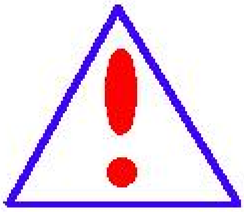
UHV-500

Cable Fault Locator

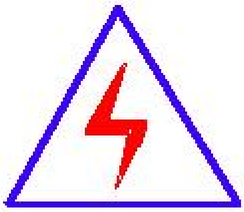
User Manual

Dear Client,

Thank you for Purchasing our UHV-500 Cable Fault Locator. Please read the manual in detail prior to first use, which will help you operate the equipment skillfully.



Our aim is to continually improve and perfect the company's products, so there may be slight differences between your purchase equipment and its instruction manual. You can find the changes in the appendix. Sorry for the inconvenience. If you have further questions, welcome to contact with our service department.



The input/output terminals and the test column may bring voltage, when you plug in/pull out test line or power outlet, they will cause electric spark. PLEASE CAUTION RISK OF ELECTRIC SHOCK! To avoid risk of electric shock, be sure to follow the operating instructions!

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◆ SERIOUS COMMITMENT

All products of our company carry one year limited warranty from the date of shipment. If any such product proves defective during this warranty period we will maintain it for free. Meanwhile we implement lifetime service. Except otherwise agreed by contract.

◆ SAFETY REQUIREMENTS

Please read the following safety precautions carefully to avoid personal injury and to prevent the product or any other attached products being damaged. In order to avoid possible danger, this product can only be used within the scope of the provision.

Only qualified technician can carry out maintenance or repair work.

--**To avoid fire hazard or personal injury**:

Use Proper Power Cord

Only use the power wire supplied by the product or meet the specifications of this product.

Connect and Disconnect Correctly

When the test wire is connected to the charged terminal, please do not connect or disconnect the test wire at will.

Grounding

The product is grounded through the power cord; besides, the ground pole of the shell must be grounded. To prevent electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, please do check that the product is properly grounded.

Pay Attention to the Ratings of All Terminals

To prevent the fire hazard or electric shock, please be care of all ratings and labels/marks of this product. Before connecting, please read the instruction manual to acquire information about the ratings.

Do Not Operate without Covers

Do not operate this product when covers or panels removed.

Use Proper Fuse

Only use the fuse with type and rating specified for the product.

Avoid Touching Bare Wire and Charged Conductor

Do not touch the bare connection points and parts of energized equipment.

Do Not Operate with Suspicious Faults

If you encounter operating faults/suspect there is damage to this product, do not continue. Please contact with our maintenance staff.

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in Explosive Atmospheres.

Ensure Product Surfaces Clean and Dry

—Security Terms

Warning: indicates that death or severe personal injury may result if proper precautions are not taken

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Caution: indicates that property damage may result if proper precautions are not taken.

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I. Cable Fault Tester

1. Brief Introduction

Smooth wire communication and power transmission depend on the normal operation of cable lines. Once the cable error happens, without timely detect and excluded, great economic losses and bad social influence will be caused . Thus, the cable fault tester is an important tool for maintaining the various cables. The Cable fault tester owns a variety of fault detection methods, with the application of the most advanced electronic technology achievements and devices, using computer technology and the special electronic technology, and also combined with our company's successful experience in the cable tester . It is the full-featured brand-new products combined with high-tech and intelligence.。

This cable fault tester is a comprehensive set of cable fault detection equipment. It can be used to detect flash-over cable fault, the earthing of the resistance, short circuit , cable break, and poor contact, with acoustic instrument, the exact location of the fault can be accurately detected. This tester is particularly suitable for testing voltage power cables and communication cables in various models and different levels

2. Main Characteristics

Fully Featured

It can test faults safely, rapidly and accurately ; This Tester uses low-voltage pulse method and high-voltage pulse flash-over method to detect a variety of cable faults, especially for flash-over of cable, it can be used directly without burning through cables . If equipped acoustic tester, the exact location of the fault can be accurately measured;

High precision

The instrument uses a high speed data sampling method ,The sampling rate of A/D can be 100MHz, which made the read resolution of this machine is 1 meter, and the blind spot detection scope is 1m.；

High intelligence

Test results are automatically displayed on the large LCD display with waveform and data; which made the fault spot easy to be detected. And it owns Chinese menu with operation functions, so you don't need the training of the operating personnel;

The waveform and data can be stored and tuned out;

waveform and data will still be stored even when it is turned off because of the function of the non-volatile devices.

it can show the dual trace;

it can compare the fault waveform with normal waveform, which is conductive to further determine the fault;

It can extended the proportional of the waveform;

If the waveform proportion changed, the accurate testing can be achieved ;

The position of the double cursor can be changed as you like, it can show the direct distance or the relative distance of the fault point and the tested point ;

It can modify the transmission speed with different tested-cable;

The small size makes it portable and the built-in rechargeable battery makes it easy to carry and use.

3. The Main Technical Parameters

Applications and Uses

This tester can test various types of power cables (voltage 1KV ~ 35KV) and telephone cable, FM communication cables, coaxial cables, and the short circuit on the metal overhead cables, grounding, high resistance leakage, high impedance fault flash-over ,cables disconnection, and poor contact fault; and it can also test the length of the cable and the waveform transmission velocity.

Farthest test distance: 15Km (open wire up to 100 km)

Detection blind area : 1m

Data-reading resolution: 1m

Power dissipation : 5VA

Conditions of Use: Ambient temperature 0 ℃ ~ + 40 ℃

(Limit temperature -10 ℃ ~ + 50 ℃)

Relative humidity 40 ℃ (20 ~ 90)% RH

Atmospheric pressure (86 ~ 106) Kpa

Volume: 275 × 220 × 160mm3

Weight: 1.8kg

4. The block diagram and the basic principles of the Tester

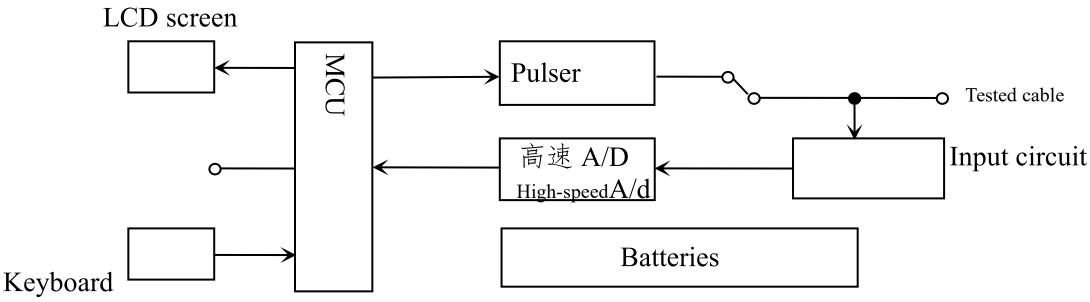
4.1 The basic principle

According to the principle of fault detection method the tester used , when the tester is triggered by the flash-over , the single transient waveform will come out , so that the tester should have the function of storing oscilloscope, capturing and displaying the single transient waveform. The instrument uses digital storage technology, taking advantage of high-speed A / D converter for sampling , and change the transient analog signal into digital signal, when the signal is stored in the high-speed memory, and processed with the CPU microprocessor, the signal can be transferred to the LCD display control circuit , and change into the timing lattice information, therefore the current sample waveform parameters can be showed on the LCD screen.

When the tester is triggered by the pulse, the tester will sent out probe pulse with a certain cycle, and the pulse will be put into the tested-cable and input circuit, the A / D will start immediately, the sampling, storing, processing and displaying process is just like the same ; The LCD display should show the reflection waveform.

4.2 The block diagram

The microprocessor is the core of the tester, it controls of the transmitting , the receiving and the digitization processing of the signal; The working method of block diagram is shown as below:



Working Diagrams

The digital processing tasks of the microprocessor including --the data collection, storage, digital filtering, cursor movement, distance calculation, graphical comparison, expanding the ratio of the image, and then the data can be transferred to the LCD display. And it can be also connected with the PC though the communication port.

The pulse generator is the logic pulse made automatically with a certain width according to the encoded signal the microprocessor sent. Processed by the transmitter circuit, this pulse is converted into a pulse of high amplitude, and then sent to the cable- tested.

High-speed A / D signal generator is used when the signal is returned from the tested cable, the signal is processed by the A/D sampling circuit, changed into the digital signal and finally sent to the microprocessor for processing.

The keyboard is the key to the man-machine communication. According to the test command, the operator can input the instruction through the keyboard to the computer, and then complete a test function by a computer.

5. The Structure Of The Panel

6. Interface Function description

6.1 Interface Function Instruction

1) Power Switch

It controls the power of the tester, press this bottom, the instrument is powered on, the display will show the viewport ;

2) Power outlet

External 12V DC power input;

3) Mode selection switch

It is divided into two files, when pressed down, it is in the flash-over working mode, when pop up, it is in the pulse working mode;

4) Gain knob

This knob controls the magnitude of the waveform;

5) Output interface

Connecting the tested end of the tested cable with testing line;

6) USB interface

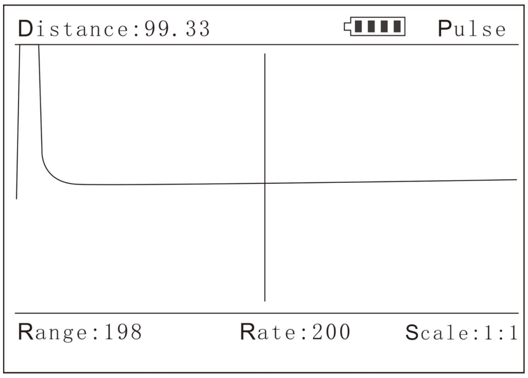
USB port can only be used for expansion port, while can not be used for communicati on;

7) Charge Indicator

Connected to an external power source (DC12V) with the cable, the tester can be charged;when it shows red, it indicates it is charging, green indicates it is fully charged.

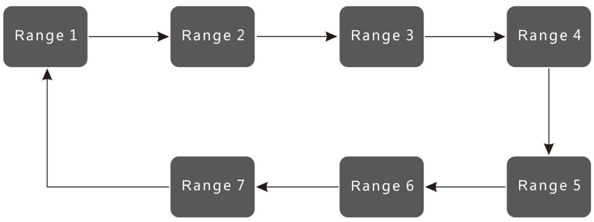
6.2 Button Function Instruction

The initial interface:



1) "Range" button

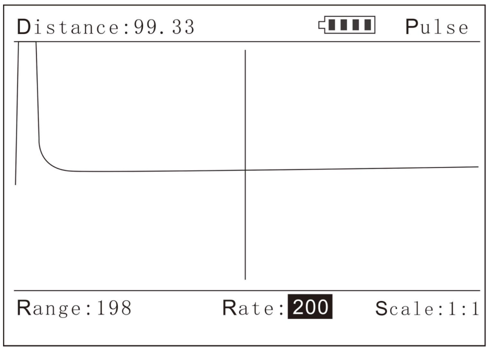
Adjusting the measurement range on the LCD screen , there are seven files in total, each time when pressed , the range doubled, if it is already the maximum range, pressing the "Measuring Range" key , then it will return to the minimum range of that file;



2) "Velocity" button

The initial waveform velocity of the tester is 200m / μs, the corresponding data should be entered in accordance with the actual type of the cable, otherwise the result will be incorrect . There are some of the common values of the velocity of the cable for reference in appendix 1 . If the velocity can not be confirmed, it should be calibrated (please check Chapter 7 1.2 "velocity check"). The Modifying of the velocity is showed as follows:

① Press the "waveform velocity" key to highlight the velocity menu, as showed below



② Press the ← or → key to modify the velocity value;

③ when it is already adjusted to the required velocity values, pressing the "waveform velocity" to confirm and exit velocity menu;

3) "Pulsing" button

Each time you press this bottom, the tester will sent out a pulse and then sample;

4) "Communication" button

The content on the LCD screen will be upload to the host computer via USB,please see the appendix II about the installment and use of the host computer.;

5) "Zoom" button

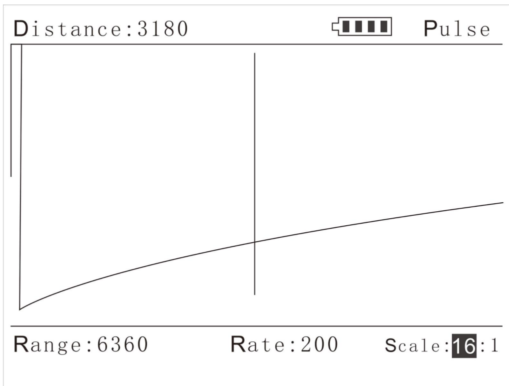
Proportion and measuring range has the following relationship:

Measuring range	Proportion					
The fist range	1:1					
The second range	1:1					
The third range	1:1	2:1				
The fourth range	1:1	2:1	4:1			
The fifth range	1:1	2:1	4:1	8:1		
The sixth range	1:1	2:1	4:1	8:1	16:1	
The seventh range	1:1	2:1	4:1	8:1	16:1	32:1

The red font in the table indicates different measuring ranges, and shows the ratio automatically.

To change the ratio, you need to do the following steps (notes: On the first range and second range, the proportion operation can not be performed):

① Press the "Zoom" button , the interface will be showed as follow:



② Press "menu" to select proportion, the number behind the proportion will be highlighted, the interface will be showed as follow:

③ Press← or → key to change the proportion range ;

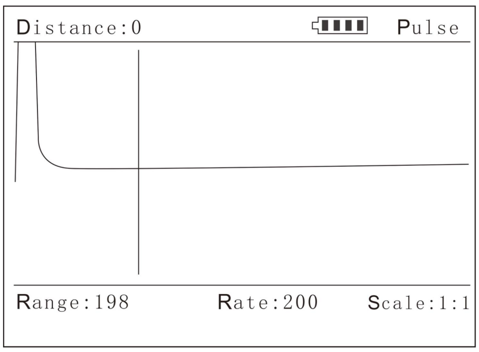
④ Press "Zoom" button to confirm and exit to the main menu.

6) "Zero" button

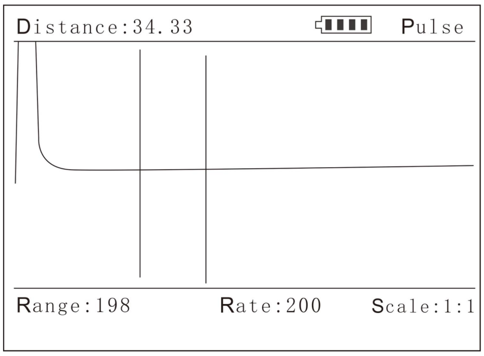
There are two cursors on the screen when the tester is on, one is in the leftmost of the panel (start) and another is in the intermediate position, the leftmost point is the position of the default zero position 0 (leftmost), the default value of the central cursor is the median, when it needs to change the zero position, the following operations should be took:

① Press ← or → to move the central cursor to the zero point to be set:

②Press "Zero" key , the original starting cursor and the moving cursor coincide into the new starting point, The fault distance on the upper left of LCD screen shows zero.



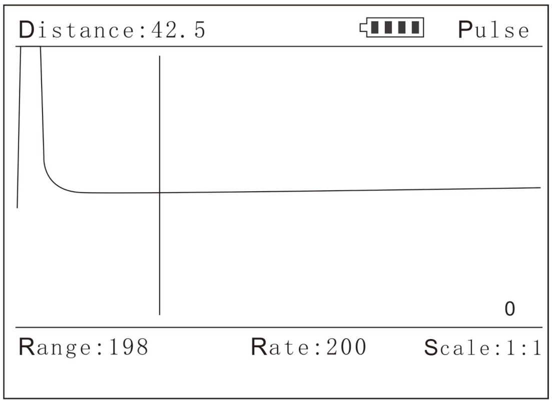
③Press ← or → key , what shows on the upper left of the display screen is the relative value between the starting cursor and the moving cursor;



7) "Storage" button

The instrument owns the waveform-storage function, with this function, The waveform tested can be stored in the instrument, so that it can be tuned out for future comparison, the detailed steps are showed as follows:

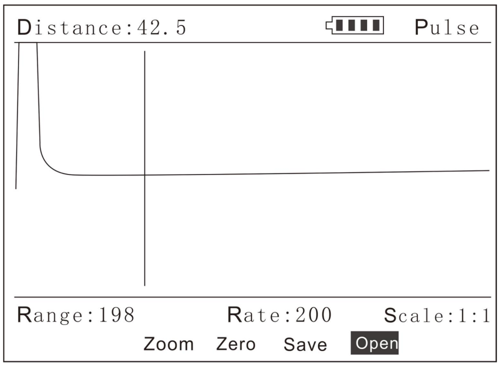
Press "Storage" button to confirm, the waveform on the screen will be stored in the microcontroller FLASH:



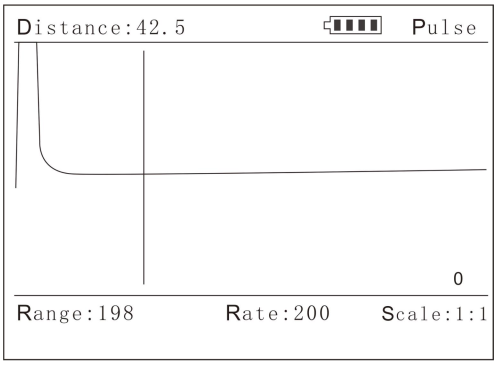
8) "Open" button

Since the instrument uses a non-volatile memory, stored waveform will not lose even the instruments is shutdown. Thus,The waveform and parameters can be tuned-out any time for analysis, and the stored waveform can be tuned out to compare with the current waveform for pinpoint the exact fault point. Here are the detailed steps:

① Press the "Menu" key, choose the sub-menu options, press ← or → key to "tune out" the highlight:



②Press "Open" button to confirm, the waveform stored in the FLASH microcontroller will be tuned out:



③ The FLASH have three pictures, press ← or → key choose the picture which to be open.

7. The use of the tester and fault testing methods

7.1 Pre-test preparation

7.1.1 detect the type of fault

Before testing cable fault, the first thing need to so is to detect the type of the fault, then we can judge which test method should we use. By means of a multimeter, megohmmeter or other tools, and spot experience, you can predict the fault type.

If the fault type is off-load voltage, short-circuit, bad connection, or low impedance grounding, it should be tested by the low-voltage pulse method. If it is high impedance fault, high voltage flash-over method should be used. If the fault type can not be determined, you can use the waveform comparison method.

7.1.2 velocity check

When the velocity of the cable can not be determined, it must be adjusted to ensure the accuracy of the measurement.

The methods are showed as follows:

1) Prepare a standard cable which is of the same type with the tested cable , linking it to the tester's output port;

2) Turn on the instrument power switch;

3) Please adjust the mode selection switch to the pulse mode, the upper right corner of the screen displays "pulse";

4) Press the "measuring range" button, please adjust the measurement range to a scope that is bigger than the length of the standard cable;

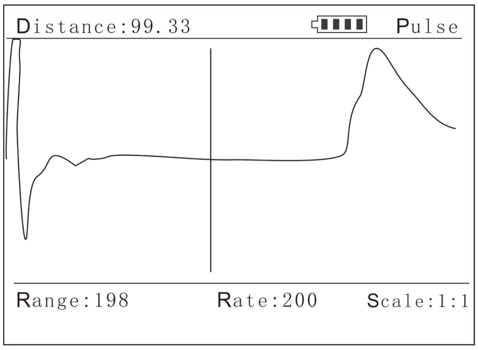
5) Press the "pulse" button to send a test pulse, then you will get the reflected waveform on the screen;

6) Press " ← or →" key to move the cursor to the inflection point of the reflected waveform; if the reflected waveform is not good to identify, adjust the gain knob to change the waveform amplitude, press "Pulse" button, resend pulse;

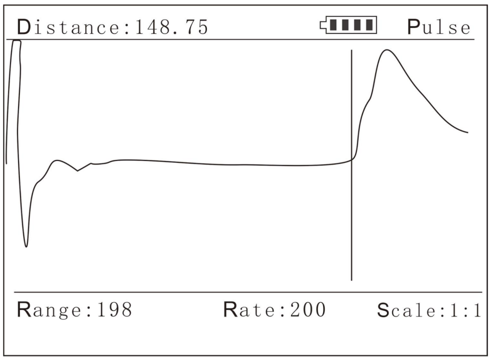
7) Press the "velocity" key and " ← or →" key to modify the velocity values until the measured distance value is substantially equal to the length of the standard cable , then please take a note of this value for future use.

For example: There is a roll of cable , which the length is 100m. The cable velocity can be measured by the following steps.

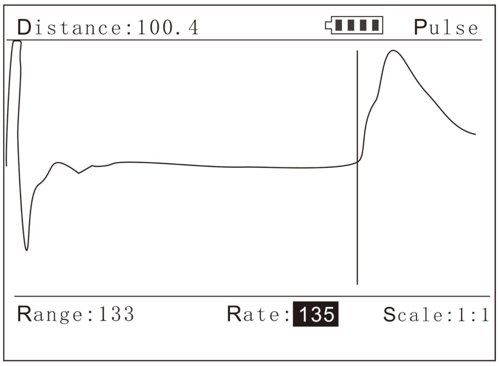
Step one: connecting the cable in a right way, and then turn on the machine, there will appear a picture as follows:



Step two: Move the cursor to the inflection point, as shown below:



Step three: Change the velocity, so as to make the the fault distance showed on the top left of the screen is about 100m , as shown below:



Step Four: You can see the cable velocity is 135.

7.2 Fault detection

7.2.1 the low-voltage pulse method

1) Please disconnect all the instruments and the tested cable;

2) Please connect the tested cable with the tester's output port;

3) Turn on power switch of the instrument;

4) Please adjust the mode selection switch to the pulse mode, the upper right corner of the screen will display "Pulse Method";

5) Please refer to Appendix 1, and then adjust the velocity , making it consistent with the measured cables;

6) Please turn the the gain knob to maximum, and then press " pulsing" button to send a test pulse, then reflected waveform will be showed on the screen;

7) If there is no reflected waveform, please adjust the measuring range and then resend pulse, trying several times, until the reflected waveform can be observed;

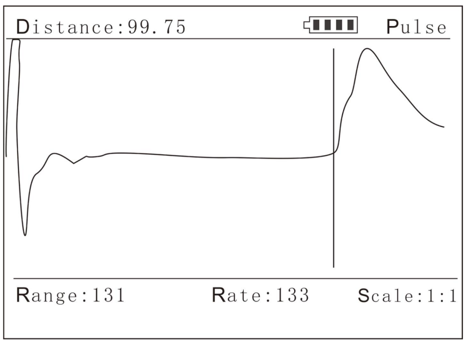
8) Please adjust the gain knob and resent the pulse, making the leading edge of the reflected waveform steepest;

9) Press " ← or →" key to move the cursor to the forefront of reflected waveform, in this case, the fault distance can be showed on the upper left corner of the screen;

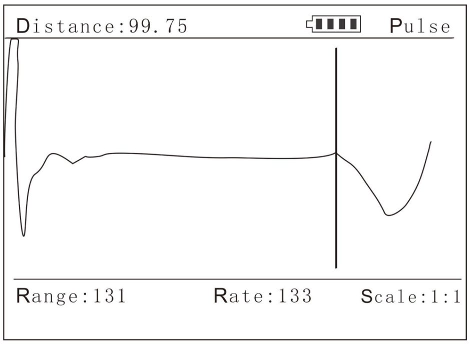
10) In order to improve accuracy, please change the waveform display proportion, the waveform will be expanded, then the pinpointing can be achieved by the above method;

11) The type of fault can be judged according to the polarity of the reflected waveform.

Off-load waveform is showed as follows:



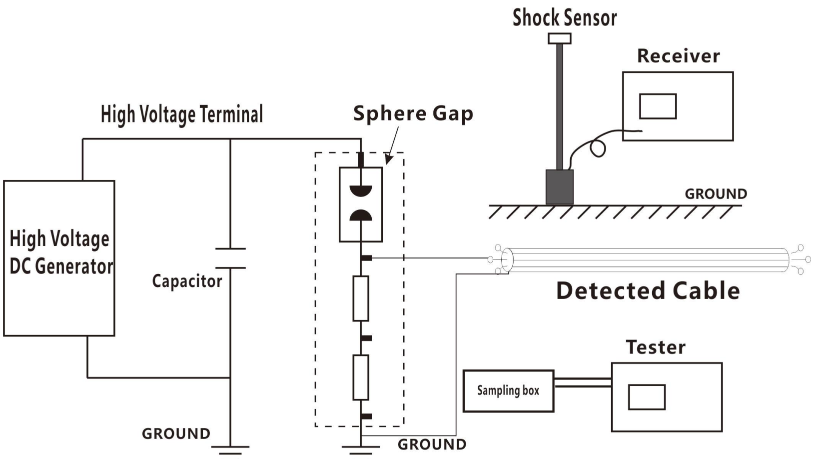
Short circuit waveform is showed as follows:



7.2.2 High voltage flash-over method (extension method)

This method is suitable when the fault resistance is high; it is achieved when the discharge ball gap sent the impulse high voltage to the tested cable, the impulse high voltage breakdown the fault point and then flash-over coming out; In a sense all the fault point which cannot be detect by the low-voltage pulse method can be measured by this method. So this method can be used in a large scope .

1) Please check whether the operating mode switch is set in the position of flash-over or not;



2) Please connect all the instruments as the picture below. And please also check the ground wire is also connected well;Of which the storage capacitor C should be more than 1μF, and the permissible ability should be suitable to the test;

3) Testing Method: Raise the voltage by the voltage regulator to a point at which the fault point can be breakdown; And the sphere gap distance should be adjusted

according to whether the tested cable can discharge normally or not; The situation of the discharging of the pulse flash-over fault point can be detect by the waveform showed in the process of discharging;

4) Flash-over can be detected by the discharging sound of sphere gap (Flash-over triggered by the breakdown of the fault point) or the instruction on the meter; if the discharge is not okay, please increase the test voltage, increasing the sphere gap distance or increase the capacity of the power-storage capacitor;

5) The test method of the fault distance is the same as the method used in low-voltage pulse method.

7.2.3 The waveform comparison

1) Please disconnect all the equipment with the tested cable;

2) Please connect the normal cable to the tester's output port;

3) Please read the measured waveform of the normal cable with low-voltage pulse method and save it (see Chapter 7, "2.1 low-voltage pulse method" and Section 2 of Chapter VI, "storage");

4) Please connect the fault cable to the tester's output port, and measure its reflection waveform;

5) Please recall/tune out the waveform we just saved (see Chapter VI Section 2 "tune out");

6) Please compare the difference between this two waveforms and then you find the fault point.

8. Notes

1) When using the low-voltage pulse method, Please remove all equipment of the fault cable;

2) When using the high-voltage flash-over method for testing, Please remember to choose working mode switch as "flash-over" mode;

3) When using the high-voltage flash-over method, please pay attention to the safety of personnel and equipment; And they must be properly grounded;

4) After the flash-over test is over, please cut off the power, and then discharge the high-voltage capacitor and cable; when discharge, please add the-current limiting resistor R to limit the discharge current, so that the current can discharge slow, when the voltage of the capacitor is reduced , then please discharge directly into the ground until the circuit resistance is zero; if discharging in a instant, the current can be up to several hundred amperes, there would be equipment ruins or personal injury.

9. Charging

When the internal battery power is not enough, it should be promptly charged; If the instrument keep long-term unused, it should be regularly charged as well to avoid damage to the battery. Charging indicator lights when charging, red indicates the charging, green indicates fully charged; charging takes about eight hours.

10. The repair of common faults

Fault Description	Possible reasons	Repair suggestions
The instrument is on, but the power indicator is off	1. The power indicator doesn't work; 2. Out of battery; 3. There is something wrong with the circuit board in the host computer	1Please check whether there are some images in the screen ; 2. Charging ; 3. Please contact with the local distributors or our company.
The instrument is on, the power indicator is on,but there is no image showed.	There is something wrong with the main board	Please contact with the local distributors or our company
The instrument is on, image also can be showed,but there is no transmitted waveform	1. The gain knob is improperly adjusted; 2. There is something wrong with the main board.	1. Please adjust the gaining knob in a proper way, and then transmitting the waveform; 2. Please contact with the local distributors or our company
When measuring,there are transmitted waveform,but there is no reflection waveform	1. Wrong measuring range; 2. The output test cable is not connected well with the tested cable 3. There is something wrong with the main board.	1.Please adjust the measuring range; 2.Please checking the connecting cables; 3. Please contact with the local distributors or our company

Appendix 1:Transmission velocity table of common cable (for reference)

The name of the cable	Items NO.	Tested Cable pair	Transmission speed
High-frequency communication	HEQ－2527×4×1.2＋6×0.9	This pair core wires	232m/μs
		others	240 ～ 244m/μs
	HEQ－2521×4×1.2	This pair core wires	248/μs
	HDYFLE22－156	This pair core wires	224m/μs
		To other core wire	230m/μs
low-frequency communication	HEQ212×4×12	This pair core wires	240m/μs
		This pair core wires	248m/μs
Oil communication	ZUQ 6KV3×703×150	Core wire — core wire	160m/μs
PVC insulated power cable	VLZ 3×120＋1×35	Core wire — core wire	178m/μs
PVC insulated power cable	VKV20 1KV3×50	Core wire — core wire	172m/μs
Medium-sized coaxial cable	4×2.6/9.4	Core wire — shield layer	283m/μs
Small-sized coaxial cable	4×1.2/4.4	Core wire — shield layer	274m/μs
Telephone cable	0.5×50	Core wire — core wire	196m/μs
	0.4	Core wire — core wire	190m/μs
	0.32	Core wire — core wire	182m/μs
Open line		Core wire — core wire	288m/μs

II.Cable trace detector

1.Product introduction

1.Equipment features:

(1) Low static drift: the core components are imported components with reliable performance.

(2) High output power: precision high-power tube is used internally to ensure that the output signal power is large enough and not easy to decay.

(3) Perfect protection function: the internal protection circuit of the instrument is complete, with overvoltage, overcurrent and other protection functions.

2.Cable trace detector layout

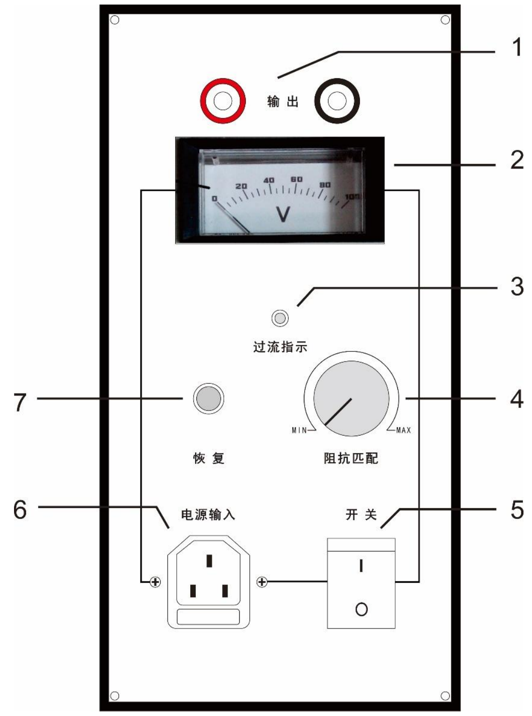


Figure 27.Cable trace detector layout

1. Output terminal   2. Pointer meter   3. Over-current indicator

4. Impedance gear switch   5. Power switch

6. Three core power supply base   7. Restore button

Note:

(1) Output terminal: the Cable trace detector signal output is used to connect the tested cable. The red terminal is connected to the normal phase cable core, and the black terminal is connected to the ground wire.

(2) Pointer meter: used to indicate the signal amplitude output indication. When the pointer has no sign of swing, please check whether the power supply is normal.

(3) Overcurrent indicator: when the test circuit has overcurrent, the indicator lights up and the instrument is in the protection state.

(4) Impedance gear switch: used to control the output signal power. Min indicates the weakest output signal and Max indicates the strongest output signal. When in use, the output power can be determined according to the swing amplitude of the meter and the sound of the headset.

(5) Power switch: used to control the opening and closing of the Pathfinder.

(6) Three core power socket: used for AC230V power input. The socket is equipped with safety socket and 2A safety tube is installed inside.

(7) Restore button: when the overcurrent indicator light is on, press this button to restore normal.

3.Technical parameters

(1) Working mode: output - fixed frequency intermittent square wave signal

(2) Output power: pomax ⩾ 100W

(3) Output impedance: 1 Ω-∞

(4) Output signal frequency: 16KHz

(5) Output signal amplitude: 15v-340v

(6) Power supply of Pathfinder transmitter: AC230V ± 10%

2.Operation principle

1. Tracing principle

The principle of Cable trace detector is: add an electromagnetic wave signal to the tested cable, receive the path signal through the magnetic signal receiving channel of the pointing instrument, and find the cable path. According to the characteristics of the minimum electromagnetic signal received on the ground directly above the cable, the buried position of the cable can be found accurately. The principle of path detection is shown in Figure 28:

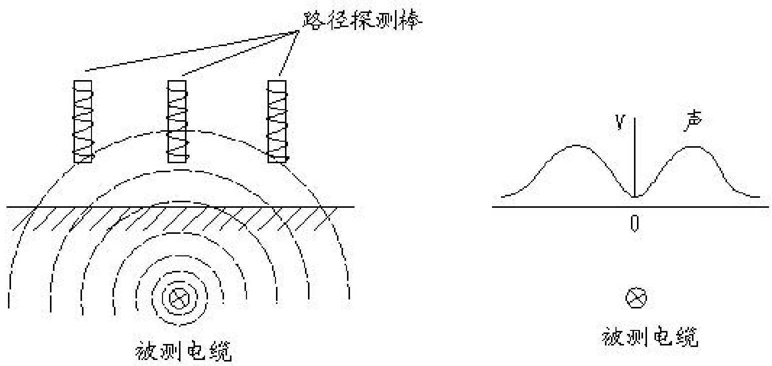


Figure 28 path detection diagram

2.Tracing method

(1) Disconnect all electrical equipment from the tested cable;

(2) Connect the test line with the tested cable core and ground wire and the corresponding output terminal of the Pathfinder.

(3) Connect the power supply, adjust the impedance matching switch to the appropriate position, and then start the machine.

(4) Switch the pointing instrument key to the path block, insert the path probe, the probe is perpendicular to the ground, monitor along the cable, find the smallest point between the two largest points of the path signal, and then the cable burial path can be detected.

Note: when searching the cable path, the pointing instrument must be placed in the path block, that is, press the pointing / path key. At this time, you can also directly watch the indicated value of the magnetic channel pointer meter without headphones to determine the cable embedding position, that is, the maximum indicated by the meter is near the cable, and the minimum or zero indication is directly above the cable (the receiving antenna is perpendicular to the ground).

III.Cable faut locator

1.Product introduction

1.Equipment features:

(1) Easy to carry: built in rechargeable battery power supply, suitable for various occasions.

(2) High positioning accuracy: quartz crystal oscillator and high-speed signal processing chip are used for signal sampling and processing, with acoustic and magnetic synchronization function to ensure accurate and reliable positioning accuracy.

(3) Strong anti-interference ability: under severe interference conditions, the instrument can still ensure good performance and stable operation.

(4) High receiving sensitivity: special manufacturing process is adopted, the transmission distance is increased, and the instrument can still receive signals clearly.

2.Cable fault locator layout

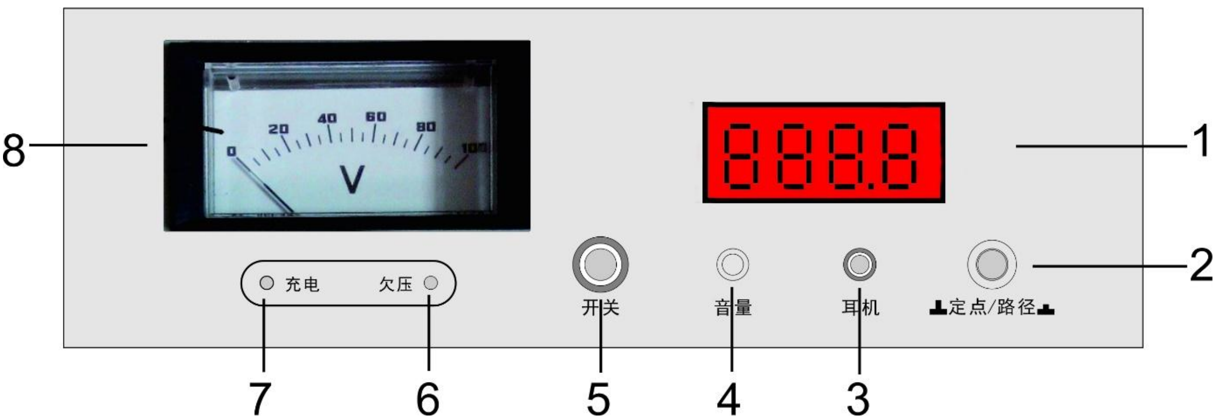


Figure 29. Cable fault locator layout

1.

1.Nixie tube display 2. Fixed point / path 3. Earphone socket

1. Volume adjustment 5. Power switch 6. Undervoltage indicator 7. Charging indicator 8. Pointer meter

Note:

(1) Nixie tube display: it is used to observe the time difference when the acoustic magnetic synchronization is fixed.

(2) Fixed point / path: fixed point mode when not pressed and path mode when pressed.

(3) Headphone socket: used to plug in headphones to listen to path signal sound and fixed-point discharge sound.

(4) Volume adjustment: adjust the size of path sound and fixed-point sound.

(5) Power switch: the switch that controls the instrument.

(6) Undervoltage indicator light: when this light is on, the equipment shall be charged in time.

(7) Charging indicator light: this light comes on when the charger is inserted.

(8) Pointer meter: displays the size of the received electromagnetic signal.

Figure 30. Cable fault locator back layout

1. Sound input socket 2. Magnetic input socket

Note:

(1) Sound input: used to insert the earpiece at fixed point.

(2) Magnetic input: insert path or fixed-point magnetic signal probe

3.Technique parameters

(1) The rough measurement error is less than 10%, and the fixed-point error is

< ± 10cm.

(2) Electromagnetic channel gain > 110dB (300000 times).

(3) Sensitivity of electromagnetic channel receiver < 5 μ V。

(4) Sound channel audio amplifier gain < 120dB (1 million times when signal-to-noise ratio is 4:1)

(5) 50Hz power frequency suppression system > 40dB (100 times)

(6) Sound magnetic synchronous display monitoring: that is, when the site is fixed, the digital screen is formed under the impact of high voltage

Under the action of shock electromagnetic wave, repeat the count once, and display the fault distance or full 500.0.

At the same time, the high resistance earphone monitors the spark generated by the cable fault point during the impact discharge and electric breakdown.Seismic wave to eliminate the interference of environmental clutter.

(7) Power consumption: < 120mA (0.7W)

(8) Buried depth detection: ≤ 3M

2.Operation principle

1. Cable fault locator principle

The fixed-point instrument adopts the fixed-point principle of the combination of acoustic measurement fixed-point method and acoustic magnetic synchronous fixed-point method. When the acoustic measurement method is fixed, the digital tube meter of the pointing instrument indicates the seismic wave received by the acoustic probe, and the headset also reflects the seismic sound wave received by the acoustic probe.

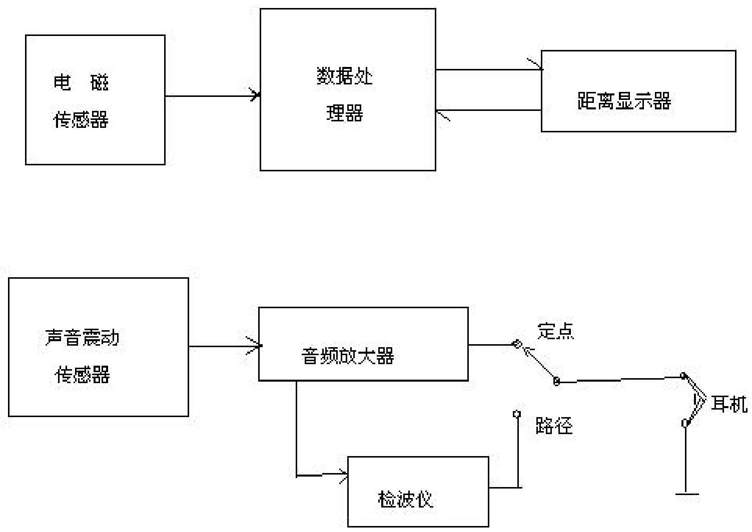


Figure 31 Cable fault locator diagram

At the fixed point of impulse high voltage discharge, the electromagnetic sensor receives the electromagnetic wave radiated by the cable and sends it to the data processor. After amplification and shaping, it starts the internal distance conversion circuit. When the sound sensor receives the seismic wave of the fault point transmitted from the underground, it is also sent to the data processor for amplification and shaping to generate the counting interrupt signal, and let the distance display display display the final processing result (fault distance number). And freeze the displayed figures to provide stable observation. During the second impulse discharge, repeat the above process and refresh the last displayed data. Because the propagation speed of electromagnetic wave is very fast, which is much higher than that of surface acoustic wave, according to the propagation time difference between electromagnetic wave and acoustic wave, the fault distance is converted by data processing circuit by using the formula s = TV (s: distance, unit meter; t: time difference, unit second; V: propagation speed of acoustic wave in surface layer or cable, XXX M / s).

The audio amplifier can amplify the weak seismic wave signal picked up by the sound vibration sensor, monitor its size by the headset, and accurately fix the point with the data on the display screen.

If the seismic wave is too weak to form a counting interrupt signal, the distance display will automatically send an interrupt signal to make it full bright and display 500.0m.

2. Cable fault location method

(a) after the flash tester roughly measures the fault distance, first understand the cable direction, joint, residual, etc. Then measure the rough fault distance and find the approximate location of the fault point.

(b) apply impulse voltage to the fault cable. When the impulse high voltage generator makes high voltage impact on the fault cable (the impulse high voltage amplitude shall be high enough to ensure full breakdown and discharge at the fault point), force the fault point to discharge rhythmically. Whether the fault point is discharged or not is the key to the success of test and fixed-point.

(c) place the sound vibration sensor probe above the cable path (or fault cable body), turn on the power switch, and set the pointing instrument to the "fixed point" position. On the one hand, monitor the seismic wave through the headset, on the other hand, observe the distance display screen. When the seismic wave is not heard (the listening point is too far away from the fault point), count and refresh once from the display screen for each impulse discharge, and display the full amount of 500.0 each time. Move the sensing probe along the path above the cable until the seismic wave sound of the fault point is heard (it indicates that it is not far from the fault point at this time). When the seismic wave sound heard is strong enough, the distance display will show the number of fault distances. At this time, the sensor probe can be directly placed at the corresponding position according to the digital display distance. Move the probe back and forth at this place to find the place with the lowest digital display value, which is the accurate fault position. And this digital display value is also the approximate local buried depth of the cable (at this time, the sound in the headset should be the largest, and the sound heard each time is synchronized with the refresh display of the digital display).

For faults with small discharge sound, the discharge ball gap can be increased, the impulse voltage can be increased, or the capacitance can be increased to improve the impact energy and discharge sound, so as to facilitate the fault location.

For dead ground fault and closed cable fault, the discharge sound is particularly small. When fixing a point, the distance must be measured accurately. If necessary, dig the ground near the fault and directly monitor the fixed point on the surface of the cable. For dead ground fault, the path meter plus path signal can be used to carefully identify the fault point, and the weak change of path signal can be used to find the fault point.

In the actual test, we should learn to flexibly use the fault fixed-point methods such as acoustic measurement fixed-point method and acoustic magnetic synchronous fixed-point method, which will quickly find the fault point with twice the result with half the effort.

3. Measuring the buried depth of cables

When measuring the path of the cable, the probe head shall be vertically close to the minimum sound point on the ground, so that the probe tilts 45 degrees along the cable path (the sound becomes louder at this time), and then move the probe in parallel along the vertical direction of the cable path. At the same time, use headphones to monitor the sound. When the minimum sound is heard again, the distance the probe moves on the ground is the buried depth of the cable.

4. Operation skills of acoustic magnetic synchronous cable fault locator

Any kind of instrument and equipment can give full play to its function with half the effort only after fully understanding its performance and characteristics. Although the operation of the pointing instrument is extremely simple and convenient, it must be used skillfully according to the field characteristics in order to give full play to its advantages.

From the principle introduced in the operation manual, this pointing instrument starts counting after the electromagnetic sensor in the instrument receives the radiated electromagnetic wave generated by the fault cable during impulse discharge, and stops counting after the sound sensor receives the seismic wave generated by the fault point discharge. The time difference between electromagnetic wave and sound vibration wave multiplied by the propagation speed of underground sound wave is the linear distance from the probe to the fault point (i.e. the value displayed on the digital screen). In other words, only after the impact flashover, the probe hears the seismic wave from the fault point and stops the counter, the displayed value is effective and reliable. However, there may be two situations when locating the fault point on site. One is that the probe is too far away from the fault point. When the high-voltage equipment shocks and discharges the cable, the pointing instrument only starts counting after the electromagnetic sensor receives the radiated electromagnetic wave, and there is no seismic wave to stop the counting of the counter, and the headset can not hear the seismic wave. Therefore, the counter will count up to the original set number of 500.0. Moreover, the counter will be refreshed again every time the impulse discharge occurs, but 500.0 is still displayed. The screen information only tells the operator that the impulse flashover function of the high-voltage equipment is normal, so it is safe to continue to measure and listen along the cable path. In the second case, when the shock flashover occurs, the earphone can hear strong enough seismic wave sound, and the counter will no longer display full scale 500.0. Instead, a fixed value is displayed. (there may be a jump in the last two digits), the probability of repeated display of this fixed value is quite high. At this time, the operator can conclude that the digital display distance is the linear distance from the probe to the fault point.

When the fault distance can be determined, the next step is to arbitrarily move the probe about one meter along the cable path to judge the direction. If the reading decreases by one meter, it proves that the moving direction is correct. If the reading increases by one meter, it means that it is far away from the fault point. The probe can be moved directly near the fault point according to the screen display distance. At this time, the seismic wave intensity increases and the screen display number decreases significantly. As long as you move the probe carefully and slowly there, you will always find that the reading at some point is the smallest. No matter the probe moves in any direction, the reading will increase. Then this point is just above the cable fault point. The screen display number at this moment is the cable burial depth at this point. And if you monitor with headphones at this time, you will find that this point is the maximum point of seismic wave.

5. On-Site precautions

In the actual cable fault location site, the situation is often very complex. Four points should be noted Yes.

(1) If the site environment is noisy (such as beside the highway with large traffic flow, the street with many people, or near the construction site, etc.). During flashover impulse discharge, in addition to the vibration wave from the fault point, there are also the sound of car engine, horn, footsteps, speech, machine roar. These noises will seriously affect the reading stability of the counting screen of the pointing instrument. Makes the readings seem disorganized. In fact, it still has its regularity. Careful observation of the reading can find that the reading of the counting screen always has a relatively stable maximum reading. No matter how the noise interference changes, as long as the noise is not continuous, the occurrence rate of this maximum reading is very high. This reading is the distance from the fault point. Ignore the irregular

small readings that often appear on the counting screen. As the probe approaches the fault point, its maximum reading will gradually decrease. When the stable maximum reading becomes the minimum, this is the exact position of the fault point.

(2) If there is continuous loud noise at the fixed-point site, such as the sound from motor, blower, exhaust fan, generator, vacuum pump, etc., the digital display will fail. No matter where the probe is placed, the digital display screen will always show a small value of a few tenths of a meter (or even 0.1M). At this time, only the acoustic and electrical synchronous detection function of the pointing instrument can be used to listen to the seismic wave synchronized with the refresh count of the digital screen, use people's judgment to distinguish the environmental interference noise, and determine the fault location with the maximum point of the vibration wave, without paying attention to the reading of the digital display screen.

(3) The cable fault point located on the site is located in the buried pipe. During impulse discharge, the sound is the highest at the two ports through the pipe, but the sound may not be heard at the central part of the pipe, so there may be fixed readings at the two pipe orifices, while only 500.0 is displayed at other places (such as the central part of the pipe or away from the pipe orifice). At this time, the fault position in the pipe can be judged according to the value change law of the two stable reading points. As long as the pipe is dug out, the probe can be used to carry out accurate positioning on the pipe, and the error at this time will generally not exceed 10 cm.

(4) If the fault cable is located on the bent of the cable trench and it is a closed fault (i.e. the cable sheath is not broken. During impact discharge, the flashover of the fault point is only between the core wire and the sheath, and there is no

spark outside). During impulse discharge, there is long-distance strong vibration on the cable body, and the maximum position of vibration can not be determined by acoustic measurement method and synchronous fixed-point method. At this time, the conventional pointing instrument will completely fail, and the acoustic magnetic synchronous pointing instrument can give full play to its advantages. As long as the probe is placed on the cable body with strong vibration, the digital display screen will record the distance between the probe and the fault point at the same time of impact flashover. The operator can quickly place the probe near the fault point according to the distance indication to find the position corresponding to the minimum reading of the digital display screen, which is the accurate fault point. Sometimes, there will be slight vibration along the whole cable during impulse flashover, and the strength is almost the same everywhere, but the sound at the joint may be a little louder. This is the "motor" effect of the cable during impulse discharge. Don't be confused by this sound. The vibration sound at the fault point is very large, which is obviously different from the small vibration sound of "motor" effect vibration of the whole line. You can ignore this small vibration and go straight to the obvious larger vibration wave (from the fault point).

Due to the high sensitivity of the electromagnetic sensor of the pointing instrument, when the host of the pointing instrument is too close to the running cable, the power frequency radiation of the cable will seriously interfere with the counter. The phenomenon is that the last two and three digital tubes of the counter will flash constantly and cannot count normally. At this time, as long as the host is rotated 90 degrees, the side of the host is aligned with the cable and away from the running cable, the power frequency radiation interference can be reduced and the counting screen can read normally.

In case of cable failure, as long as high-voltage impulse flashover equipment is equipped to conduct high-voltage impulse flashover to fully discharge the fault point, 2-3 people carry a pointing instrument to listen to and measure each cable joint that may fail along the cable path (generally, the probability of failure of the middle joint and end of the cable is more than 90%). If the fault point is not at the joint, the operator can listen one meter and one meter along the cable path separately, and generally can accurately locate the fault point within one hour. Only when the length of the faulty cable is more than 500 meters or even several kilometers, can the fault location be found quickly, accurately and economically by roughly measuring the fault distance with the intelligent cable instrument.

When accurately locating the cable fault, first of all, ensure that the impulse voltage of the impulse high-voltage generating equipment should be high enough to make the fault point fully breakdown and discharge (it can be judged from the sound size and crisp and loud degree of ball gap discharge, or from whether the waveform on the cable meter screen has large vibration waveform). In order to make the discharge sound at the fault point of the faulty cable loud enough, the energy of impulse flashover voltage can be increased. The method is to appropriately increase the impulse voltage and increase the capacity of the energy storage capacitor as much as possible, such as 2-10 μ F。 In this way, greater acoustic vibration can be generated when the fault point is discharged, and the detection distance of the probe of the pointing instrument can be increased. Speed up fixed-point speed and improve accuracy.

For low-voltage power cable, the rough measurement and fixed-point method are completely the same as that of high-voltage power cable, except that the applied impulse voltage is much lower than that of high-voltage cable. According to experience, the maximum impulse voltage can be added to more than 10kV, but not more than 12kV. Because the pulse impact high voltage is added, the duration is generally only 1-3ms. Although the instantaneous power is large, the average power is very small. Generally, the impact high voltage below 12kV is completely harmless to the low-voltage cable. According to the successful examples of fault detection of low-voltage power cables all over the country, there is no problem when the impact high voltage is added below 12kV during fault location of low-voltage power cables, and the fixed point is safe, accurate and fast.

Finally, it should be noted that whether the high-voltage power cable or the low-voltage power cable, when the fault point is broken and damp and the gold attribute of the fault point is grounded, when the high-voltage flashover is impacted, the fault point generally will not produce flashover discharge. Therefore, the general pointing instrument can not hear the sound of discharge, resulting in the failure of pointing. We must use other methods to implement pointing. Don't doubt it easily.

Appendix I packing list

No.	Name	QTY	Packaged or not
1	Host	1	
2	Route test instrument	1	
3	Cable fault locator	1	
4	Flash meter sampling box	1	
5	Flash meter signal wire	1	
6	Flash meter charger	1	
7	Route test instrument output line(red & black)	1/1	
8	Test wire (black 1.5m)	1	
9	Route test magnet bar	1	
10	Route test magnet bar	1	
11	Grounding wire	1	
12	Cable fault locator charger	1	
13	Earphone	1	
14	Receiver	1	
15	Receiver connection wire	1	
16	Straps	1	
17	Fuse (2A)	3	
18	Three core power cord	1	
19	Ground needle	1	
20	Instruction manual	1	
21	Inspection report	1	
22	Certificate	1	
16	Straps	1	
17	Fuse (2A)	3	
18	Three core power cord	1	
19	Ground needle	1	
20	Instruction manual	1	
21	Inspection report	1	
22	Certificate	1	