Huazheng®

Cable Fault Location Unit

USER MANUAL

Huazheng Electric Manufacturing (Baoding) Co., Ltd

Contents

HZ-A10 Cable Fault Location Unit

I. Overview

1.1 Product Features

Through continuous development and innovation, the product possesses the following features:

- Full-length testing of power cables: It can accurately measure the total length of power cables, providing important data for cable installation, maintenance, and management.
- Wave velocity calibration: By calibrating the signal propagation speed in the cable, it improves the accuracy of fault location.
- Embedded design with an English interface, stable operation, resistant to crashes and viruses.
- Adopts distributed control bus technology, with high automation, simple operation, and convenient test wiring.
- Equipped with a 12.1-inch large screen, touch mouse operation, high-brightness display, suitable for outdoor use under sunlight, lithium battery power supply for convenient on-site testing; engineered plastic case for shock and moisture resistance, achieving extreme stability.
- The software enables automatic switching between the low-voltage pulse method and the impulse current method, with simple wiring and intuitive testing; automatic identification and search of waveform inflection points, automatic positioning of fault inflection points, and automatic reading and display of fault distances.
- The waveform is displayed in three zones on the same screen, with ten measured waveforms randomly displayed for selection; simultaneously implements both automatic and manual processing modes for waveform positioning verification, and has the function of storing, playing back, and analyzing test waveforms.

1.2 Technical Specifications

- Capable of testing various major insulation faults in power cables of different voltage levels, cross-sections, media, and materials, including: open circuits, short circuits, low-resistance, high-resistance leakage, and high-resistance flashover faults.

- Display mode: 12.1-inch industrial-grade LCD screen
- Storage space: Fixed 4G
- Testing methods: TDR, ICE
- Operation mode: Optoelectronic knob operation (touch screen function optional)
- Pulse width/pulse amplitude (100ns ~ 10μs, 120V)
- Gain adjustment (-20 ~ +40dB)
- Output impedance matching (120Ω)
- Testing distance: 5m ~ 100km (v/2=80m/μs)
- Minimum testing distance (dead zone): 5 meters
- Precise positioning error: ±0.2m
- Testing error: System error less than ±1%
- Resolution: (v/2)*f meters (v/2: half-wave velocity m/μs; f: sampling frequency MHz)
- Sampling frequency: 3.125MHz, 6.25MHz, 12.5MHz, 25MHz, 50MHz, 100MHz, 200MHz, 250MHz
- Power supply: DC12V

1.3 Operating Conditions

Working temperature: -10℃ to +45℃

Relative humidity: ≤90% (non-condensing)

II. Introduction to Cable Fault Location

2.1 Types of Cable Faults

■ Based on the cause of the fault:

● Externally induced faults (forced faults)

● Non-externally induced faults (non-forced faults)

☆ Joint faults

☆ Outer sheath faults

☆ Body faults

■ Based on the nature of the fault:

● High-resistance faults (insulation resistance above 1k ohms)

● Low-resistance faults (insulation resistance below 1k ohms)

● Dead ground faults (insulation resistance nearly zero)

2.2 Fault Location Process

The basic requirements for cable fault location are rapid location, safe operation, and accurate positioning, which greatly depend on the technical proficiency of the operators and the reliability of the equipment.

Before locating the fault, it is important to understand the basic information of the cable, such as its type, length, joint positions, laying method, etc. Additionally, it is essential to have some understanding of the nature of the fault before locating it.

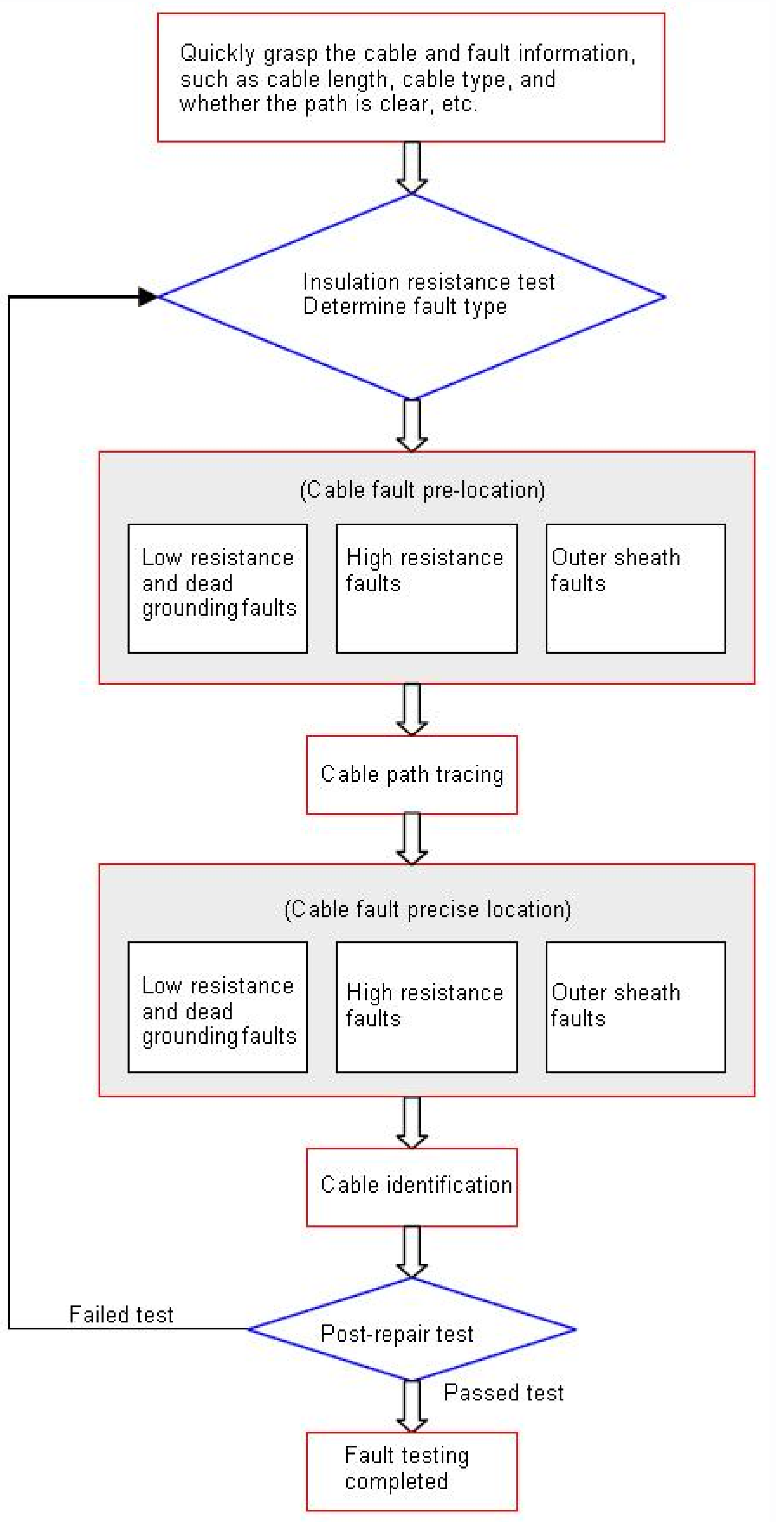


Figure 2.1 Fault Location Process

Cable fault location is a highly specialized technical discipline that can be both challenging and straightforward. It is challenging because locating cable faults basically requires equipment; otherwise, it is very difficult. However, if one has the equipment and masters the knack, faults can be quickly located.

Tips for Cable Fault Location:

● Many cable faults are caused by external damage, and can be found by patrolling the line.

● When locating faults, it is best to have detailed cable information. If the information is not available, it is advisable to search for it yourself rather than relying solely on diagrams.

● Different test methods and instruments are required for different types of cable faults. Accurate pre-judgment can greatly improve efficiency.

Safe Operation

Great care must be taken when operating high-voltage equipment. Safety regulations must be strictly adhered to, and procedures must be followed. Before conducting fault testing, it is essential to strictly observe the following five safety rules:

During fault testing, prevent other personnel from approaching the site. It is advisable to isolate the fault testing area with warning signs to prevent electric shock accidents. After testing, discharge the tested cable. Safety first, prevent electric shock!

2.3 Safe Operation

Great care must be taken when operating high-voltage equipment. Safety regulations must be strictly adhered to, and procedures must be followed. Before conducting fault testing, it is essential to strictly observe the following five safety rules:

● Ensure the cable under test is de-energized.

● Prevent the cable under test from being re-energized.

● Ensure there is no residual voltage in the cable under test.

● Ground the cable cores of the cable under test.

● Isolate or shield surrounding live equipment.

During fault testing, prevent other personnel from approaching the site. It is advisable to isolate the fault testing area with warning signs to prevent electric shock accidents. After testing, discharge the tested cable. Safety first, prevent electric shock!

Possible issues:	Solutions:
Unable to obtain test waveform when measuring high resistance faults	Check if the system parameter settings are reasonable, the condition of both ends of the cable, and whether the applied testing method is appropriate (if the multiple pulse method fails to obtain a waveform, try using the pulse current method), and whether the cable joints or fault points are wet and require arc burning...

III. Operation Instructions

3.1 Panel Composition

The panel diagram of the A10 Cable Fault Tester is shown in the figure below. Please pay attention to selecting the corresponding output port and switches according to the testing requirements.

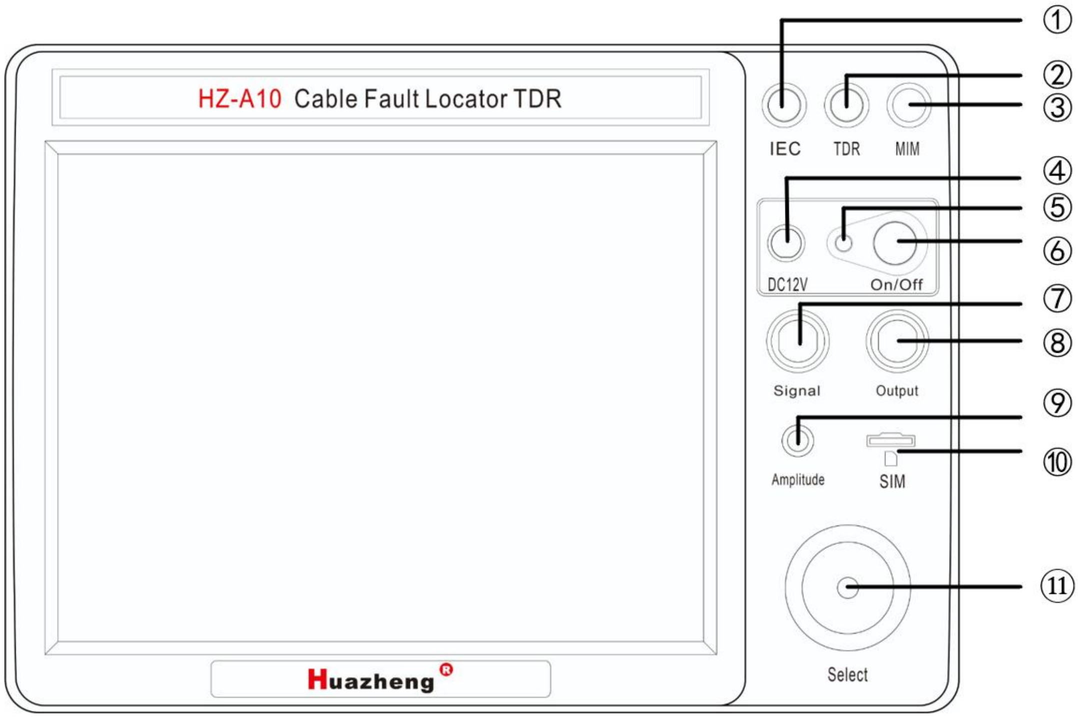


Figure 3.1 Panel

① "Flashover Method Indicator Light": Red LED, which lights up when the device is in high-voltage impulse flashover sampling mode.

② "Pulse Method Indicator Light": Green LED, which lights up after the device is powered on and indicates that the device is in pulse testing mode.

③ "Multiple Pulse Method Indicator Light": Red LED, which lights up when the device is in multiple pulse sampling mode.

④ "Charging Socket": This socket is used for charging the device with a charging cable.

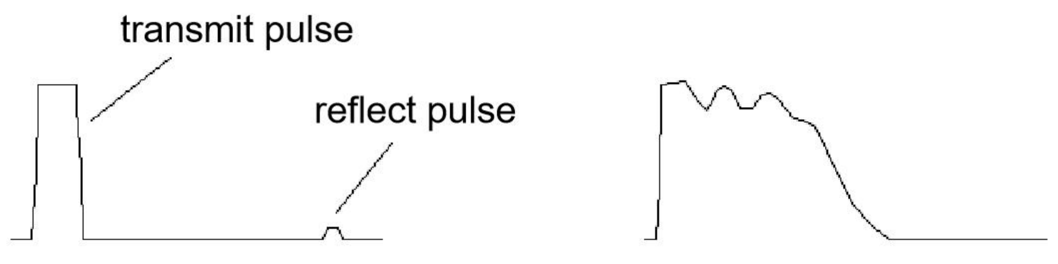
⑤ "Power Indicator Light": This light turns on when the power switch is pressed, indicating the power status of the device.

⑥ "Power Switch": Press to turn on the device, and release to lock and turn off the device.

⑦ "Communication": Used for signal transmission between the device and the trolley.

⑧ "Output Socket": The instrument uses a four-pin aviation socket for signal output and input during cable fault testing.

⑨ "Output Amplitude": Used to adjust the input and output pulse amplitude. Adjustment should be made based on the waveform displayed on the screen. If the adjustment is too small, the pulse reflection will be minimal or even unable to be sampled, as shown in the figure below (left). If the adjustment is too large, the reflected pulses will connect without intersecting the baseline, or the baseline may become slanted, as shown in the figure below (right). Generally, before sampling, rotate the input amplitude knob about 1/3 of the way, and then adjust it based on the size of the sampled waveform for resampling.



⑩ "Wireless Communication": The SIM interface enables remote transmission of measurement data.

⑪ "Optoelectronic Rotation": Operate the entire system by rotating. Pressing this key indicates confirmation.

3.2 Composition of the Display Area

After powering on, the system automatically enters the testing interface, which is shown below:

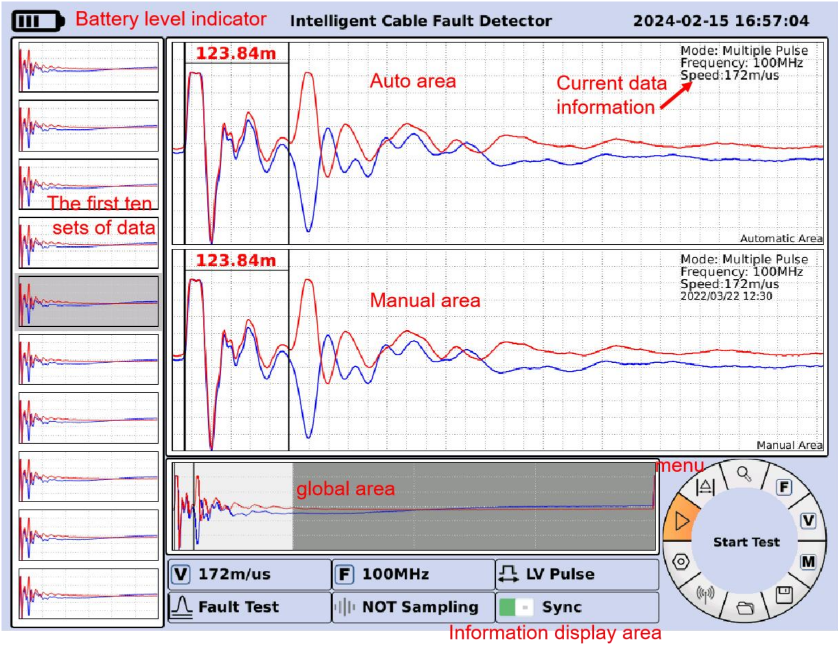


Figure 3.2 Software Testing Interface

3.2.2 Waveform Display Area

The waveform display area is mainly divided into the automatic zone, manual zone, global zone, and the first ten waveform display zone.

The automatic zone displays the latest data waveform collected each time, and shows the current fault distance in the waveform area if the testing method is low-voltage pulse or multiple pulse.

The manual zone and global zone display the same waveform.

The manual zone displays any selected data waveform, and fault positioning can be performed using a knob.

The global zone displays the full view of any selected data waveform. The non-shaded part of the waveform in the global zone corresponds to the waveform in the manual zone, and the view can be compressed or extended by selecting and adjusting the view function with the knob.

On the left side of the interface is the first ten waveform display zone, which updates from bottom to top as new samples are taken. That is, the newly collected data waveform is displayed in the bottom area, and the first data waveform is overwritten. When the user clicks on a waveform, the background of that waveform display area becomes brighter. Clicking the small arrows on the right side of the manual and automatic zones can expand these zones respectively, providing a good visual effect for waveform positioning and view adjustment.

3.2.3 Other Displays

The top left corner of the interface displays the current remaining battery level of the instrument. When the battery is low, it will indicate low battery, allowing the user to charge the instrument in a timely manner.

The top right corner of the interface displays the current time. If the time is inaccurate after powering on, the user can open "Other Settings" using the knob to set the time manually.

3.2.4 Test Information Display

The bottom of the interface is the test information display area, which mainly includes the current wave velocity, cursor position (manual fault positioning distance), current testing method (default is low-voltage pulse testing method), X-axis distance (the actual distance corresponding to the full wavelength in the manual zone, which is also the non-shaded part of the waveform in the global zone), and 50 ohms (output impedance).

3.2.5 Rotation Menu

The bottom right corner of the interface is the menu selection area. Clockwise, the options are: start sampling, positioning line adjustment, view area adjustment, fault measurement settings, velocity measurement settings, historical data view, save data file, open data file, print report, and other settings.

The default function when the system is powered on is "start sampling". The user can select specific functions using the knob, with the text description of the corresponding function displayed in red font on the left side of the rotation menu. The default sampling mode when powered on is single mode, but the user can set it to continuous mode, with the text description displayed on the left side of the rotation menu.

For detailed descriptions of each function, please refer to the instrument operation manual.

3.2.6 Startup

Press the power switch, then long-press the ⑪ "Optoelectronic Rotary" button until the screen lights up and the buzzer sounds. Release the button to start the device.

3.3 Fault Testing

As shown in Figure 3.3, rotate the "Photoelectric Rotator ⑪" to switch the focus to F, with the center displaying "Fault Test Settings".Press the ⑪ "Optoelectronic Rotary" button to enter the fault testing settings interface. Rotate the ⑪ "Optoelectronic Rotary" to select a testing method, sampling frequency, or wave velocity, and press the button to confirm your selection. You can also enter a custom wave velocity.

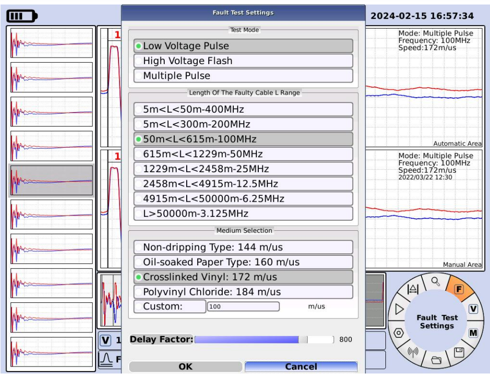


Figure 3.3 Fault Detection Setting Interface

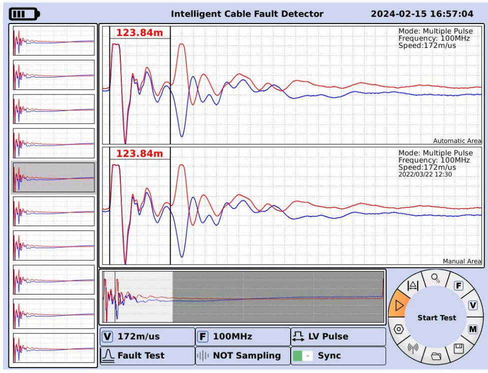


Figure 3.4 Main Menu After Successful Parameter Setting

Rotate the ⑪ "Optoelectronic Rotary" to move the focus to the "OK" button and press it to save the settings. The main menu interface will now appear as shown in Figure 3.4. The focus should be on ▷. Press the "Photoelectric Rotator ⑪" button to start sampling. If you need to change the settings beforehand, you can switch to the "Cancel" button and press the "Photoelectric Rotator ⑪" to go back and make modifications.

3.4 Velocity Measurement

As shown in Figure 3.5, rotate the "Photoelectric Rotator ⑪" to switch the focus to V. then press the button to enter the velocity testing interface. Press the ⑪ "Optoelectronic Rotary" to switch the focus between fault cable length L range selection (the system automatically sets an appropriate sampling frequency), "OK", and "Cancel". Alternatively, rotate the ⑪ "Optoelectronic Rotary" to move the focus to "Cable Length", press the button, and use the pop-up numeric keypad to enter the length.

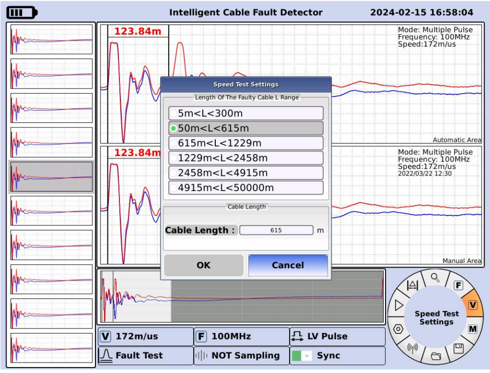


Figure 3.5 Speed Measurement Setting Interface

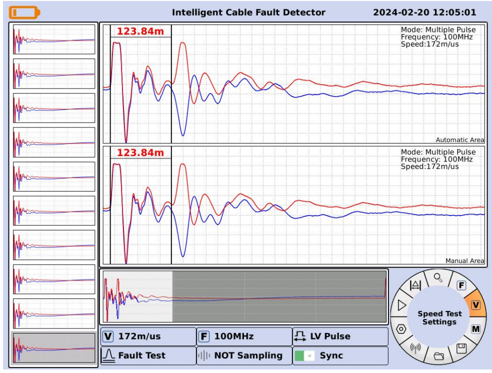


Figure 3.6 Main Menu After Successful Parameter Setting

After selecting the length and sampling frequency, rotate the ⑪ "Optoelectronic Rotary" to move the focus to the "OK" button and press it to save the settings. Once the settings are complete, rotate the ⑪ "Optoelectronic Rotary" as shown in Figure 3.6 to start data acquisition.

3.5 Distance Marking

As shown in Figure 3.7, rotate the "Photoelectric Rotator ⑪" to switch the focus to .

Press the "Photoelectric Rotator ⑪" again, and then rotate the knob left and right with the focus on to adjust the left clamping line. With the focus still on , rotating the knob left and right will adjust the right clamping line. When adjusting the clamping lines, the step size increases gradually with the number of rotations. If you overshoot the desired clamping position, rotate the knob from right to left, with the step size increasing gradually as the number of rotations increases. The main interface display area shows the current actual clamping distance (fault distance) as shown in Figure 3.8.

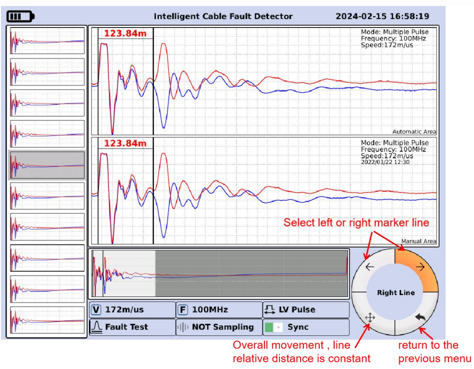


Figure 3.7 Sub-menu for Adjusting Alignment Line

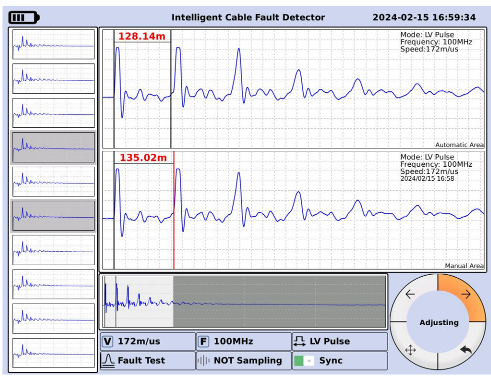


Figure 3.8 Fault Distance Display Interface

3.6 View Adjustment

As shown in Figure 3.9, rotate the ⑪ "Optoelectronic Rotary" to move the focus, then press the button to enter the view adjustment interface. Rotate the knob to compress or stretch the waveform, as shown in Figure 3.10.

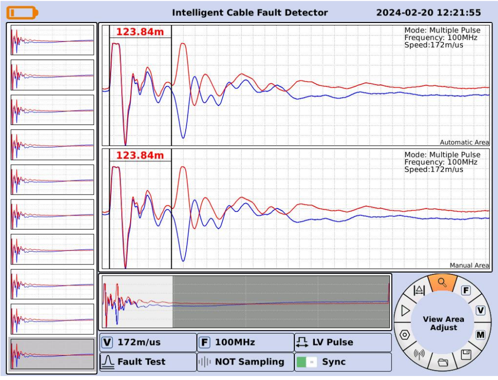


Figure 3.9 Main Menu for View Adjustment

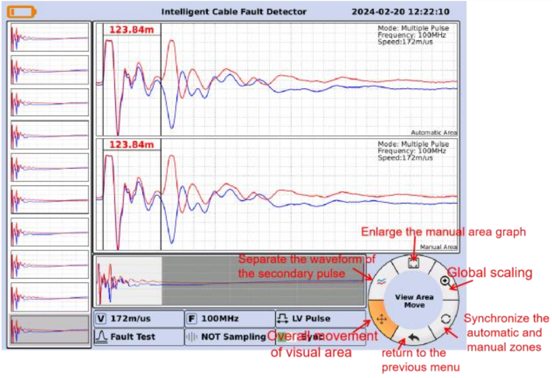


Figure 3.10 View Adjustment Interface

3.7 Open Historical Data

As shown in Figure 3.11, rotate the ⑪ "Optoelectronic Rotary" to move the focus to a historical data entry, and press the button to select it.

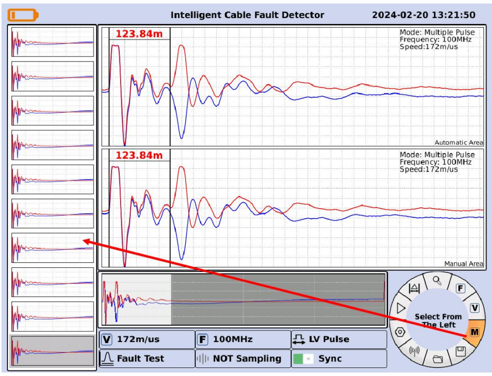


Figure 3.11 Historical Data Selection Interface

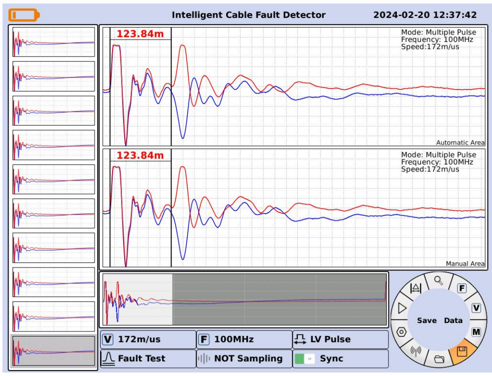


Figure 3.12 Main Menu for Saving Data Files

3.8 Save Data

Select a set of data (for example, select the 8th set of data), and then, as shown in Figure 3.12, rotate the "Photoelectric Rotator ⑪" to switch the focus to . Press the "Photoelectric Rotator ⑪" to save this set of data.

3.9 Open Data

As shown in Figure 3.13, rotate the "Photoelectric Rotator ⑪" to switch the focus to . Press the "Photoelectric Rotator ⑪" to enter the data opening interface. As shown in

Figure 3.14, rotate the "Photoelectric Rotator ⑪" to switch the focus, and press the "Photoelectric Rotator ⑪" to open this set of data and exit the interface.

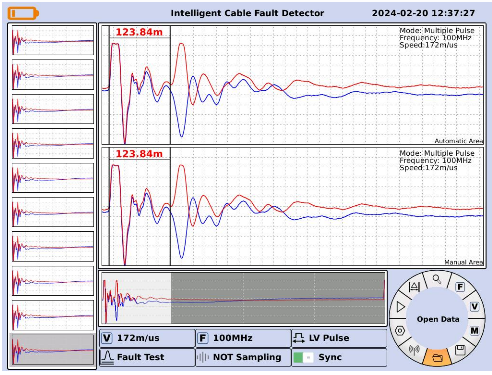


Figure 3.13 Main Menu for Opening Data Files

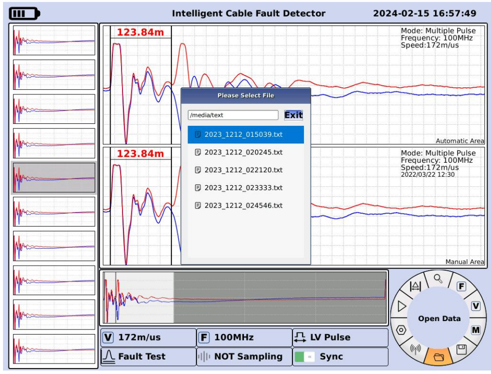


Figure 3.14 Data Opening Interface

3.10 Other Settings

As shown in Figure 3.15, rotate the "Photoelectric Rotator ⑪" to switch the focus to . Press the "Photoelectric Rotator ⑪" to enter the other settings interface. As shown in Figure 3.16, press the "Photoelectric Rotator ⑪" to switch the focus to backlight, and adjust the brightness by rotating the knob.

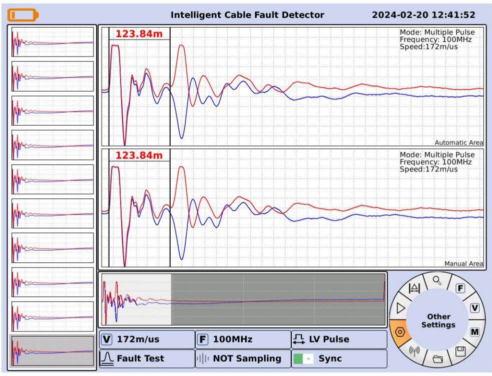


Figure 3.15 Main Menu for Other Settings

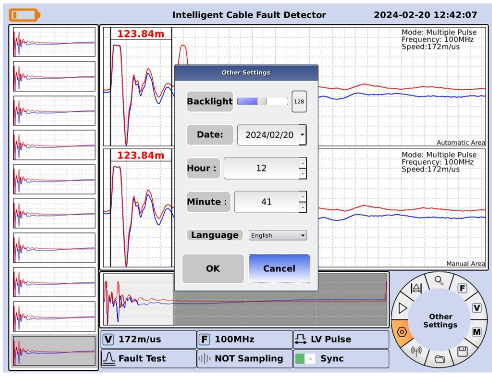


Figure 3.16 Other Settings Interface

Date Adjustment: Select "Date" with the cursor, press the ⑪ "Optoelectronic Rotary" to switch between year, month, and day, select the position to adjust, and press the button to make your selection.

Time Adjustment: Select "Hour" or "Minute" with the cursor, press the ⑪ "Optoelectronic Rotary", and rotate it to adjust the time.

Language Adjustment: Select "Language" with the cursor, and rotate the ⑪ "Optoelectronic Rotary" to switch between English, Chinese, Russian, and Turkish.

Once all settings are complete, move the focus to the "OK" button and press the ⑪ "Optoelectronic Rotary" to save the settings.

3.11 Shutdown

Long-press the ⑥ "Power Switch" until the screen backlight turns off, then release the button to shut down the device.

IV. Testing Instructions

4.1 Low-Voltage Pulse Method Operation

The low-voltage pulse method is used to test the velocity of electric wave propagation in cables, the total length of the cable, low-resistance faults (fault phase resistance below 1kΩ), open circuits, and short circuits. The main unit can complete the task without the need for a multiple pulse generator. It also provides a basis for using the multiple pulse method to test high-resistance faults in cables.

4.1.1 Principles of Pulse Testing

When measuring cable faults, the cable can be regarded as a uniformly distributed transmission line. According to transmission line theory, when a pulse voltage is applied to one end of the cable, the pulse propagates along the line to the far end at a certain speed (determined by the dielectric constant and magnetic permeability of the cable medium). When the pulse encounters a fault point (or an impedance discontinuity), it will generate a reflection, and the flash tester records the transmission time T between the sent pulse and the reflected pulse. The distance S to the fault point can then be calculated based on the known propagation speed V, using the formula S = V•T/2, **as shown in [reference not found].** To measure the total length, the terminal reflected pulse can be used: L = V•T/2. Similarly, if the total length is known, the propagation speed can be calculated: V = 2S/T.

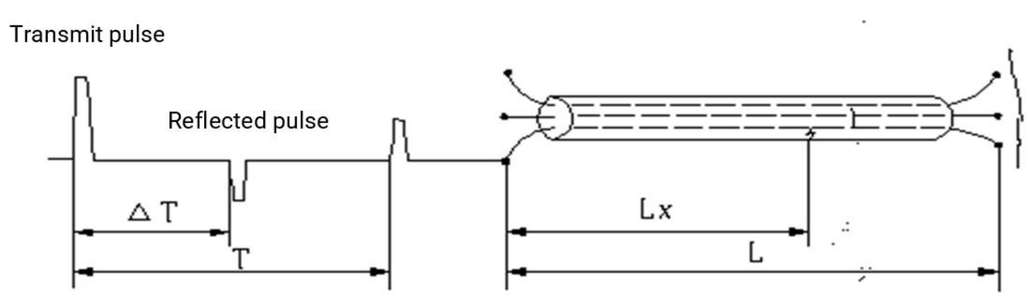


Figure 4.1 shows the schematic diagram of the low-voltage pulse method test.

During testing, a low-voltage pulse is applied to the fault phase of the cable, and the pulse propagates along the cable until it reaches an impedance mismatch, such as an intermediate joint, T-joint, short circuit point, open circuit point, or terminal end. These points cause reflections of the electric wave, which are received by the tester when the reflected pulse returns to the cable test end. The tester can display this process in real-time.

Based on the test waveform of the cable, we can determine the nature of the fault. When the transmitted pulse and the reflected pulse are in phase, it indicates an open circuit fault or an open terminal end. When the transmitted pulse and the reflected pulse are out of phase, it indicates a short circuit to ground or a low-resistance fault.

A fault where the insulation resistance at the fault point drops to the characteristic impedance of the cable, or even where the cable resistance is zero, is referred to as a low-resistance fault or short circuit fault (Note: This concept is defined from the perspective of using the low-voltage pulse reflection method, considering the effect of different impedances on the polarity change of the reflected pulse).

A fault where the insulation resistance of the cable is infinite or the same as the insulation resistance of a normal cable, but the voltage cannot be fed to the user end, is referred to as an open (or broken) circuit fault.

The fault phase (or the phase being tested) of the cable and the ground wire are connected to the input lines of the test system (the other end of the input lines is connected to the aviation socket of the test system).

4.1.2 Fault Testing

Press the ⑥ "Power Switch" as shown in Figure 3.1 (reference missing), and rotate the ⑪ "Optoelectronic Rotary" to move the focus to the center, where "Fault Test Settings" is displayed. Press the ⑪ "Optoelectronic Rotary" button to enter the fault testing settings interface, select "TDR", choose the desired sampling frequency and medium, rotate the ⑪ "Optoelectronic Rotary" to move the focus to the "OK" button, and press it to save the settings. The main menu interface will now appear as shown in Figure 4.3. Move the focus with the ⑪ "Optoelectronic Rotary", and press the button to start the test and wait.

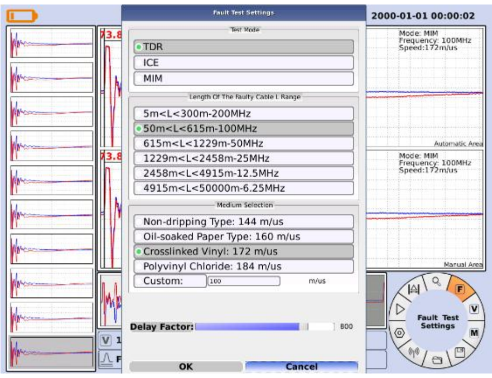


Figure 4.2 Fault Detection Setting Interface

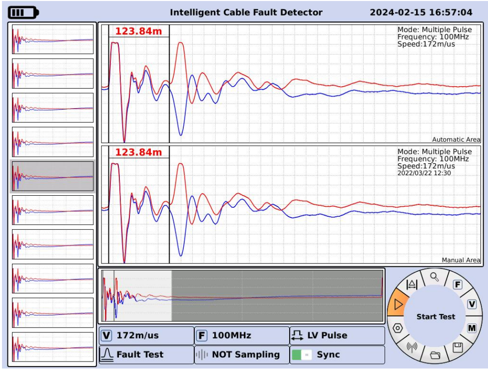


Figure 4.3 Main Menu After Successful Parameter Setting

Figures 4.4 and 4.5 show the waveforms of an open circuit fault and a short circuit fault measured using the low-voltage pulse method, respectively.

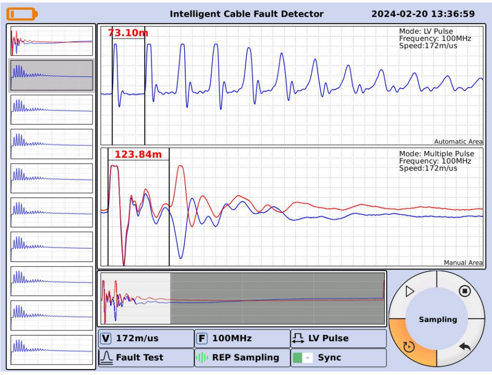


Figure 4.4 Open Circuit Fault Waveform Measured by Low-Voltage Pulse Method

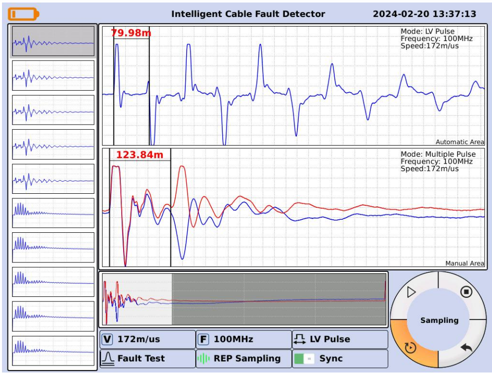


Figure 4.5 Short Circuit Fault Waveform Measured by Low-Voltage Pulse Method

4.1.3 Velocity Measurement

As shown in Figure 4.6, rotate the ⑰ "Mouse" knob to switch the focus to 

. Press the ⑰ "Mouse" knob to enter the speed test interface. After selecting the cable length and sampling frequency, rotate the ⑰ "Mouse" knob to switch the focus to the "OK" button, and press the ⑰ "Mouse" knob to successfully set the parameters. Once the settings are complete, rotate the ⑰ "Mouse" knob to the position indicated by "Error! Reference source not found." and press it to start data acquisition, resulting in speed measurement results as shown in Figure 4.7.

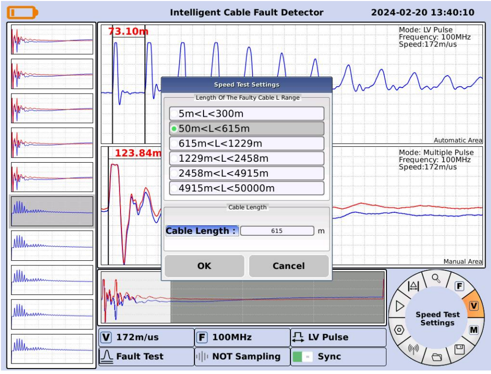


Figure 4.6 Speed Test Setting Interface

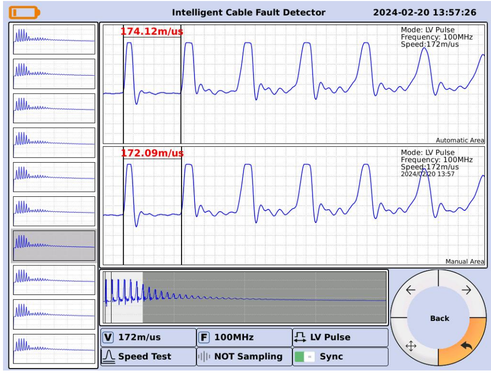


Figure 4.7 Interface After Speed Test Completion

4.2 Operation of the Pulse Current Method

When using the pulse current method, the wiring diagram is as follows:

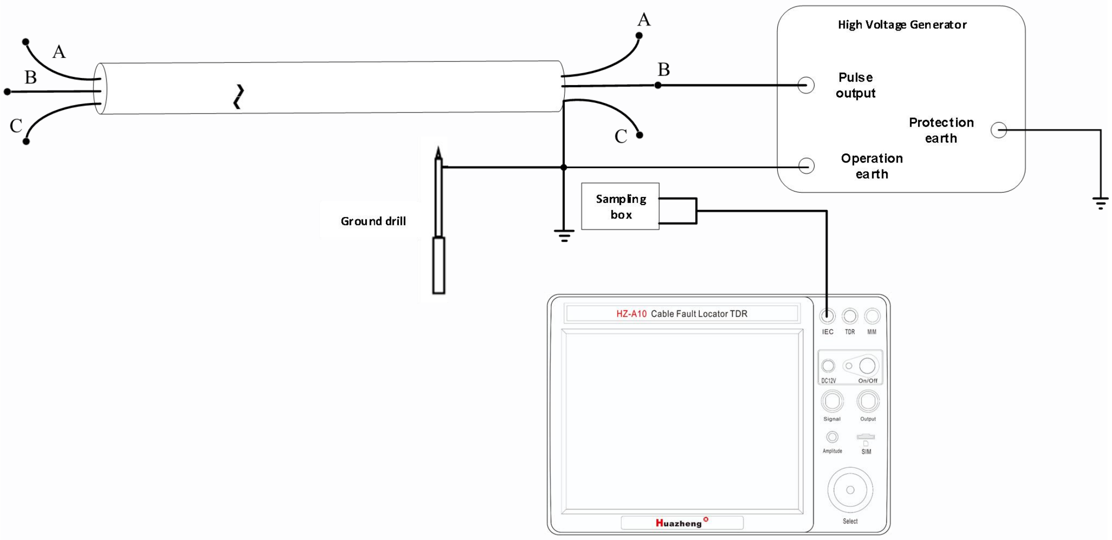


Figure 4.8 Wiring for the Pulse Current Method

High-impedance faults in power cables (High-impedance fault: A fault where the DC resistance at the fault point is greater than the characteristic impedance of the cable) account for over 90% of all faults. Although the multiple pulse method easily resolves most high-impedance faults, it is powerless in cases where voltage drops caused by the multiple pulse generator and discharge conditions of extremely high-impedance faults occur. This is where the impulse flash current method comes into play, and this device also includes traditional testing methods. Most high-impedance faults in cables (high-impedance leakage faults and high-impedance flashover faults) can be tested using the impulse flash method, but the waveforms are complex, making it difficult for users to accurately interpret high-impedance fault waveforms, often leading to large errors in preliminary measurements.

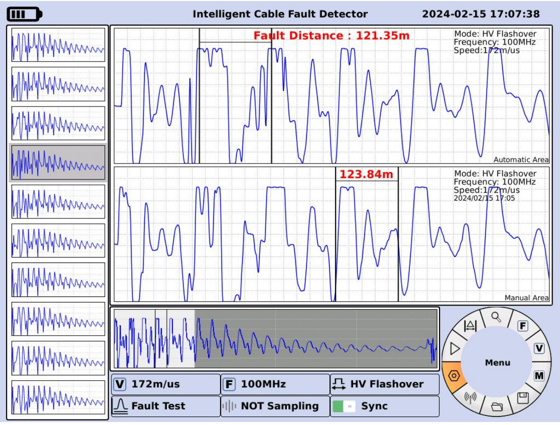


Figure 4.9 Test Waveform of the Pulse Current Method

For fault testing using the impulse flash method, the current sampling method is typically employed. Current sampling is recommended due to its simple wiring, high safety, and easily identifiable waveforms. After connecting according to the wiring diagram, use the speed key to select the transmission speed or re-enter the speed value. Turn the input amplitude knob to about 1/3 (note: fine-tuning is required), and then press the sampling key to put the instrument in the waiting state for sampling.

Adjust the sphere gap (if discharging occurs, the discharge should be clear and loud, and the current in the operation box should be greater than 10A-15A; otherwise, it is considered as not discharging. Please readjust the sphere gap and increase the impulse flash voltage). After adjusting the input amplitude knob, energize the faulty cable to increase the voltage. When the voltage reaches a certain level, the fault point will experience flashover discharge, and the instrument will record the waveform. Based on the waveform size, you can readjust the input amplitude, repeat the sampling, until a relatively standard waveform is obtained. The impulse flash test waveform is shown in Figure 4.9.

If the instrument freezes during sampling, a port error will be prompted. Exit the testing software, press the "reset" button on the main unit, re-enter the testing software, and resample.

Note: Generally, 1mm of sphere gap adjustment represents approximately 3KV. Please adjust appropriately based on the voltage level of the cable being tested.

Waveform Characteristics: The transmitted pulse is a positive pulse, and the reflected pulse is also a positive pulse but with a negative kickback at the leading edge. Due to the nature of the fault and other factors, the size of the negative kickback varies but is much smaller than the amplitude of the positive pulse.

When setting the cursor, position the blue cursor line at the intersection of the rising edge of the positive pulse and the baseline. If the cursor line placed by dragging the mouse is not accurate, use the left and right adjustment of the "fine-tuning" key until it is in the appropriate position, and then press the "set" key. Position the green cursor line at the intersection of the falling edge of the negative kickback and the baseline. If the cursor line placed by dragging the mouse is not accurate, use the left and right adjustment of the "fine-tuning" key until it is in the appropriate position. The fault distance displayed in the test results area at the bottom of the screen is the rough measurement distance from the main unit.

If no negative pulse appears, set the end cursor at the intersection of the rising edge of the reflected pulse and the baseline. The fault distance displayed in the test results area at the bottom of the screen will increase by about 10%. You only need to subtract about 10% from the displayed fault distance for precise positioning.

If you are dissatisfied with the inflection points chosen for the start and end points of this test, you can reposition them. **(Due to the complexity of the waveform, automatic positioning is not set for this test method.)** If you encounter difficult fault waveforms, please contact our company. Alternatively, you can install our remote synchronous testing software to achieve real-time on-site rough measurements. Our company's experts can guide you remotely to quickly position the fault and measure the rough fault distance. You only need to go for precise positioning. This will quickly resolve sudden cable faults, reduce losses, and quickly restore power supply.

With the multiple pulse testing method available, this method (which involves complex, irregular, and difficult-to-identify waveforms) is no longer used. It is only employed when dealing with high-impedance cable faults that cannot be broken down by the voltage drop of the multiple pulse generator in high-voltage equipment.

4.3 Problems and Solutions

If the wiring and operation are correct, the possible reasons for being unable to locate the fault and the corresponding solutions are:

■ Excessive water ingress at cable joints – It is difficult to obtain a pre-location test waveform in this case. The "arc burning" method is also not effective in drying out the moisture. You can try using the pulse current method multiple times.

■ The opposite end of the cable is not processed – If the cable end is connected to equipment such as loads, surge arresters, CTs, PTs, etc., it is necessary to remove any equipment that may affect the measurement results as much as possible, while also preventing potential damage to other equipment.

■ Unable to precisely locate the fault point – It is possible that the selected impulse discharge energy for precise positioning is too small. Pay attention to selecting an appropriate test voltage.

■ Incorrect parameter settings – Parameters such as incorrect test voltage, length test range, gain range, etc. Please read the instruction manual carefully or contact our company's technical personnel.

V. Transportation, Storage

5.1 Transportation Precautions

The instrument has undergone corresponding temperature, humidity, vibration, and shock tests according to the Group II specifications outlined in GB6587.1. However, please handle with care during transportation, protect from sunlight and moisture, and avoid violent impacts.

5.2 Storage Conditions, Storage Period, and Precautions

To facilitate the maintenance and use of the instrument, please pay attention to the following environmental requirements.

■ Storage temperature: -40℃ to +50℃

■ Relative humidity: 40℃ (20% to 90%) RH

■ Atmospheric pressure: (86 to 106) kPa

When the instrument is not in use, it should be stored in its original packaging in a dry and well-ventilated environment, free from gases that could cause corrosion. There should be no severe mechanical vibration or shock around the instrument, and no strong electromagnetic field effects.

VI. Maintenance

When the instrument malfunction cannot be easily resolved, users are advised not to attempt repairs themselves to avoid exacerbating the issue. Please contact the company promptly, and we will provide dedicated service to assist you.

Table 6.1 Fault Phenomena and Troubleshooting

Fault Phenomenon	Cause Analysis	Troubleshooting Method	Remarks
When the system is turned on, the screen displays but automatically shuts down after a few seconds	The internal battery voltage of the instrument is too low	Charge the battery	
System freeze	The instrument is subjected to strong interference	Restart the instrument after it shuts down due to freezing; when performing multiple pulse or pulse current ranging, do not touch the instrument during high-voltage discharge to avoid strong electrical interference.	

HZ-G35A HV Generator

I. Overview

The HZ-G35A integrated high-frequency high-voltage power supply is an innovative, new-generation, fully integrated high-voltage power supply product developed by our company based on our long-term experience in cable fault testing research and current market demands. It features stable performance, leading technology, portability, and safety. The equipment meets the "Standards for High-Voltage Test Equipment for the Electric Power Industry of the People's Republic of China". This product adopts a switching power supply principle, with a maximum output of 32 kV DC negative high voltage. It has an integrated design, stable performance, built-in capacitors, drop-out impulse ignition, and is equipped with emergency stop and automatic discharge functions, ensuring safety and reliability. When used with any of our company's cable fault testers, it can conveniently use the multiple pulse method or current impulse flash method for rough measurement or pre-location of cable faults. When used with a cable fault locator, it can quickly and accurately locate the fault point, making it an indispensable part of the cable fault testing system.

II. Performance Characteristics

1. Fully integrated design with built-in capacitors and simple wiring.
2. Touch screen human-machine interface for easy operation and clear, intuitive display of instrument status.
3. Voltage adjustment, automatic voltage stabilization, and automatic protection functions.
4. The output high voltage has single pulse and continuous pulse functions, which can be used with fault testers for ranging and with locators for finding fault points.
5. Software-controlled drop-out impulse ignition discharge with adaptive discharge and pulse cycle.
6. Emergency stop button and automatic discharge function for safe and reliable operation, with automatic voltage reduction and discharge during emergency stop or shutdown.

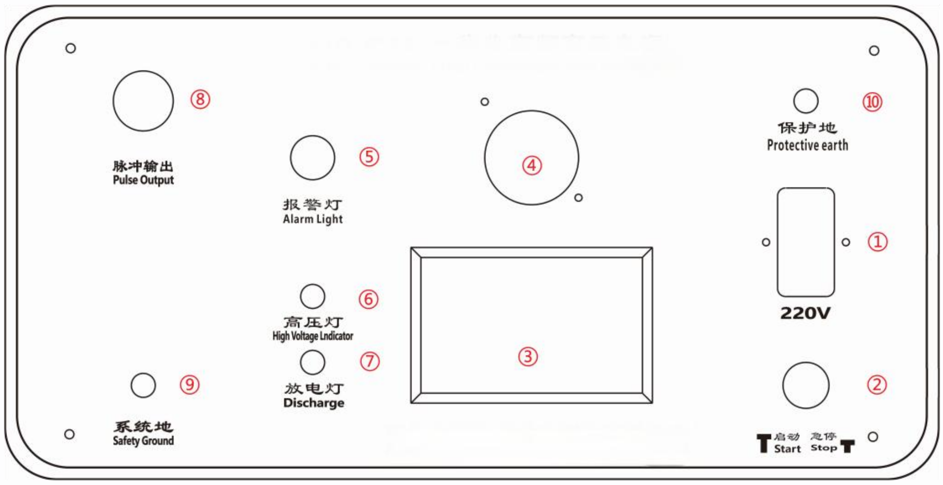
7. Continuous working time of no less than 6 hours, meeting the maximum working time requirement for cable fault testing.
8. Engineering rod-type case design, compact structure, small size, light weight, and easy to carry.

III. Technical Parameters

This product is mainly used for impulse discharge testing of power cables up to 35kV, in conjunction with cable fault waveform sampling and precise fault point location using a locator.

1. Output mode: Pulse output
2. Output voltage: DC negative voltage ≤32kV
3. Operating current: ≤10A
4. Working modes: Single pulse, continuous pulse
5. Built-in capacitor: 3uF/32kV
6. Discharge energy: ≤1536J
7. Pulse cycle: 4s～8s adaptive
8. Automatic discharge: Automatic discharge upon shutdown
9. Power supply: 50Hz 220V±10%
10. Display screen: 800×480 resolution touch LCD screen
11. Operating temperature: -10℃～40℃
12. Operating humidity: ≤80%
13. Altitude: ≤1000 meters
14. Dimensions: 550(L)300(W)435(H) mm
15. Weight: ≤28kg

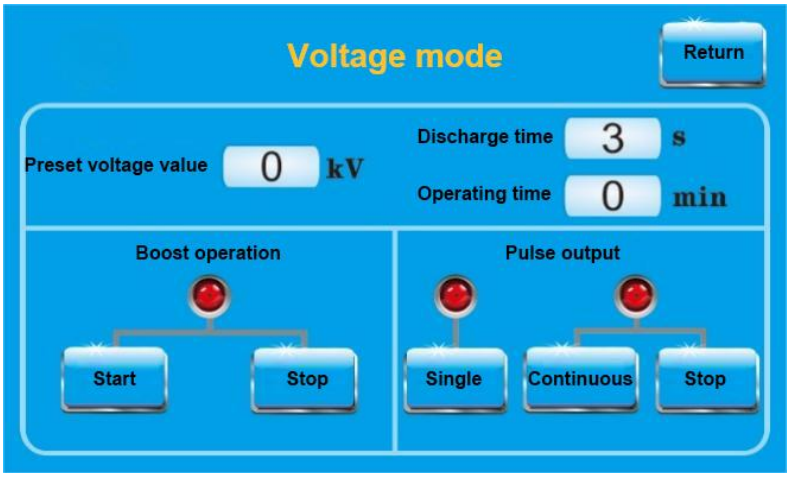
IV. Operation Panel



1. Three-in-one power switch: Standard three-prong socket for 50Hz 220V with a 10A fuse; boat-type switch that lights up and turns on the display screen when turned on, controlling the power supply of the instrument.
2. Start/emergency stop knob: Press down for emergency stop; rotate clockwise and it will automatically pop up to start. In any situation, pressing this button will stop the operation and automatically discharge the high voltage.
3. Display screen: 800×480 resolution touch LCD screen for setting voltage, single pulse, continuous pulse, etc., and displaying the discharge time and working time of the instrument.
4. Voltmeter: Displays the output voltage value and can be used to judge if the fault point has broken down and discharged by observing the voltage drop.
5. Alarm light: An integrated sound and light alarm device that indicates the automatic discharge status of the high-frequency high-voltage power supply. When the power switch is turned on, the alarm device starts to alert. After setting the voltage and rotating the start/emergency stop knob (rotate clockwise and it will automatically pop up to start), press the start button, and the discharge mechanism will activate, deactivating the alarm. In this case, the instrument automatically boosts and discharges according to the set voltage. After the test is completed and the emergency stop button is pressed, the alarm light will flash and alert. When the power is turned off, the alarm light will automatically turn off.

6. High-voltage indicator light: When the "Start" button on the "Voltage Boost Operation" interface is clicked, the instrument will automatically boost the voltage, and this indicator light will turn on.
7. Discharge indicator light: Indicates automatic discharge after an emergency stop or shutdown and power off. As the internal high voltage of the instrument gradually discharges, this light will gradually dim.
8. Pulse output: Outputs single or continuous high-voltage pulses for multiple pulse method testing, impulse current method testing, fault location, and other wiring.
9. System ground: The working ground for high voltage, which should be connected to a reliable grounding electrode (system ground). For phase-to-sheath (ground) faults, this grounding electrode should be connected to the cable outer sheath. For phase-to-phase faults, connect this grounding electrode to one of the faulted phases and then reliably connect it to the system ground.
10. Protective ground: A grounding wire specifically for safety protection that must be separately connected to a reliable grounding electrode using a dedicated grounding wire. (If on-site grounding conditions permit, try to ground separately from the cable, with a grounding resistance of less than 6 ohms.)

V. Touch Display Screen



1. Voltage setting: Click "Voltage Preset Value" to set the voltage. The setting range is 6-32 kV.

2. Voltage boost control: After setting the preset voltage, go to the "Voltage Boost Operation" interface. ① Click the "Start" button, and the machine will automatically boost the voltage, and the boost indicator light will turn green. (Before starting, the emergency stop/start switch must be rotated clockwise and automatically pop up. At this time, the emergency stop/start switch is in the start position, and the voltage can be boosted.) ② Click the "Stop" button, and the machine will stop boosting the voltage, and the boost indicator light will turn red.
3. Pulse output: After setting the voltage boost on the screen, go to the "Pulse Output" interface. ① Click the "Single" button, and the instrument will output a single pulse and then automatically stop. ② Click the "Continuous" button, and the instrument will operate in continuous high-voltage pulse mode, and the continuous pulse indicator light will turn green. ③ Click the "Stop" button, and the instrument will stop outputting continuous high-voltage pulses, and the continuous pulse indicator light will turn red.
4. Discharge time: Automatically displays the discharge time based on the set voltage.
5. Working time: Real-time display of the instrument's continuous pulse working time.

VI. Operating Instructions

After all the device connections are properly made, please perform a self-check on the device.

Self-check procedure:

Upon powering on, the alarm light will activate. Set the voltage to 6 kV in voltage mode, rotate the start/emergency stop button, and then select start on the voltage boost operation interface. At this point, the alarm light will turn off. When the voltage meter pointer starts to rise, select continuous in the pulse output menu. After 4 seconds, you will hear an internal action sound, and the voltage meter pointer will drop. After several discharge cycles, press the start/emergency stop button again. There will be an action sound inside the device, and the discharge indicator light on the panel will illuminate steadily. When the discharge indicator light turns off, the automatic discharge of the device is complete.

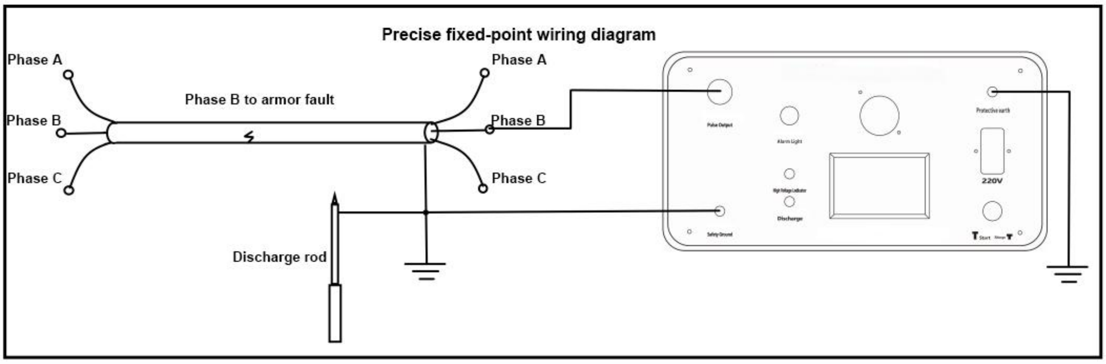
After completing these steps, it confirms that all functions of the device are normal, and it is ready for testing operations.

There is no need to stop after the self-check; you can directly set the desired voltage (it is generally recommended to increase the voltage gradually from low to high) and follow the normal operating procedures.

A. Pulse Output Mode

This mode is used for multiple pulse testing, current impulse flashover testing, fault location, and other tasks. It can output single high-voltage pulses or continuous high-voltage pulses, with a continuous pulse cycle of 4s to 8s.

The following describes the operation process for fault location in detail. For other purposes, please refer to the corresponding wiring schematic diagram.



1. Wiring Steps for the Entire Device:

a. Pulse Output Wiring: Insert the red high-voltage cable plug into the "Pulse Output" socket on the panel, and connect the clip end to the faulty cable core.

b. Capacitor Grounding Wiring: Insert the black test cable plug into the "Capacitor Grounding" socket on the panel, and connect the black clip end to the system ground at the test site.

c. Protective Grounding Wire: Use a dedicated 4-meter grounding wire, with one end clipped to the "Protective Grounding" terminal on the panel and the other end clipped to a grounding rod at the site. The grounding rod must be positioned away from the "system ground".

(Special Note: In a distribution room, if it is not possible to insert a grounding rod, connect the "Capacitor Grounding" to the system ground and the "Protective Grounding" to the yellow-green grounding busbar on the distribution room wall. Ensure that the system ground and the yellow-green grounding busbar are independently grounded.)

d. Wiring of Remaining Cable Cores: In addition to the high-voltage cable connected to the faulty phase core, short-circuit the remaining cable cores and armor and connect them to the system ground.

e. Discharge Rod Wiring: The discharge rod is equipped with a 3-meter single-end clip wire, which should be connected to the system ground.

2. Inspection:

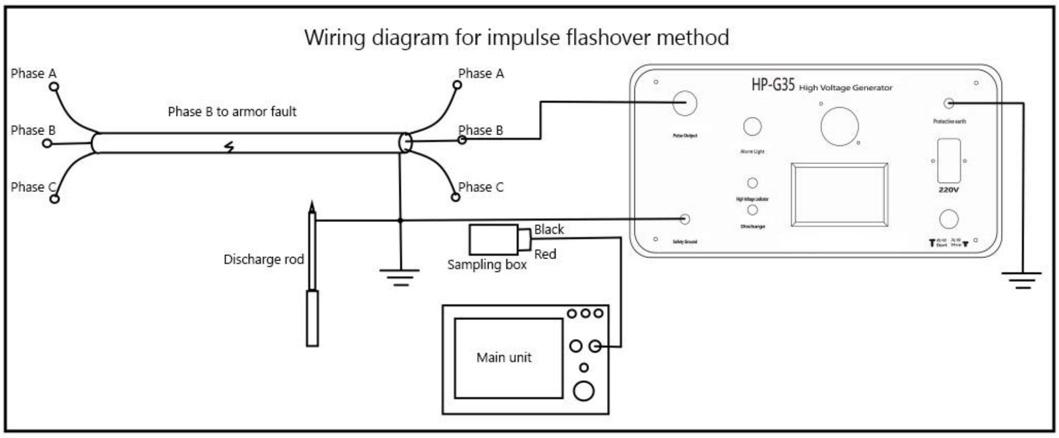
Check that all switches are in the "off" position, the emergency stop button is pressed, and the wiring is correct. If everything is normal, connect to the 220V working power supply.

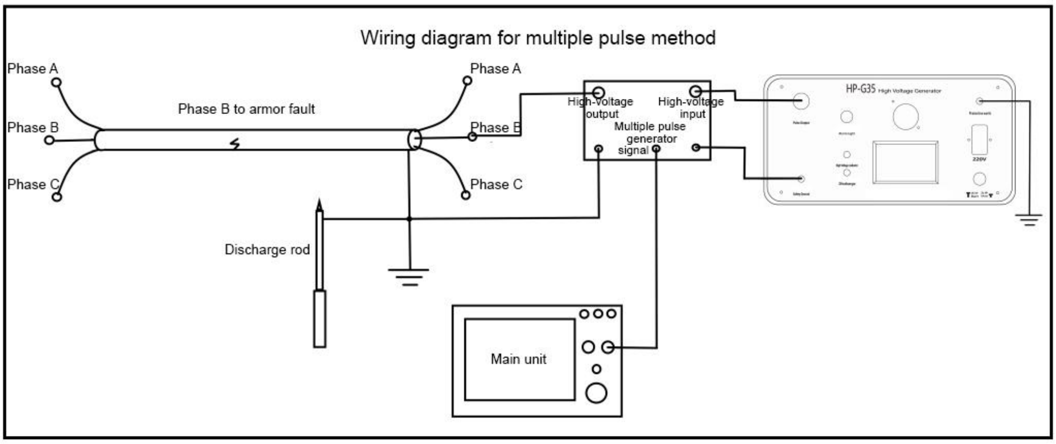
3. Operation:

Turn on the switch, touch the screen to activate it, and the discharge time will be displayed as 3s. Rotate the "Emergency Stop" button clockwise to start, then click on the "Voltage Preset Value" on the screen to set the voltage. Next, on the "Voltage Boost Operation" interface, click the "Boost" button. When the desired voltage is reached, click the "Single" button on the "Pulse Output" interface. The device will then emit an internal mechanism action sound, and the voltage meter will show a high→low→high swing. If this change occurs, it indicates that the fault point has discharged, and you can directly click the "Continuous" button to output continuous high-voltage pulses. If no such change occurs, it indicates that the voltage is too low. You can continue to increase the voltage and repeat the operation until the fault point discharges.

4.Shutdown:

After determining the fault point, click the "Stop" button on the "Pulse Output" interface, then click the "Stop" button on the "Voltage Boost Operation" interface, and press the "Emergency Stop" button. After about 5 seconds, the "Discharge Indicator" light on the panel will change from bright to dim, and the voltage meter will display a voltage returning to around 0kV. Turn off the switch and use the discharge rod to discharge any residual electricity in the tested cable. Wait for about 5 seconds, then disconnect the device power cable, high-voltage output cable, cable grounding wire, and finally, the protective grounding wire and discharge rod.





VII. Precautions

1. This instrument is an integrated high-frequency high-voltage power supply and is a dedicated device for impulse high-voltage testing of cable faults.
2. This instrument is a highly integrated, automated high-voltage device. For special cable faults (such as dead shorts (where the resistance measured with a multimeter is close to zero) or very high resistance faults (resistance greater than 200 megohms)), due to its integrated system, this device is not suitable for testing. Please use another high-voltage source (such as a test transformer) for testing or contact the manufacturer.
3. During automatic discharge upon shutdown, wait for about 5 seconds for the discharge indicator light to change from bright to dim. In case of unexpected power outages or other abnormalities, the main unit will also automatically activate the backup power supply for discharge. It is recommended to use the discharge rod to release any remaining capacitance charge at the cable end.

4. This instrument contains high voltage. In case of abnormalities, please contact our company immediately. Users should not attempt to disassemble or repair the instrument themselves, as this may cause further damage to the instrument or even endanger the user's safety. Any faults or damage caused by unauthorized disassembly or repair by the user will not be covered by the warranty.

5. During use, if the voltage meter pointer remains at a certain voltage setting value for several discharge cycles without dropping and no internal sparking sound is heard, please immediately press the emergency stop button and turn off the power. Wait a moment before retrying. If the device does not produce any internal action sounds after several restarts, please contact the manufacturer.

Important Notice:

Please strictly follow the operating instructions!

This product is a high-voltage device, and some fault phenomena may produce discharges or open flames. When testing, please ensure that it is not used in environments with high levels of gas or flammable vapors. If such conditions are encountered, please contact the manufacturer to adopt alternative testing methods. The manufacturer is not responsible for any safety accidents that occur as a result of using the device in such environments!

HZ-B HZ-R10 Pin-Point Locator+Cable RouteTracer

Section 1 Introduction To The Cable Path Tracer

I. Overview

The Cable Path Tracer consists of a transmitter and a route receiver. This instrument is specifically designed for cable fault location testing. Its main function is to detect the path of cables. The instrument adopts a microcomputer central processing unit and dedicated integrated circuits. It is characterized by high receiving sensitivity, low static drift, strong anti-interference capability, stable operation, and high accuracy. The instrument is more rugged and durable, thereby reducing its repair rate. The route receiver is powered by a high-capacity rechargeable lithium battery, offering the advantage of longer battery life.

II. Basic Composition And Main Applications

The instrument comprises the following two parts:

- Transmitter: Sends test signals to the cable under test .
- Route Receiver: Receives signals near the buried cable through a sensor and identifies the direction of the cable path.

III. Technical Specifications

1. Detection Range: 5km
2. Detection Depth: 3m
3. Routing Error: 5cm
4. Transmitter Basic Parameters: Output Frequency: 9.6kHz; Output Power: 5W
5. Route Receiver Basic Parameters:

◆ Input Frequency: 9.6kHz

◆ Routing Error: ±2cm

◆ Depth Measurement Error: ±5cm

◆ 9V rechargeable lithium battery, capable of continuous operation for 8 hours.

◆ LCD Display: High-brightness true-color screen with a resolution of 320 x 240, suitable for outdoor use.

IV. Introduction To The Route Receiver

3.1 Connection and Control of the Receiver Host

The following figure shows the connection method and control buttons of the Cable Path Tracer receiver host:

1. Liquid Crystal Display (LCD)
2. One-key adjustment button
3. Turn on the receiver host (press and hold for 3 seconds until the red LED indicator lights up) / Turn off (press and hold for 3 seconds)
4. Mute on/off
5. Connection socket for sensor
6. Connection socket for headphones
7. Charger connection port.

3.2 Connection of Sensor and Handle

3.2.1 The following figure shows the method for connecting the adjustable handle to the sensor:

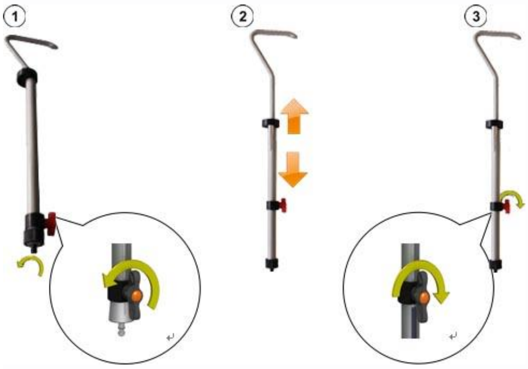
① ②

3.2.2 Connect the sensor and headphones to the receiver host.

Connect the headphones to the black socket ❻ on the receiver host. Please make sure to align the white marks on the plug and socket. The plug is plug-and-play; do not rotate it!

3.3 Adjusting the Height of the Handle

The following figure demonstrates how to adjust the height of the handle.



V. Operating Instructions

4.1 Preparations Before Detection

① Check the battery level of the routing receiver: After turning it on, the battery level will be displayed. If it is less than 25%, please charge it first and start using it after the battery level is above 50%.

② Suspend both ends of the cable: In general, the end of the cable being tested is disconnected from the ground. You only need to disconnect the starting end of the cable from the distribution cabinet (if the neutral wire is grounded, make sure to disconnect it).

4.2 Using the Transmitter

Note: When the transmitter is in operation, do not touch the output terminal with your hands to prevent electric shock. Do not connect the transmitter to a live cable, and do not short-circuit the output directly.

① Please turn off the transmitter before connecting it.

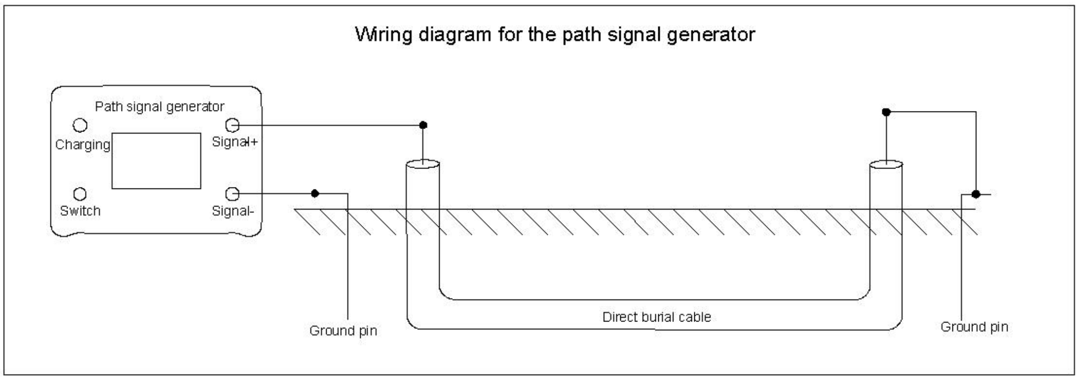
② Insert the red and black output wires into the corresponding output jacks on the transmitter.

③ Clip the red output wire clamp to the good phase of the cable, and then ground the terminal of the good phase. If the cable armor is intact and the outer sheath is not damaged, you can also open the armor at the test end and clip the red clamp to the armor for testing.

④ Clip the black output wire clamp to the system ground at the test end.

⑤ Connect the 24V power adapter and turn on the transmitter power switch. The display will show the working voltage and transmission frequency. The transmitter will start working.

⑥ Do not short-circuit the red and black output clamps while the transmitter is turned on.



Transmitter Connection Diagram

4.3 Role and Usage of the Routing Receiver

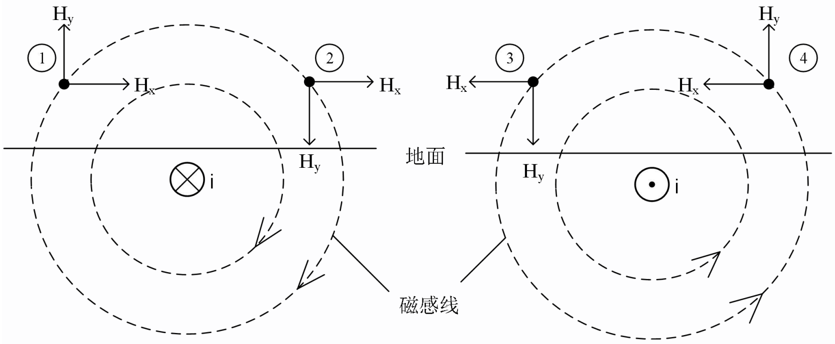
4.3.1 Role of the Routing Receiver

The signal generated by the transmitter is transmitted to the underground cable being detected through a direct connection. An induced current is generated on the underground cable, which propagates along the cable to a distance. During the propagation of the current, electromagnetic waves are radiated from the underground cable to the surface. When the receiver detects on the ground, it receives electromagnetic wave signals on the ground above the cable, and discriminates the location and direction of the underground cable based on changes in the strength of the received signals.

4.3.2 Principle of Detecting Low-Voltage Cable Routing and Burial Depth Using the Routing Receiver

The principles are the magnetic flux line direction identification method and the triangulation method.

① Magnetic Flux Line Direction Identification Method: The routing receiver contains two coils that are perpendicular to each other and are perpendicular to the direction of the low-voltage cable. As shown in the figure below, when the device is located on the left side of the cable, the direction of the magnetic flux lines from the cable passing through the two coils is opposite; when the device is located on the right side of the cable, the direction of the magnetic flux lines passing through the two coils is the same.



Principle of the Magnetic Flux Line Direction Identification Method

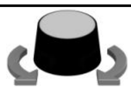
② Triangulation Method: Step 1: First, use the magnetic flux line direction identification method to find the low-voltage cable route, and select a point A on the previously identified low-voltage cable route. Step 2: Place the device on the left side of the cable and ensure that the handle is parallel to the cable, while ensuring that the arrow above the device forms a positive 45° angle with the vertical direction (i.e., the arrow points to the upper right). Place the probe end on the ground and move the handle horizontally to the left parallel to the direction of the low-voltage cable. When the received signal reaches its first minimum value, record this point as B. Step 3: Place the device on the right side of the cable and ensure that the handle is parallel to the cable, while ensuring that the arrow above the device forms a negative 45° angle with the vertical direction (i.e., the arrow points to the upper left). Place the probe end on the ground and move the handle horizontally to the right parallel to the direction of the low-voltage cable. When the received signal reaches its first minimum value, record this point as C. The straight-line distance between points A and B (or A and C) on the ground represents the burial depth AD of the low-voltage cable. The general error is around ±5 cm. Note: The accuracy of detecting the burial depth of low-voltage cables may be affected by soil conditions, adjacent cables, and the metallic material of the cables. When detecting burial depth, avoid bends in the low-voltage cable and stay at least 10 meters away from the transmitter to prevent inaccurate depth determination or increased error.

4.3.3 Introduction and Usage of the Routing Receiver Host

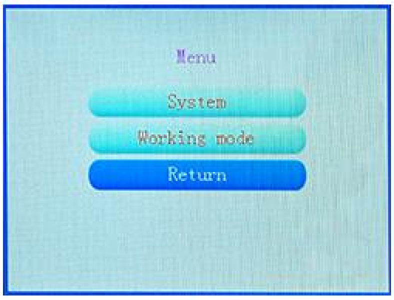
① Turning On/Off the Receiver Host: Press the power button on the receiver host to turn it on or off. After three seconds, the receiver host is ready for use, and the measurement interface will be displayed.

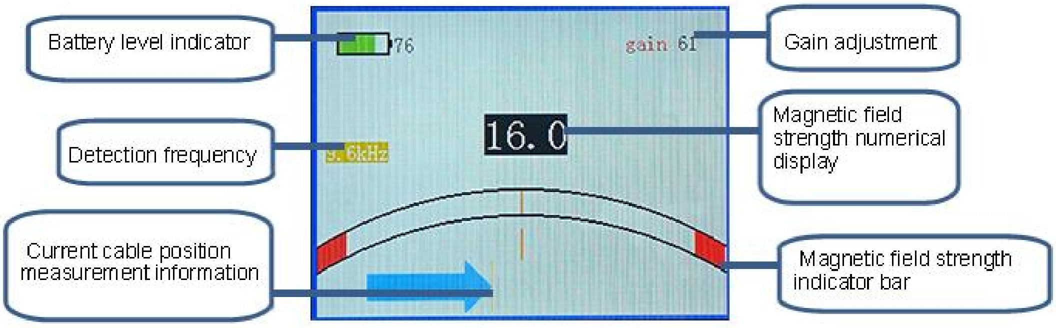
② Battery Level Self-Check: After turning on the device, please check the remaining battery level of the lithium-ion rechargeable battery in the upper right corner of the display. If you find that the battery level is less than 25%, please charge it first and start using it after the battery level is above 50%.

③ One-Key Adjustment Knob of the Path Finder: The receiver host is mainly adjusted using a one-key adjustment button. Please refer to the figure below for the usage of the one-key adjustment button.

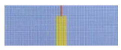
Gesture	Functions of the measurement interface
	Adjust the gain

④Adjustment and Settings of the Measurement Interface: Press and hold the power button on the main panel of the pathfinder host to turn it on. To access the menu interface from the measurement interface, press a single key. In the submenu of working modes, select "Path Detection" to switch to the path detection measurement interface, as shown in the figure below:





4.3.4 Usage Method

Steps	Action
1	Please place the ground sensor of the cable tracer at the starting point of the cable.
2	Please continuously observe the direction indicated by the arrow on the display screen, the magnetic field strength value, and the magnetic field strength indicator bar. If the arrow points to the right (i.e., ), it means the cable is on the right side of the sensor, and you should continue moving to the right. As you get closer to the cable during the movement, the arrow will get closer to the centerline of the screen, and the sound signal in the headphones will become louder. If the arrow points to the left (i.e., ), it means the cable is on the left side of the sensor, and you should continue moving to the left. As you get closer to the cable during the movement, the arrow will get closer to the centerline of the screen, and the sound signal in the headphones will become louder. When a yellow line appears on the axis position (i.e., ), it indicates that the cable is directly beneath the sensor, and you should continue moving forward.
3	When the cable is detected directly beneath the sensor: if the magnetic field strength value consistently displays 99.9, you should rotate the single key counterclockwise to reduce the gain; if the magnetic field strength value is less than 90, you should rotate the single key clockwise to increase the gain, making it easier for the user to roughly estimate the distance to the cable.

VI. Precautions

5.1 For detecting loops, the magnetic flux direction recognition method is used. When the probe reaches a loop in the cable, if the route receiver indicates alternating left and right arrows, this is a normal phenomenon due to the crossing magnetic fields at the loop. At this point, it is advisable to tentatively skip over the loop, find the exit of the loop, and then continue the measurement.

5.2 Equipment Maintenance: This instrument is designed for outdoor use and should be kept clean and dry. When not in use, the instrument should be stored in its packaging box in a cool, dry place. Before each use, check the battery level of the route receiver. This instrument is intended for use only by trained and experienced professional electrical personnel. Anyone else should keep away from this instrument.

VII. Standard Configuration

- One receiver host with shoulder strap
- One slave sensor
- One adjustable height handle with a range of 450 – 750 mm
- One headphone with hi-fi sound quality
- One signal cable, 1.20 m long, for connecting the receiver host to the sensor
- One lithium-ion battery charger, input: AC100-240V/0.5A, output: DC8.4V/1A
- One Chinese instruction manual.

Section 2 Introduction to the Fault Locator

I. General Overview of the Acoustic-Magnetic Fault Locator for Cable Faults

Due to the extreme complexity of the environments in which power cables are laid, precise fault location has always been a critical step in cable fault testing. Even with an accurate initial distance estimate, it can be difficult to quickly and accurately pinpoint the location due to external environmental influences. The Acoustic-Magnetic Fault Locator for cable faults is a portable, ultra-quiet, and visual impulse discharge reception device designed for precise fault location, specifically used in conjunction with a high-voltage impulse generator. It adopts new technologies such as intelligent background noise reduction and sound tracking, enabling continuous optimization and perfect sound effects, recording characteristic sounds of impulse discharges and comparing them with signals picked up on-site. When the front-end continuous impulse discharge is applied, the Acoustic-Magnetic Fault Locator captures the impulse discharge sound from the fault point within the estimated distance range as it propagates along the ground above the cable, which is then recorded by the ground sensor on the surface. The distance between the detection point and the actual fault point on the cable can be determined by the volume of the impulse discharge noise.

II. Technical Features

◆ Ultra-quiet noise reduction processing, excellent discharge sound quality, and a quieter background, with monitoring headphones selected for quick and reliable fault location.

◆ Ultra-quiet technology and BNR (Background Noise Reduction) intelligent technology are used to adjust the volume of impulse discharge.

◆ A specially designed self-dropping ground sensor with molded construction, equipped with sensing connectors for soft surfaces, hardened surfaces, and lawns.

◆ Reliable imported connectors are used to ensure sound purity, and a humanized, height-adjustable probe handle is designed for easy use.

III. Technical Parameters

◆ Sensor dynamic range: Sound channel > 104dB.

◆ Impulse discharge sound amplification > 90dB, with an upper limit of impulse discharge volume at 84dB(A).

◆ LCD display: High-brightness true-color screen with a resolution of 320 x 240, suitable for outdoor use.

◆ Power supply: Lithium-ion rechargeable battery.

3.1 Standard Configuration

◆ One receiver host with shoulder strap.

◆ One sensor (ground microphone).

◆ One height-adjustable handle with a range of 450 – 750 mm.

◆ One headphone with audio-grade sound quality.

◆ One signal cable, 1.20 m long, for connecting the receiver host to the sensor.

◆ One hard ground probe, 18 mm long.

◆ One grass probe, 75 mm long.

◆ One charger.

◆ One Chinese instruction manual.

3.2 Connection and Control of the Receiver Host

The following figure shows the connection method and control buttons of the receiver host of the fault locator.

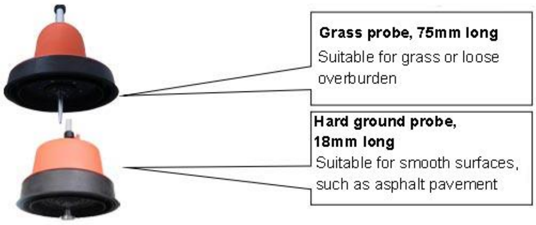
1. Liquid Crystal Display (LCD);
2. One-Touch Adjustment Button;
3. Power on the receiver host (press and hold for 10 seconds until the red LED indicator blinks) / Power off (press and hold for 3 seconds);
4. Mute on/off;
5. Connect to socket, attach sensor;
6. Connect to socket, attach headphones;

7. Charger connection port.

IV. On-site Installation and Operation of the Locator

4.1 Starting the Locator and Preparing the Sensor

- Connect the sensor to the appropriate probe or needle. The locator sensor can be connected to two different types of probes, including a standard 18mm long hard ground probe and a 75mm long grass probe. These probes and needles can be screwed on to adapt to various ground cover conditions.

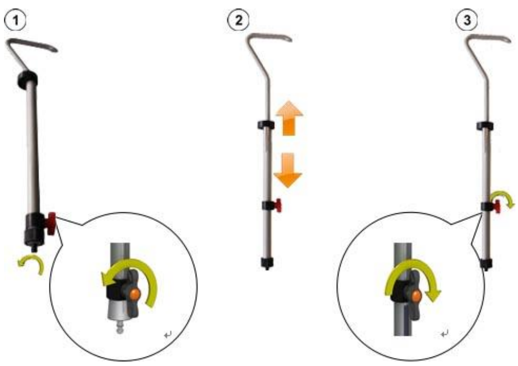


4.2 Connecting the Adjustable Handle to the Sensor

- The following diagram illustrates how to connect the adjustable handle to the sensor.

4.3 Adjusting the Height of the Handle

- The following diagram shows how to adjust the height of the handle.



4.4 Connecting the Sensor, Headphones, and Receiver Host

- Connect the headphones to the black socket on the receiver host. Please ensure that the white markings on the plug and socket are aligned. The plug is plug-and-play, do not rotate it!

4.5 Introduction to the Receiver Host of the Locator

1. Powering On/Off the Receiver Host

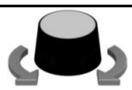
- Press the power button on the receiver host to turn it on or off. After about ten seconds, the receiver host will be ready for use, and the measurement interface will be displayed.

2. Battery Level Self-Check

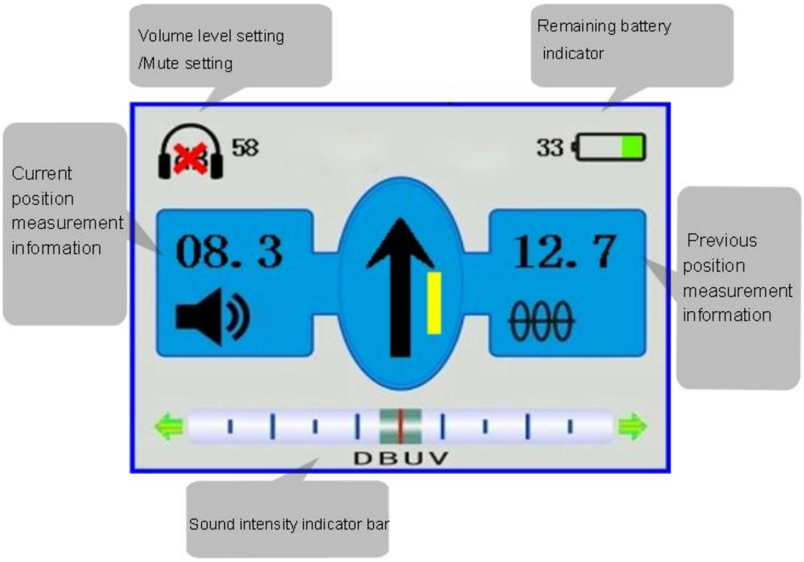
- After turning on the device, please check the remaining battery level of the lithium-ion rechargeable battery in the top right corner of the display. If you find that the battery level is close to 25%, please charge it first and start using it when the battery level is above 50%.

3. One-Touch Adjustment Knob on the Locator

- The receiver host is mainly adjusted using the one-touch adjustment button. Please refer to the following diagram for the use of the one-touch adjustment button.

Gesture	Functions of the measurement interface
	Adjust the volume (sound amplification)

4. Display on the Measurement Interface: The locator provides audio signals through the headphones. When you are in the process of precise location determination and approaching the fault point, the locator displays relevant information that may be useful via the measurement interface.



V. Starting to Use the Acoustic-Magnetic Locator for Cable Faults

Please connect the high-voltage integrated impulse generator (high-voltage unit) to the faulty cable and start applying an appropriate impulse voltage to cause flashover breakdown discharge at the fault point of the faulty cable. An appropriate impulse voltage refers to the highest allowable impulse voltage that is suitable for the model of the cable being tested and will not cause damage to the cable. For more details on the use of the high-voltage impulse generator (high-voltage unit), please refer to the operation manual for the integrated high-voltage power supply of the product.

5.1 Procedure for Precise Location Determination

When you are approaching the fault point, please follow the following procedure in order:

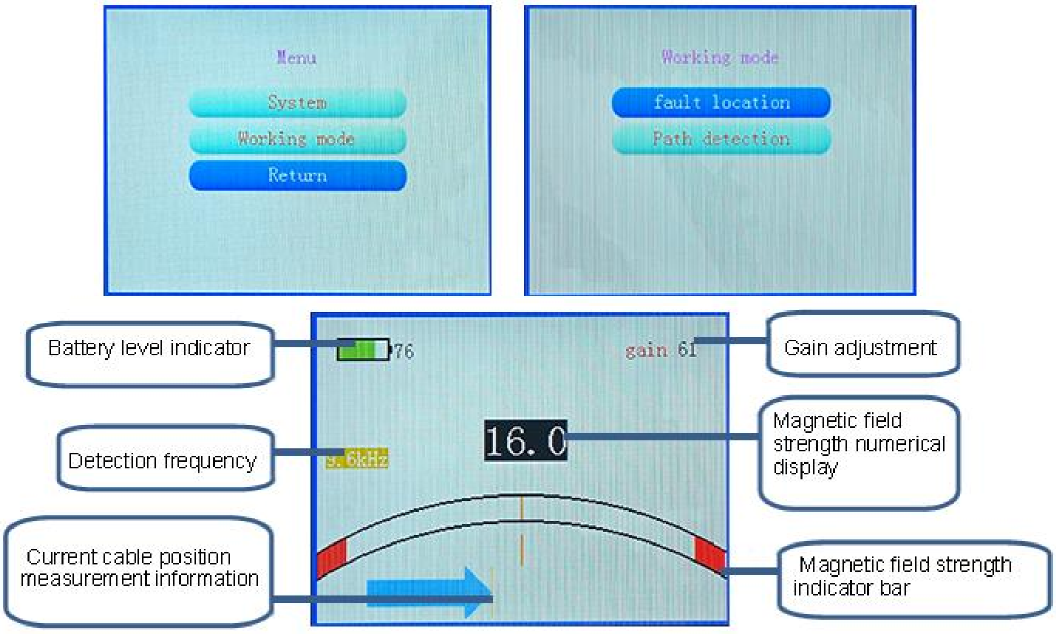
Steps	Action
1	Please place the ground microphone of the locator at the starting point.
2	If the locator cannot pick up any sound signals at this measurement point, please proceed along the path of the cable under test. When you find that the locator receives the first useful impulse discharge sound signal, the liquid crystal display on the left side of the locator's main unit will automatically show the sound level at that measurement point. If you are unable to pick up impulse discharge sound signals through the ground microphone or headphones over a longer area, you should try to pinpoint the location from the starting point in the opposite direction.

3	Please continue along the path of the cable under test, moving one step at a time, and adjust the position you believe to be the center axis of the cable under test as necessary. At each measurement point, please pause for a few impulse discharge pulse signals. As you get closer to the cable fault point, you will hear a louder knocking sound, and the numerical value displayed on the locator for the current measurement point will gradually decrease.
4	Please rotate the ground microphone of the locator by 180° and approach the fault point again with smaller steps.
5	Please continue to reduce the step size, search for the location with the loudest fault sound, and determine the fault point as accurately as possible. Then, make an precise mark on the ground.

5.2. Procedure for Route Detection

5.2.1 Adjustment and Settings on the Measurement Interface

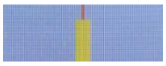
You need to press a single button on the measurement interface to enter the menu interface. In the submenu for working modes, select "Route Detection" to switch to the route detection measurement interface, as shown in the figure below:



5.2.2 Procedure for Route Detection Operation

When performing route detection, please follow the following procedure in order:

Steps	Action
1	Please place the ground-probing sensor of the locator at the starting position of the cable.

2	Continuously observe the direction indicated by the arrow on the display screen, the magnetic field strength value, and the magnetic field strength indicator bar. If the arrow points to the right (i.e., ), it means the cable is on the right side of the sensor, and you should continue moving to the right. If the arrow points to the left (i.e., ), it means the cable is on the left side of the sensor, and you should continue moving to the left. If a yellow line appears at the axis position (i.e., ), it means the cable is directly below the sensor, and you should continue moving forward.
3	When the cable is detected directly below the sensor: If the magnetic field strength value consistently displays 99.9, you should rotate the single button counterclockwise to reduce the gain. If the magnetic field strength value is less than 90, you should rotate the single button clockwise to increase the gain, making it easier for the user to accurately judge the distance to the cable.

5.3. Shutting Down the Locator

Please press and hold the power on/off button on the locator host.

Note: This instrument is only for trained and experienced professional electrical personnel.

Anyone else should stay away from this instrument.