001_ **Q9 sampling port:** fault test and fault waveform acquisition
- ⑧_x0001_ **Communication:** in order to realize the machine output data, complete the communication of PC machine;
- ⑨_x0001_ To the power socket and switch;
- ⑩_x0001_ Safety grounding terminal.

3、On-site wiring



Low voltage impulse testing

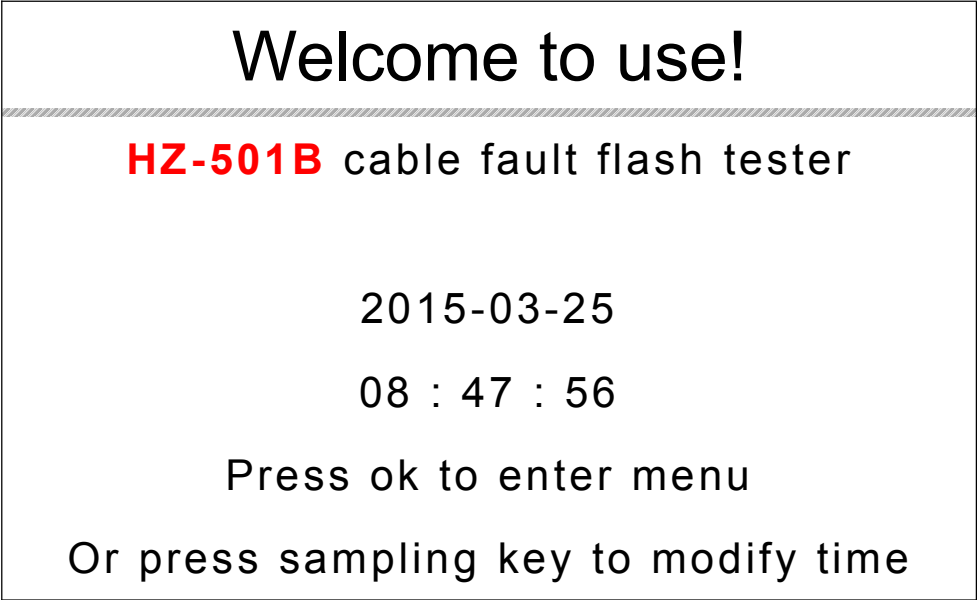


Flash sampling connection wire

III Operation steps

1、Display setting and operation

1.1 Turn on the power, entering data set interface.



Date set graph

①_x0001_ The screen display date and time, if need modify date and time, use sample/keep and right and left arrow to modify it, and press ok to confirm.

②_x0001_ if not modify date and time, at any step to press ok to confirm it, then entering test interface, the testing function as following graph.

Flashover	Impulse 1	Impulse 2	XLPE170 m/μs
Print			Extend voltage
Communication			move
Open			Calculate
Store			
Test level: 1 3 5 7		sample	keep

Testing Interface

1.2 Keyboard operation

1、**ok**

Confirmation key

2、**Reset**

Press reset key, the program restart

3、**← And →**

Together used with other key to input data, extend, compress and move cursor.

4、**Sample |keep**

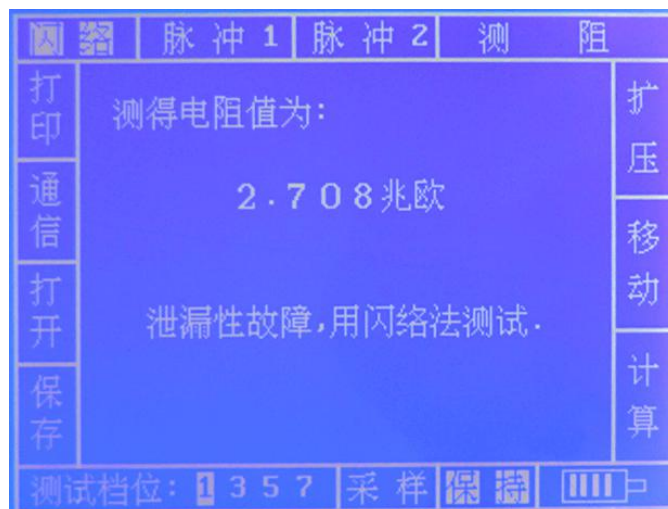
Trough **Sample|keep** key , transfer “sample” to “keep” state。

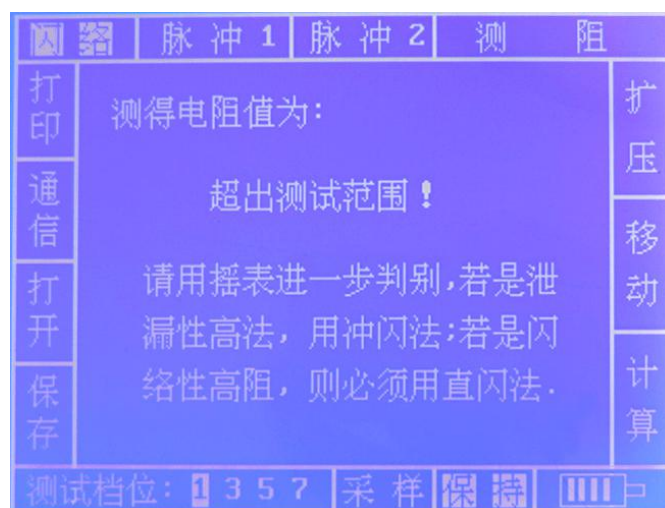
5、**Function**

Function with 3 functions: Measure resistance、Measure distance、Measure speed ,
press this key to circle display “Resistance” “XLPE 170m/us” “Measure speed”
(Measure distance At XLPE state, measuring speed only at impulse stage)。

(1) **Measure resistance**

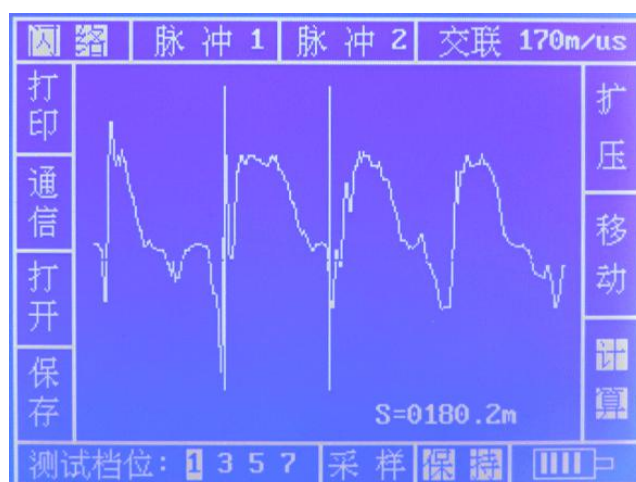
At keep state, press function key, and select measure resistance ,press ok key to enter measure resistance state.





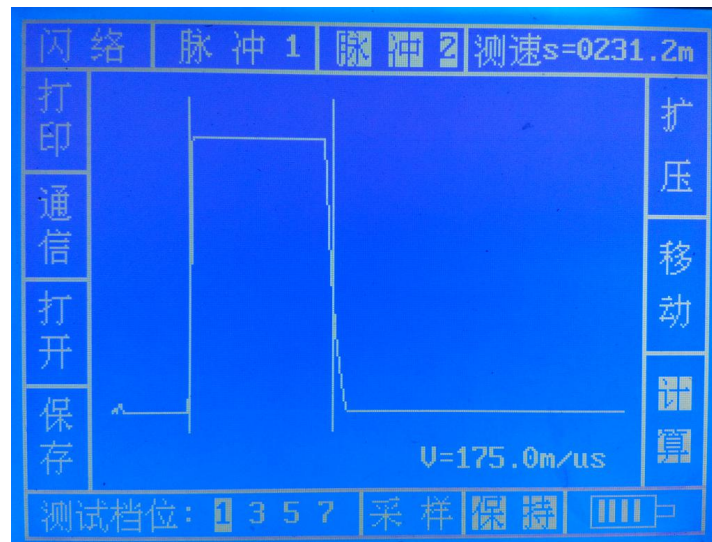
(2) Measure distance

At keep state, press **function** key ,select "XLPE 170m/us" ,Then press **wave form** **calculate**,then press **←** 、 **→** and **ok** to measure distance,the method as following graph :



(3) Measure speed

At keep state,press **function** key,select measure speed, use **ok** and **←** **→** input cable length,then press **waveform** to select **calculate** ,then -press **←** 、 **→** and **ok** key to measure speed ,the method as following graph.



6、Flashover | impulse

①at keep state, press **flashover | impulse** key, circular transfer among flashover→impulse 1→Impulse 2.

②At impulse and sample state, press **flashover | impulse** key, transfer "impulse1" to "impulse 2" alternately.

7、Measure range

Measure range (1km, 3km, 5km, 7km) to select by **measure range**. Can be carried at sample or keep state. At calculate state, press **measure range** to move cursor to right.

8、Media

Cable media through the operation of the media select key settings, press medium key, the propagation speed of the cable medium and the radio wave are successively in the following turns.

XLPE170 m/μs, →crosslinking oil 160 m/μs→no drip 156 m/μs →rubber 172 m/μs, optional 150.0m/μs

The speed of data choice through **←** **→** and **ok** input.

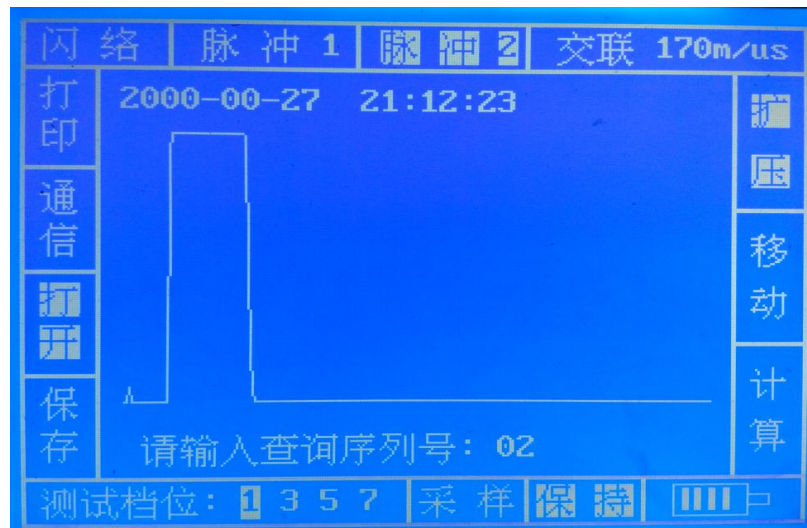
Media selection can be carried both before sample data, but also after keep data.

9、Display

Press display mode key, can transfer at "open", "store" state in circle.

"Open", the equipment can be deposited into 10 groups of waveform data picture, numbered 1-10, operation right and left arrow keys to select number, according to the

button to confirm the selected number of memory recall waveforms display and processing ("processing" includes diffuser and mobile, computing and printing, storage and communication etc., as shown in the following figure) as follows:



On the basis of the above graph, continue to press **display** handle the interface, press the **waveform** can be expanded, move, calculation; press store key can be printed, communication.

In the "store" state, on the current sampling or from memory recall display on the screen waveform storage and display the data storage location number for later access or processing. If press the **ok** key, and press the **waveform** key, then quit the "store" function.

10、**Wave form**

- a) in order to facilitate the observation of the waveform of a certain period or all, press **waveform** key to choose "expansion" or "move" state, use left and right arrow keys to achieve the expansion of the waveform, compression and move around the operation.
- b) use **waveform** selected "calculation" state, the first cursor line mostly in the calculation of initial position, move the cursor to accurate location by the right and left arrow keys. Then press the OK button, the second cursor line appears in a certain position of the waveform, then use **range** and the right and left arrow key to move second cursor line to affirmed end position of waveform, completed the calculation on the end-point distance or speed, the data show at the right side of the screen

s=xxxxx.xm or $V = xxx.xm / \mu s$.

- a) In the calculation process, if you press **waveform** key again, it can exit the calculation state.

11、Store

At store state,press **store** key,it will prompt" press ok key to print waveform, press pint key to cancel",press **ok** key,can complete screen copy printing,during printing,if want to stop printing, press **sample|keep** key.

12、Communication

Press **store** key ,after select"communication"state,press **ok** key,waiting for a response, it complete communication task. As same, if press **ok** key and press **store** key again,then exit communication function. communication is going on after connected with a PC.

2、Pinter Usage

2.1、Install the print paper

- ①_x0001_ Open the box cover, press the open button at the right of cover, and the cover will auto open.
- ②_x0001_ Take out of the run out of roll and change the new paper roll.
- ③_x0001_ Take out of paper end, cut it into triangles and holding a sheet of paper, turn the cover up, slightly push it, and install it well .

2.2、Key and indicator

On the printer cover,there are a online indicator SEL and a self-check/paper rolling key **LF**

- ① The indicator is on indicates that the printer works online state, and the printer is "idle" state, which can receive the print data. The indicator is off indicates that the printer works offline state, the printer is "busy", and refuses to receive the print data.
- ② Paper rolling. In the case of power supply on the printer, firstly press the SEL key, after indicator is off, and then press the LF button for more than 2 seconds, the printer began to roll the paper. When the paper goes to the desired length, then

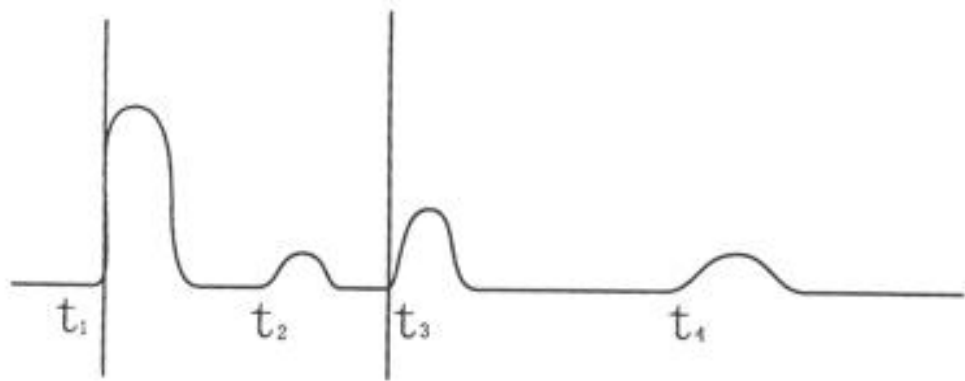
press LF button to stop the paper, then press the SEL key, let indicator return to the original state.

Special note:

Due to the printer with a thermal printer, it is necessary to complete the use of 56mm wide thermal paper.

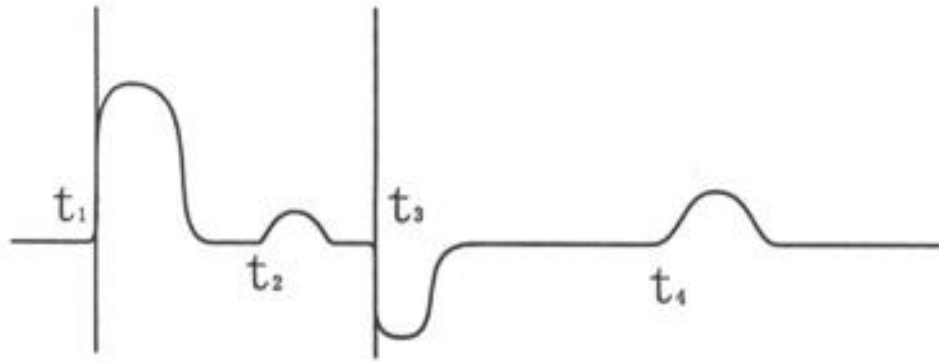
3、About wave

3.1、Wave shape analysis of open route malfunction



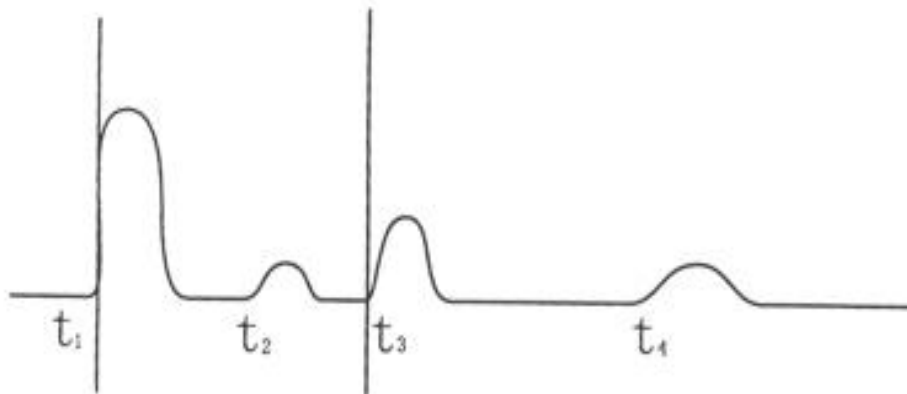
Analysis: t_1 refers to pulse wave shape of the flash tester and has positive polarity (it can also be negative such as original); t_2 refers to cable center butt joint reflective pulse wave shape (the reflective wave of joint has the same polarity in general; but it is related to the joint structure); t_3 refers to reflective pulse wave shape of open route malfunction and has positive polarity. It refers to reflection with same polarity (polarity of malfunction wave shape is same as pulse wave polarity of instrument); t_4 refers to second reflective pulse wave shape of open route malfunction. Given the attenuation of pulse wave, second reflection ratio of t_4 is smaller than one-time reflective wave amplitude of t_3 . The distance S between malfunction point and measurement end is as follow $s = |t_1 - t_3| = |t_3 - t_4|$. During the real operation, the instrument will automatically display and calculate the distance of malfunction point by moving the cursor.

3.2、Wave shape analysis of low resistance malfunction



Analysis: t_1 refers to pulse wave shape of the flash tester and has positive polarity (it can also be negative); t_2 refers to cable center butt joint reflective pulse wave shape; t_3 refers to reflective wave shape of low resistance malfunction point and has negative polarity. It refers to counter-polarity reflection (contrary to the pulse wave polarity of instrument); t_4 refers to reflective wave shape of cable terminal. The distance S between malfunction point and measurement terminal is as follows: $S = |t_1 - t_3| = |t_3 - t_4|$

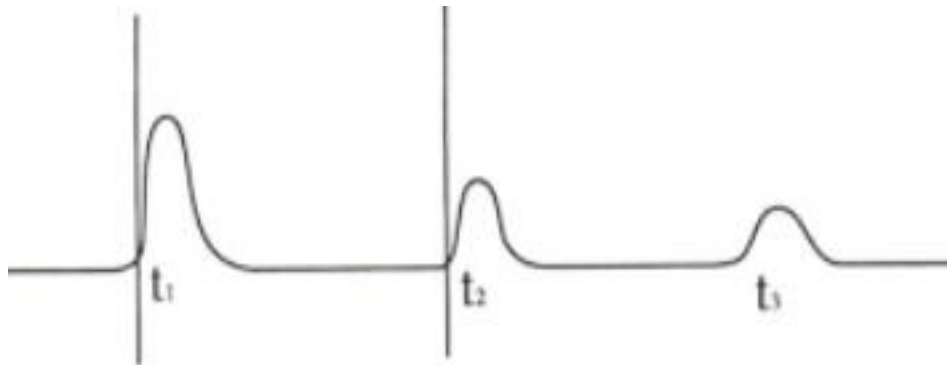
3.3、Wave shape analysis of total cable length and joint



Analysis: t_1 refers to pulse wave shape of the flash tester and has positive polarity (it can also be negative); t_2 refers to cable center butt joint counter-flushing wave shape; t_3 refers to full length (terminal) reflective pulse wave shape and has positive polarity. It refers to same polarity reflection (similar to open route broken wire malfunction); t_4 refers to full length (terminal) second reflective wave shape. Given the attenuation of pulse wave,

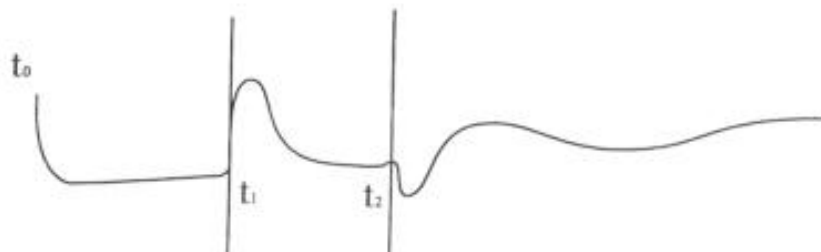
second reflective pulse wave of t_4 is smaller than one-time reflective pulse wave amplitude of t_3 . The distance S between total cable length $S_{\text{全}} = |t_1 - t_3| = |t_3 - t_4|$ and center butt joint is as follows: $S_{\text{头}} = |t_1 - t_2|$.

3.4、Measurement of transmission speed of electric wave in the cable



Analysis: t_1 refers to pulse wave shape of the flash tester and has positive polarity (it can also be negative); t_2 refers to full length reflective pulse wave shape and has positive polarity. It refers to same polarity reflection; t_3 refers to full length second reflective wave shape. The transmission speed of electric wave in the cable is as follows: $v = \frac{2S}{|t_1 - t_2|}$.

3.5、Wave shape analysis:

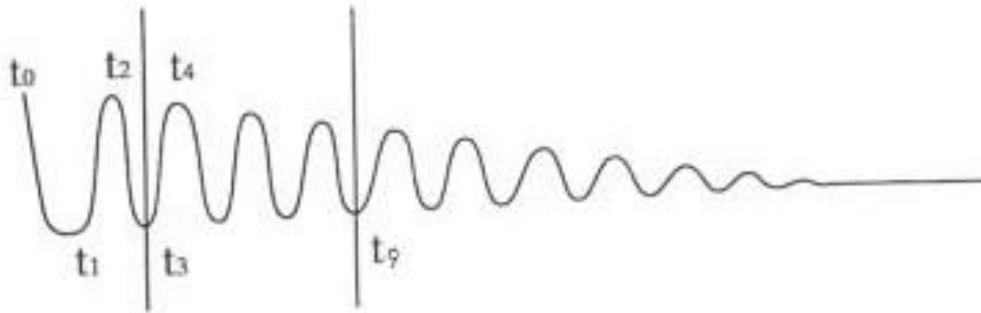


Analysis: t_0 refers to startup wave shape; t_1 refers to sphere gap power discharge wave shape; t_2 refers to second reflective wave shape of cable malfunction point. Given the

attenuation of high voltage pulse wave, the whole wave shape is like an attenuated cosine oscillations. The distance between test terminal and malfunction point is as follows:

$$S = |t_1 - t_2| \cdot v. \text{Note: General case } |t_0 - t_1| > |t_1 - t_2|.$$

3.6 Comprehensive method wave shape near the test



Analysis: t_0 refers to ball gap discharge waveform; after t_1 is the multiple reflection wave of the faults point; The whole waveform is a sine cosine oscillation. This waveform is not the same as the previous waveform analysis, we should take more reflection wave, and then take their average. First calculated t_3 time to the t_5 time of the distance S , and then divided by the t_3 time to the t_5 time between the rise and fall along the number of n ($n=6$) (two times the Cosine wave cycle), that is the distance to the fault point of the test point. Can also be calculated using the following formula:

$$S = \frac{t_n - t_3}{n - 3} \cdot \frac{v}{2} = \frac{S_n}{n - 3}$$

4、 Battery using

The instrument is equipped with nickel metal hydride battery and charger, and its use method is as follows:

- ①_x0001_ Without AC power supply, to use battery
- ②_x0001_ With AC Power supply, can use AC power, and also disconnected the AC power supply ,only use Battery, In order to avoid damage to the instrument when the abnormal AC power supply, especially in the high voltage flashover state
- ③_x0001_ When the battery is low, the instrument display screen will be warning.,

- ④ _x0001_ Connect AC power, when the instrument is not turned on, only to charge the battery. After the battery runs out, about 4 to 6 hours to fill full.

5、 Simple maintenance and common fault treatment of instrument

(1) At high voltage environment temperature, the instrument generally continuous working time better not more than two hours.

(2) Instrument should be placed in a cool and dry place at ordinary times, powered on and work more than half an hour every month.

(3) Instrument in the working process, if function keys does not play a role, we call "instrument crash", is not the instrument failure, press the reset or turn it off and restart..

(4) A 5.0A fuse inside the power supply socket of the instrument, please note that when you need to change.

(5) "Flashover" location, if the connection testing ground not according to requirement, can cause damage to the power and related parts, or when entering the instrument of the flashover voltage is too high (such as "amplitude" is too large) may result in damage to the input circuit of the instrument. At this time should be repaired and maintenance by professional and technical personnel.

IV.Cable Fault Pin-pointer

1.Description

HZ-503 cable faults pin-pointer is used for pin-Pointing kinds of cable faults of underground Power cable by using acoustic and magnetic method. by means of Electronic flashover generates by the impulse generator. Magnetic sound signal of the electronic flashover wave is picked up and amplified through the probe, and judged by auditory and visual to accuracy find out the underground cable faults.

In addition, the instrument can be used with any manufacturer's surge generator

2.Features

- Can synchronously receive sound and electromagnetic wave when faults point

discharges.

- With strong anti-disturb function.
- Structure feature: receiver and probe separate. Arm-grade anti-noise earphone.
- The probe is made of special technology with professional sound collector.
- Portable and easy to use, can fast and accurately find out the cable faults.

3. Technical Data

Receiving mode: Magnetic sound synchronization

Receiving frequency: audio frequency

Magnification: 50,000 times

output impedance :350Ω

Positioning accuracy:±0.2m

Power dissipation: Quiescent current is less than 10mA, The working current is not more than 10mA

Working voltage: DC9V Battery power

Operating temperature:-10 ~ 55°C

Dimension :200*150*80mm Weight:1.5kg (NW)

4. Panel Of Control Part



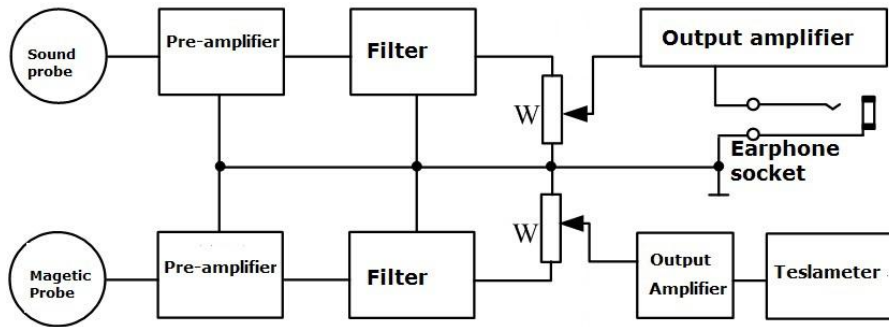
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- 1) **Header-Teslameter:** to indicate the magnetic field strength.
- 2) **Level:** adjust magnetic field strength base to make the header effective swing.
- 3) **Frequency:** adjust receiving frequency during cable route detecting.
- 4) **Volume:** Sound adjust when faults and cable route locating to adjust the suitable sound signal for the user.
- 5) **Input:** connect with the probe
- 6) **Way to work:** Select working mode
- 7) **Output:** connect with earphone



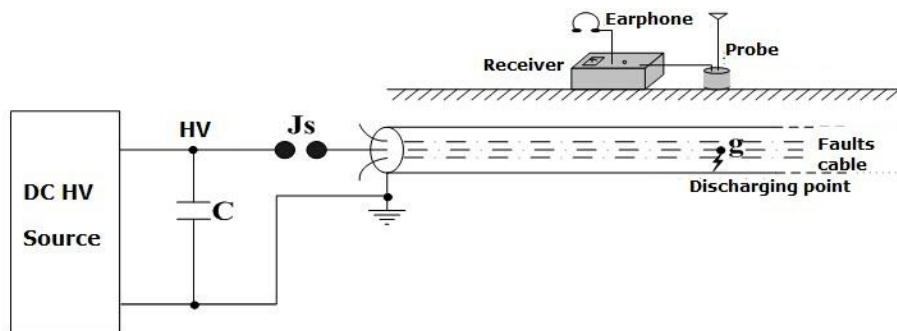
5. Cable Fault Locating Principle And Working Method

The Cable fault point produce flashover discharging under the function of high voltage, at the same time there are four kinds of physical phenomenon: echo, sound wave, electromagnetic wave, infrared wave. The cable fault flash tester detects the echo to pre-locate the cable faults. HZ-503 cable faults pin-pointer to accuracy find out the cable faults by acoustic and electromagnetic of flashover discharging.

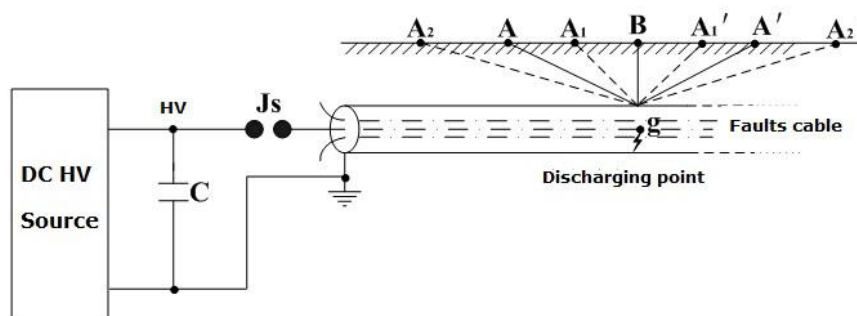


Working principle Graph

Field testing graph



Testing site



The detection process graph

6. Operation Steps

- (1). Connect the earphone and the probe well with the control part.
- (2). Adjust the **Way to work** knob to select the working mode to set the working mode at the Point mode (cable fault pin-point state).

- (3). Adjust the **Level** knob to make the header of the Teslameter swing effectively
- (4) Adjust the **volume** knob to make the sound is suitable for the user.
- (5) Put on the earphone, and hand held the instruments and the probe.
- (6) During the detection the user should walk along the cable route to detect the cable faults within the pre-location range, the noise is increased when close to the fault point ,above the fault points the sound is loudest and the header of the Teslameter is swinging strongest. this point is the cable fault point , as the B point of above graph.

7. Attentions

- 1.The batteries should be taken out of the instrument to avoid leakage, if not using it for long time.
- 2.when the battery voltage is low, the sensitivity decreased, shall immediately replace the battery.

V.HZ-504 Cable Route Tracer

1.Introduction

Cable Route tracer is specially-designed for detecting the underground cable layout position and underground depth in a certain range.

Cable route detector consists of signal transmitter and receiver (Cable fault pinpoint detector), both of which finish the detection. By united operation the Cable route detector could exactly pinpoint the cable route in the probable range of cable burial.

2.Main Consist Of Cable Route Tracer

Cable route tracer mainly consists of route signal transmitter and receiver.

2.1 Cable Route signal transmitter

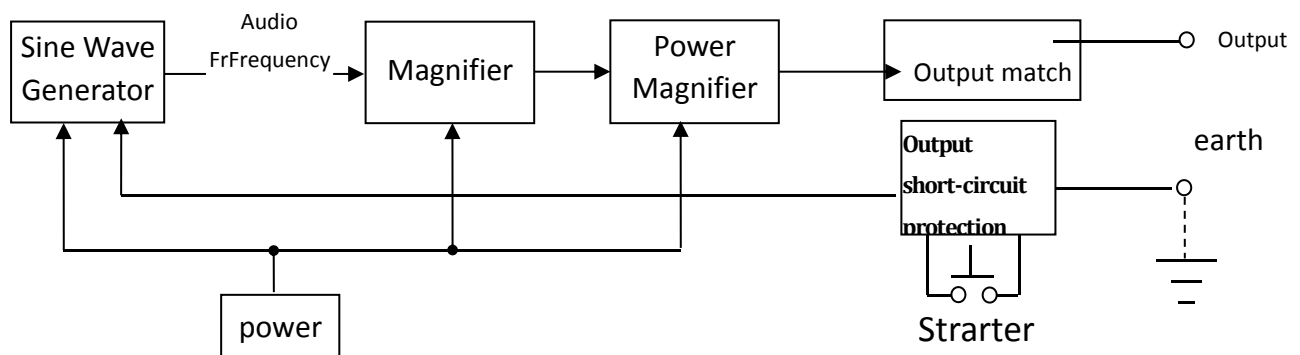
Cable route tracer is the big power route signal transmitter required in detecting the underground cable route.

2.1.1 Main Technical Index Parameters.

- a) big power output, anti-vibration, strong anti-interference ability, stable and reliable;
- b) With reliable over current, open circuit and short circuit protection function;
- c) Output Frequency: Audio Frequency.
- d) Output signal: intermittent, 0~50Vpp
- e) Working power supply: 220V (1±10%) 50Hz (1±5%);
- f) Output power: 100W;
- g) Output current: 0~2A;

2.1.2 Working principle.

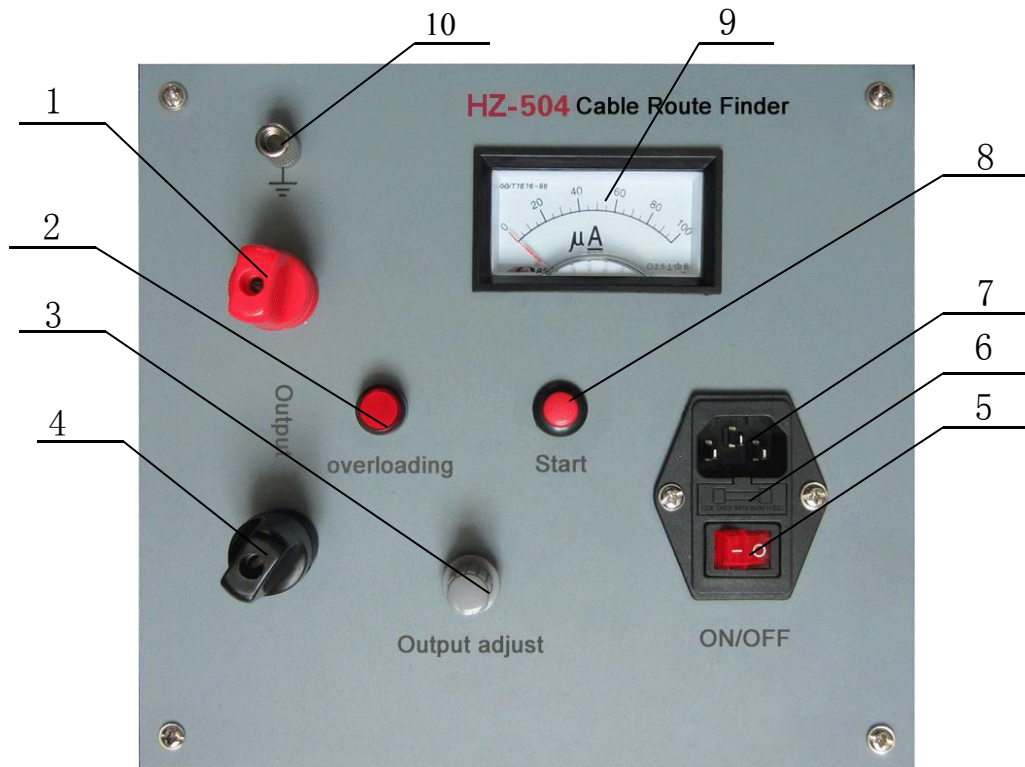
Working principle diagram.



Cable Route tracer Working Principle Diagram

Sine Wave generator output audio sine wave signal, which load to Power magnifier by control circuit, The power output impedance matching "output". If the output end load short-circuit (< 2 ohms), signal source will immediately protected, once the load short circuit condition exclusion, press the "start" button, signal source recovery normal work.

2.1.3 Cable route tracer (route signal generator) Panel layout



Cable route tracer panel diagram.

- 1、Output Positive : Signal source output positive,connected to cable phase line.
- 2、Overload indicator : Overload indicator light, the light is on at the condition of output short-circuit or too large signal.
- 3、Output adjustment: output amplitude adjustment knob, it can change the size of the output amplitude;
- 4、Output negative: signal output negative, connect to the ground wire;
- 5、Power switch: turn on the power to make the path instrument work, and at the same time there is an indicator light;
- 6、Fuser pipe : A2 Fuser pipe; one for spare.
- 7、Power input: input 220V (1 + 10%) 50Hz (1 + 5%);
- 8、Start button: when the overload lights, reduce the output amplitude, then the key can restart signal generator, the signal path to the output
- 9、The output header: when the head pointer swing it show the output signal; when the pointer does not move without the output signal; the pointer swing amplitude of said

output signal amplitude (trend of numerical output, larger or smaller does not represent a specific unit value);

10、Grounding pillar: the test site to connect safely to the earth.

2.2 Cable route receiver (Cable fault pinpoint locator)

Receiving the signals from the cable route tracer, by this detect exactly the depth and trace of underground cable.(HZ-503 Introduction)

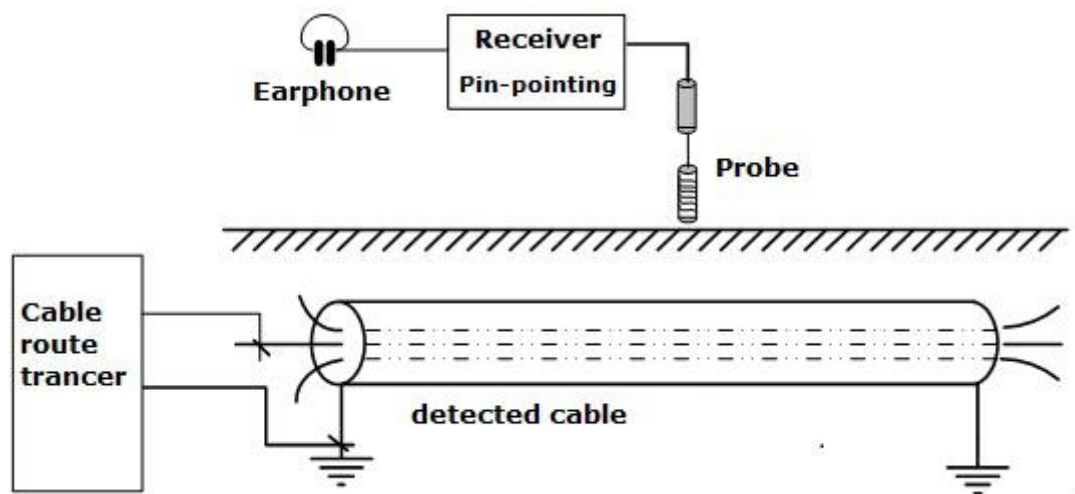
3.Cable Route Tracer Operation

3.1 Usage.

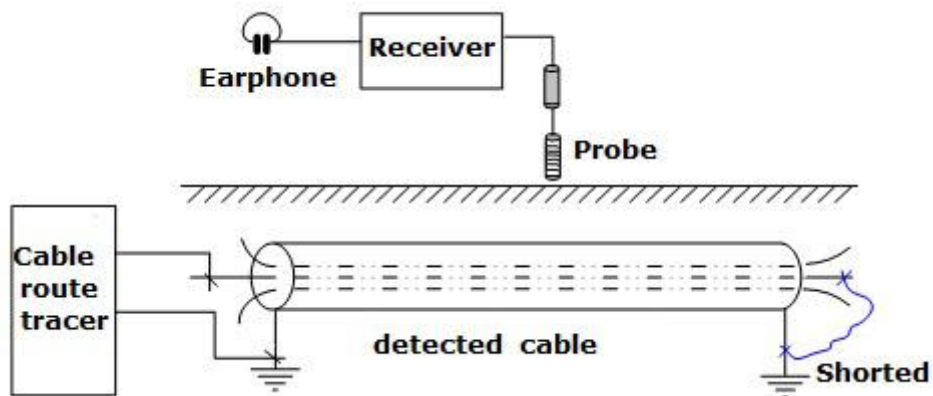
3.1.1 Probe connection

- a) Connect the power supply line
- b) Connect the red pillar (output positive) to fault cable (or working cable) phase.“Earth”black pillar (output negative),the other terminal three phase of cable should be open circuit to ground. If outputting signal is weak, Pls connect the other cable terminal is short circuit to earth.

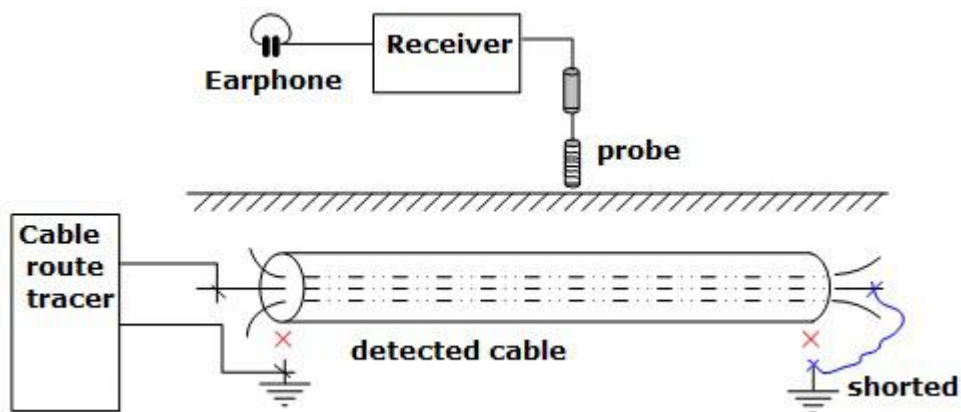
Diagram



General route detect connecting wire diagram.



Super-length or breaking cable route detection wiring diagram.



Special route detection wiring diagram.

3.1.2 Output signal initial adjustment.

Rotate "output adjustment knob" to minimum anti-clock wisely.

3.1.3 Pre-adjustment after getting through the power supply.

Press the power switch, the power indicator light; adjust "adjustable output regulation" make "output header" in the appropriate range. If the measured cable length is more than a few kilometers away, can make the the pre-adjusted output voltage increase; if the "overload" light, reduce the output amplitude, press the "start" button to restart the

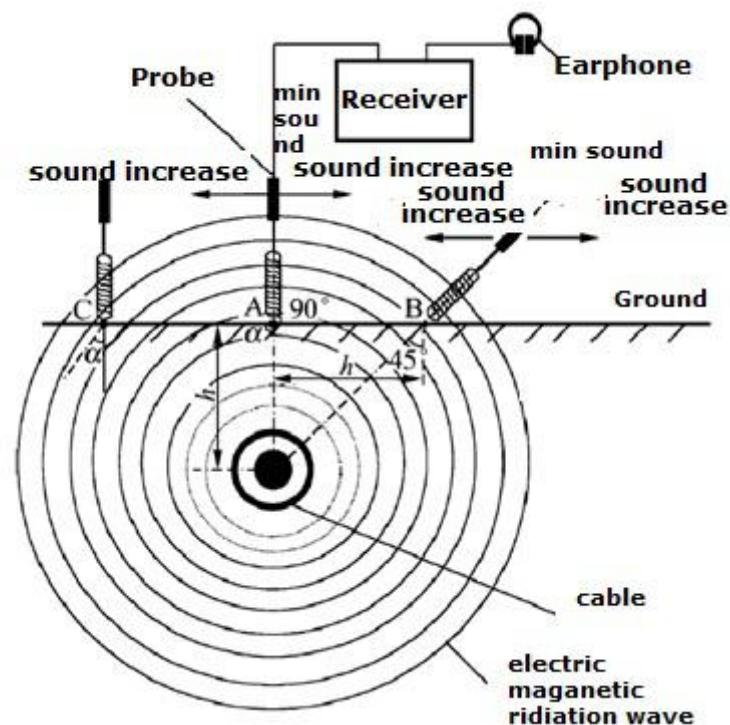
signal.

3.2 a) the receiver probe and the headset operation

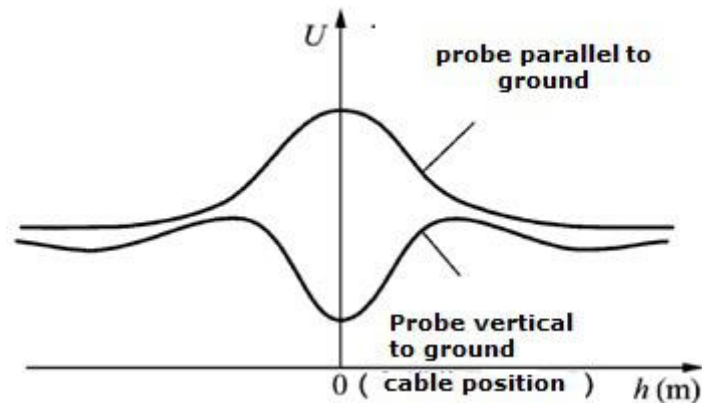
b) Receiver (Pinpoint locator) “working selection” switch to “route ” position, at this time the receiver should receive the audio route signal. “Audio volume adjustment “put in appropriate position, adjust “frequency mico-adjustment”potentiometer, which make the headphone beat output the intermittent sound. The minimum points of the probe perpendicular to the ground hear into line, is buried buried cable path.

c) To assess the cable laying depth can be measured in cable position above, will probe into the ground 45 angle perpendicular to the path to move outward when the headset sound signal weakest, the buried depth is the translated probe distance of cable above.

Diagram 4



probe position diagram



Route detection receiver amplitude and position diagram

Namely in detecting cable path to position, to always keep a vertical state of the probe and the horizontal plane, when the probe in the cable to position is above, received "headphones sound" is a relative minimum, namely "relative indication minimum location on the ground connection is the measuring cable route go to position.

Also in detecting cable path buried depth, should make a probe and cable to vertical and angle with the horizontal plane into 45; to the side of the moving probe, "headphones sound" are a change from big to small, from small to big, that at the end of the "relative indication" minimum ground the cable ground to the vertical distance is the cable in the premises of the buried depth.

4.Site Detection Notes

a) If the "output" overload signal or cable to be tested are short-circuit phenomenon, route instrument "overload" indicator light, signal source No output; at this time should reduce source output regulation or exclude the measured cable short circuit

(it is best to use "good phase") , then press the "start" button to get the normal work of the signal source

b) Before detection the operator should read the operation manual carefully so as to operate the instrument fluently; in the process of detection, the "adjustment knob" should keep stable, which can make the headphone sound "big" "small" "stable and reliable. All of which could gurateen the detected results are exact. Therefore, the operation experience of the operator proficiency level and experience accumulation is one of the necessary preconditions for the successful detection of the cable path

c) Always do the detection marks, mark clear and credible, so as to avoid unnecessary rework the retest phenomenon.

d) When the power switch is turned on, the light does not shine ,Pls check the insurance tube.

e) In strict accordance with the electric power industry operating procedures, safe operation, to ensure personal safety and equipment in good condition, so that the detection test carried out smoothly.

VI.HZ-535-4C Trolley High Voltage Pulse Generator

1.General Description

Trolley –Type High voltage pulse generator fully meet the DL/T846-2004 *"High Voltage Test equipment general technical conditions"* and DL/T474-2006 *"field insulation test guide"*. It is mainly used for surge discharging of cable faults testing of LV/HV Cable and also used for DC voltage withstand testing of others electrical device.

The units is an advanced experimental instruments which integrated of a High voltage DC source, an energy storage capacitor, a discharge ball,an automatic discharge device and a cable fault tester. It is convenient to use, portable, safety and reliability.

The units adopt high precision and stability best qualified HV electronic components and high frequency high voltage technology, make the machine has the advantages of simple structure. In order to keep the user's habit of using the transformer and the operating box, the units is human designed operation. Which integrated micro reliable circuit, safety and visible, never be broken down, and with the function of auto timing, manual surge and withstand voltage test. It is the most user-friendly operation of the Trolley type DC high-voltage pulse equipment and the best ideal device for power cable fault detection.

2.Main Features

- High voltage pulse output is even and controllable.
- With current and voltage 1.5 pointer display and the surge discharge process is intuitive and clear.

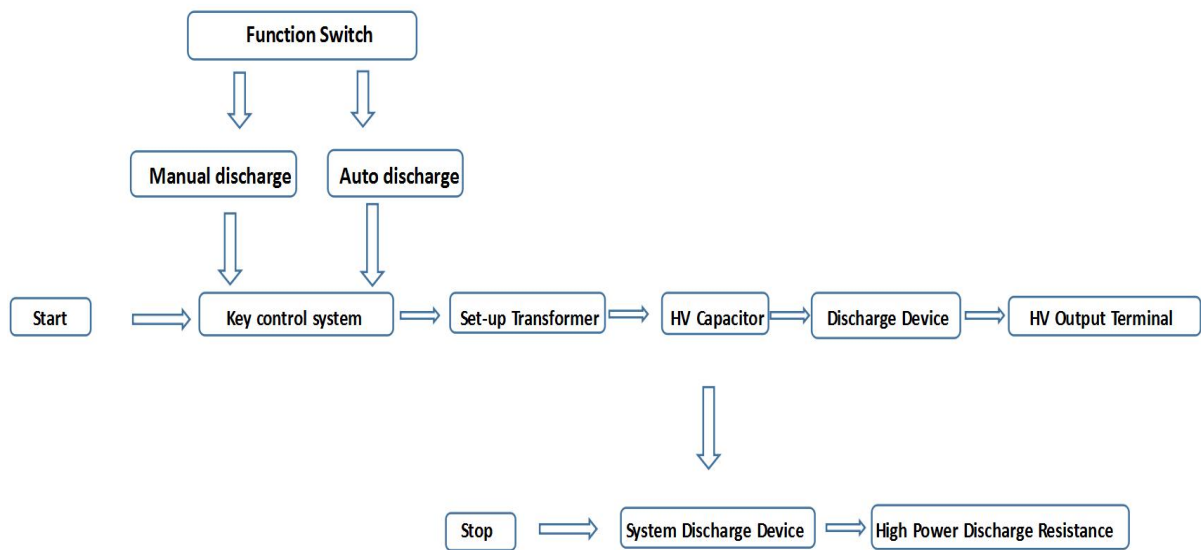
- High voltage side measurement is real-time and accurate.
- With zero start protection function, and potentiometer return to Zero output function, safe and reliable.
- This unique design of high voltage measurement, at stop state, it will auto discharge the capacitor electricity.
- Discharge time with 2 modes: Timing and manual.
- With DC Withstand voltage test function.
- Internal installation high precision test cable fault sampling waveform module.
- Humanized design trolley device, easy to move.

3.Main Technical Data

- The surge HV voltage: 0 ~35kv
- High voltage divider:Voltage Accuracy 1.5 grade
- Inside capacitor :4uF
- Surge time: Auto surge about 5s, also can control by hands.
- Surge energy :0~2450J
- Surge power:2KVA
- Size: 534L×444W×805H
- Weight: not more than 75kg(4uF)
- Power supply: AC 220V + 10% 50Hz/±2Hz
- Environment temperature: -20 ~ +50 °C

4.Working Principle

Before using the trolley high-voltage pulse generator, Selecting the function switch, then press the start button to perform high-voltage boosting. According to the flow chart as below to test the cable. After stop the test, the internal system discharge device will auto discharge the remaining high voltage on the accumulator.



5.Interface Introduction

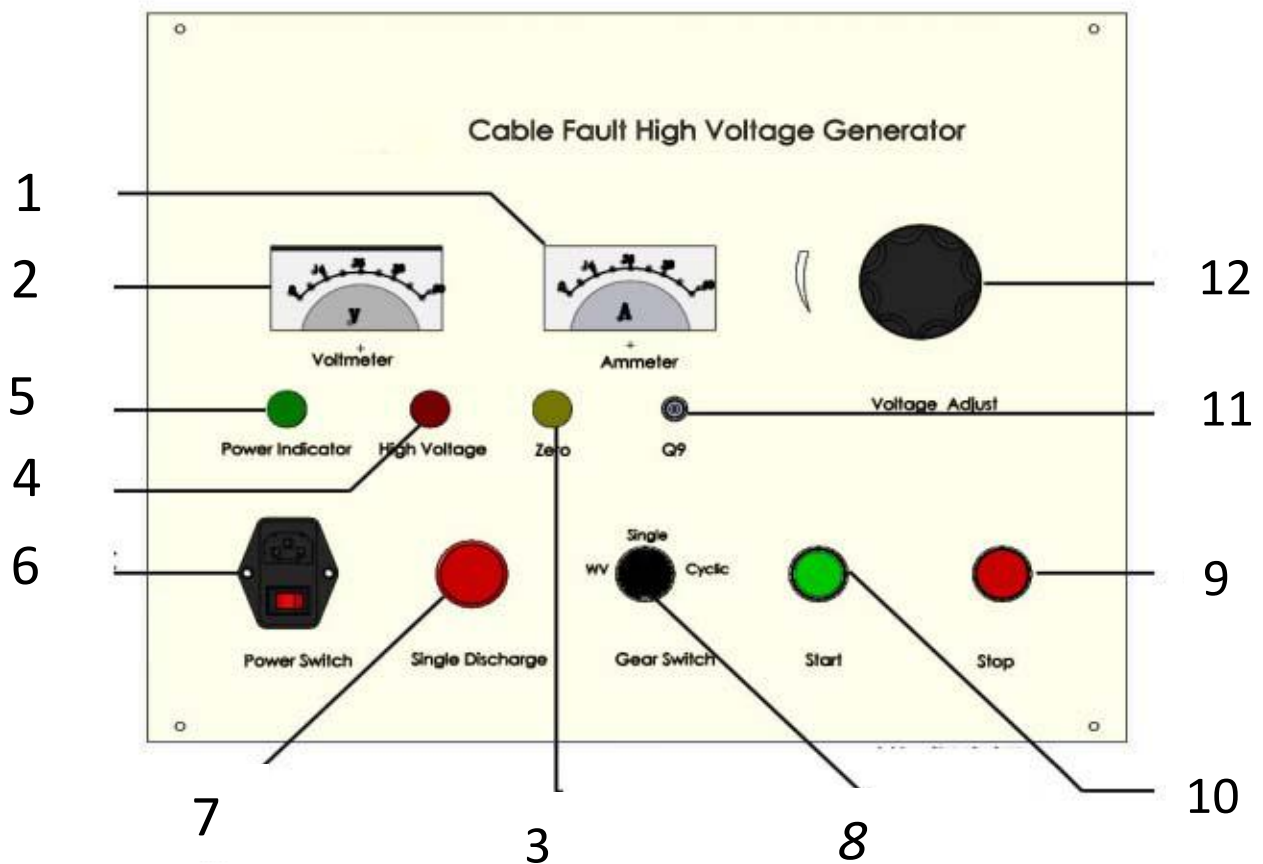


Figure 1 : Panel Diagram

1. Ammeter: Show the current of low voltage side

2. Voltmeter: Show high voltage output
3. Zero: it means that the voltage adjustable knob is at the Zero . the Start key is effective if the Zero indicator is brighter only.
4. High voltage: High voltage output indicator light. Light is on means there has high voltage output. Otherwise, light is off there is no high voltage output.
5. Power indicator light: Power indicator is light and AC220V is normal after turn on the power switch.
6. Power switch: AC 220V 50Hz power input socket. Fuse holder and main power switch of device. 8A Fuse.
7. Single discharge: The indicator will light when choose single discharge
8. Model selection: Withstand Voltage, Single model and Cycle model. WV model is to start withstand voltage test to cable. Single model is discharge by hand controlling. Press it and then adjust High voltage knob to control discharge time by hand. Cycle model is discharged automatically which means select this function to rise up voltage after start high voltage ,this device will be automatic trigger impulse discharge, time is about 5 seconds.
9. Stop button:when the test is completed or abnormal, press the key to cut off the high voltage output, the start level will automatically fall, this will also automatic discharge remaining high voltage inside the device.
10. Start button: At the zero state to pull up the start, the high-voltage is start, at the same time the High voltage light is on. At the non zero state, the start is invalid.
11. Q9: Use double Q cable connect the DC High Voltage Pulse Generator with cable fault locator, only at high voltage flashover is effective.
12. Voltage adjust: This knob is at the zero state, zero indicator is on, high voltage can start. After starting high voltage, can rise up the voltage by the voltage adjust knob.

6.Back Panel Instruction

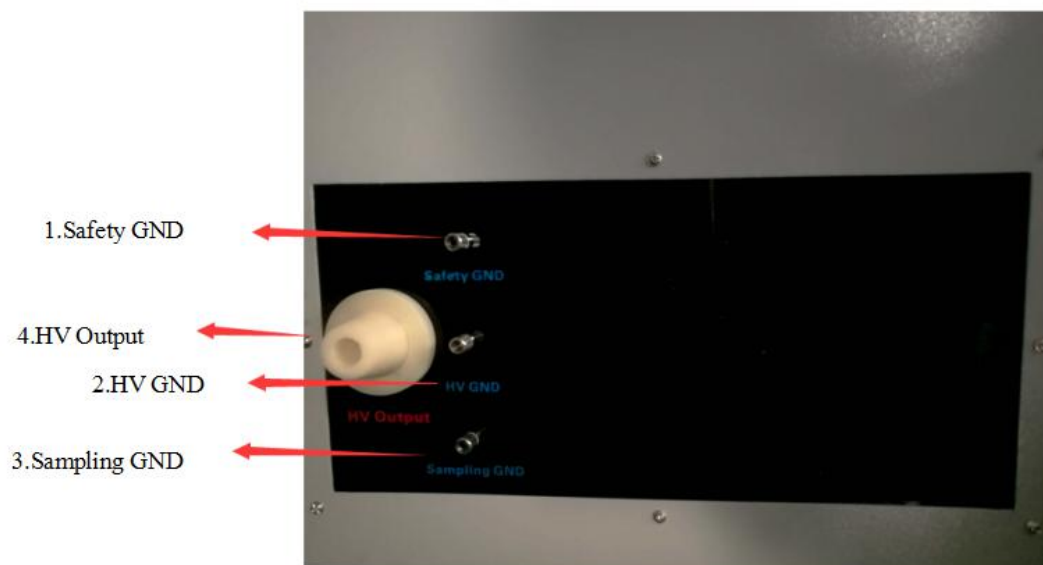


Figure 2: Back Panel Diagram

1. Safety GND: when working must be grounded, to ensure the safe use of equipment.
2. HV GND: must be connected to the root of the cable grounding wire, to ensure good grounding.
- 3.Sampling GND: Connect to the root of the tested cable,and can be connect with the HV GND to the root of tested cable, used for sample the waveform at flashover state, must be earthed well during working.
4. HV output: Special DC high voltage output terminal

7.Site Operation

1、 Cable Fault site testing:

- 1.1 Ensure 4 wires connect well and 3 wires earthed well.

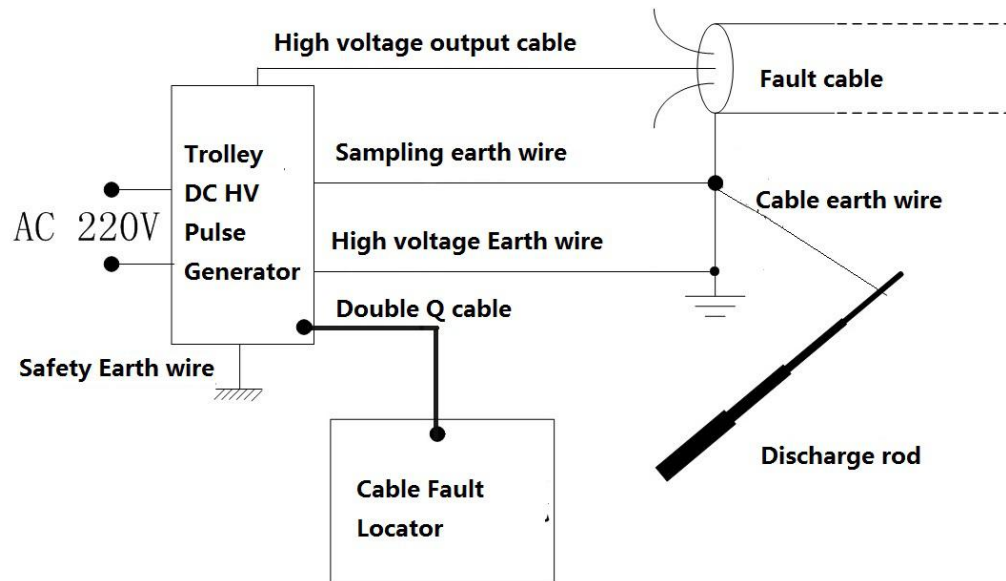


Figure 3 : Sampling connection

- 1.2 Turn on the AC 220V power supply;
- 1.3 Turn on the power switch, the power indicator light is on, and the internal fan starts;
- 1.4 To observe if the zero indicator is bright, if the zero indicator is not on, adjust the voltage to zero. Pull up the starting lever, fix the lever at start, then the High Voltage has been started, the high voltage indicator is bright.
- 1.5 Choose the right mode, when testing cable fault, select the Auto mode, at the moment can hear the sound of the internal motor work.
- 1.6 Start to boost voltage, turn the adjust voltage knob, and slowly increase the voltage until the breakdown discharge of the fault point. The voltmeter and ammeter have the discharge pointer swing.
- 1.7 Connect Cable Fault Locator to sample the waveform, then analysis waveform
- 1.8 Press the stop button after testing, press stop key at the instantaneous discharge, at this time the high voltage capacitor voltage is relatively low, it is conducive to the protection of the system of the discharge device.
- 1.9 After stop high voltage, ensure the safety to discharge the cable and wire by the discharge rod, and use the earth wire short to the cable.

**Note:**

A During testing if it occurs abnormal, press the "stop" button or turn off the power switch to ensure safety.

B No matter what test, the tested cable must be completely discharged before removing the high voltage cable.

**Common problem and Solution:****1. No response after start:**

- Check the AC 220V power supply;
- Check whether the fuse is good

2. The voltage boot is not normal

- Check the ground wire, high voltage ground wire is good and whether the adjust voltage knob is loosened;

3. High voltage can't be started.

- Check if "Adjust Voltage "knob at zero;

4. Stop button is no response

- Press the stop button for 2 to 7 seconds, or when pressing the stop button, to pull the start lever.

Tip:If you have any problems that cannot be solved, please contact the factory at any time. Do not modify it yourself to prevent accidents.