



**PCLC-901D**  
**Cable Fault Locator**  
**User Guide**

## NOTICE

Thank you for choosing our devices.

Read the instruction carefully before using, especially pay attention to the security warning and tips.

Please don't maintain device by yourselves. Contact us if any breakdown or error.

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## **1. GENERAL DESCRIPTION**

### **1.1 GENERAL :**

The PCLC-901D Power Cable Fault locator is an easy operation device used for distance locating. It's easy to operate, support both touch screen/button operation and with friendly interface.

PCLC-901D can be used alone under the low voltage impulse mode. Under the mode of impulse current, PCLC-901D needs to work with high voltage generator items. Under the multiple impulse mode, PCLC-901D also need to work with coupler. After distance locating, user could use PCLD-904P items for fault pinpointing. And these products can be combined into a set of high performance and innovative cable fault testing system.

## 1.2 FUNCTIONS:

- Multiple distance locating method:

-Low current impulse method: apply to the locating of the low resistance fault. Short circuit fault, open circuit fault. It also can be used in the measurement of the cable length, the intermediate joints, T joints, and cable termination joint. This method also can be used to correct the wave velocity.

-Impulse current method: apply to the high resistance fault, breakdown fault. Use the current coupler to gather signal from the earth wire

-Multiple impulse method: improvement of the SIM method

- 200MHz real-time sampling

-Advance tech. Upgrading for SIM method

-Max. 0.4m measurement resolution, PCLC-901D has small blind zone and is special for the short cable and nearly-terminal fault cable

- Touch screen and press key operation

-Touch operating screen with smart gesture operation

-Support cursor drag-drop function and double-click function, easy to locate

-Simple function menus with high performance.

- Big color LED screen, friendly interface

-Simple function menus with high performance

- 7" LED screen, 160° viewing angle, bright with 750cd/m<sup>2</sup> to view under sunshine

-PIP copy (pic. temporary storage). There'll be a main window and three temporary storage windows could check three waveform together.

- Waveform storage and PC communication

- Special software management for software upgrade, backup and restore in device.

- Waveform storage and communication with computer.

- Internal storage of waveform.

- Optional mini printer for waveform printing

- Support connection with PC or laptop

- Power management

- Back light weakens if no operation in 2 min and power off in 10 min. if no operation.

- Built-in Polymer Lithium-ion battery.

- Working time could reach 7 hours for each use.

### 1.3 SPECIFICATION:

Locating methods:	<ul style="list-style-type: none"><li>● Low voltage impulse method</li><li>● Impulse current method</li><li>● Multiple impulse method</li></ul>
Sampling frequency:	200MHz
Gain range:	0-70dB
Low voltage impulse voltage:	32V
Max.resolution:	0.4m
Locating range:	100km
Dead zone:	2m
Battery:	L-ion battery rechargeable batteries,7.4 V endurance time over 7 hours
Communication interface:	USB,bluetooth (optional)
Power supply:	Input AC220V,50Hz,current 1A,charge for 6 hours
Dim.:	274×218×81mm
Weight:	3.5kgs
Operating Temperature:	-10℃—40℃
Humidity:	5-90%RH
Elevation:	<4500m

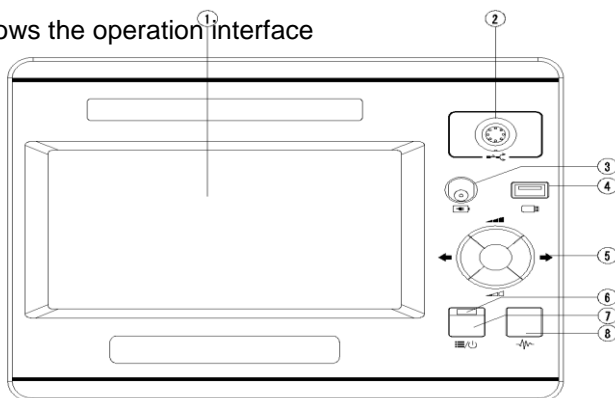
## 2. PHYSICAL CHARACTERISTICS AND OPERATION

### 2.1 CONFIGURATION

Standard : main unit, low voltage impulse testing guideline, impulse testing connecting wire and filter, charger and so on.

### 2.2 MAIN UNIT PANEL


Fig.2.1 shows the operation interface



Details:

Fig.2.1 Operation interface

❑① LED screen : Display all the information. Will introduce in the following.


❑②  Signal port: connect with testing wire. Choose different wires under different testing mode.

❑③  Charging port:connect with wire for built-in battery

❑④  USB disk:save or import waveform

5 Multiple function button:total five functions,up,down,left,right and enter.Up and down button is used for gain adjustment,left and right button is used for cursor adjustment, and enter is used to switch the dotted cursor and solid cursor

⑥ Power indicator light:it will light when power on

⑦  Power/Menu : Turn on or off the machine.When power on,it's menu button.Short press into the menu,press again to exit.

⑧  Test button:Press to test.



2.3 Menu introduction

This device adopts unique menu operation of the screen as fig.2.2

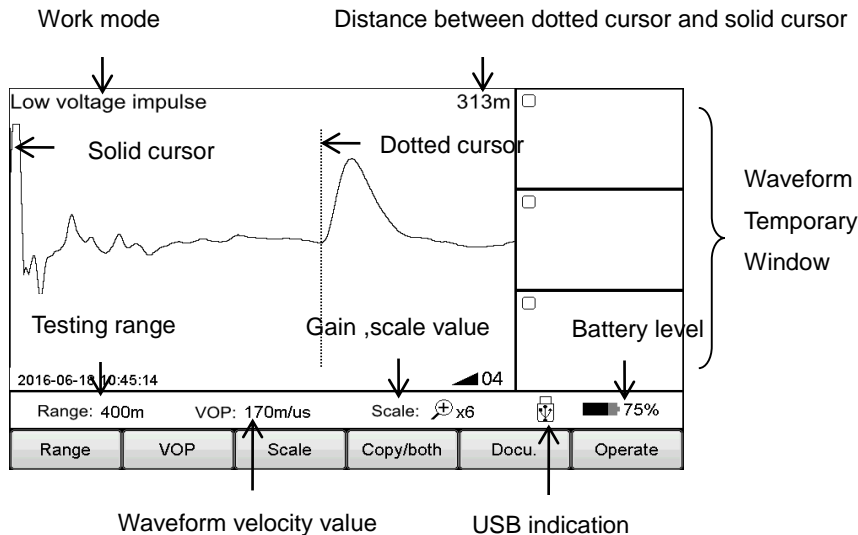


Fig.2.2 Working interface

Support both touch screen operation and Mechanical button. The operation is easy, flexible and direct.

Pop-up menu operation:

Main menu includes Range,VOP,Ratio,Scaling,Copy, Staff, Docu. And Operate.

Sub-menu will pop-up when press above button. After operation or click other position of the screen will exit sub-menu.

Press /Power/Menu or Sub-menu will enter the menu mode,and now user could use the multiple function button to operate.

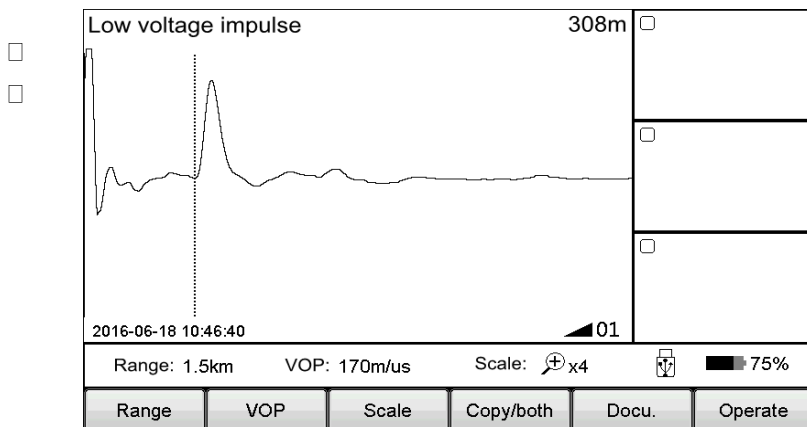
Press /Power/Menu again to exit.

Below is the introduction of main-menu button and their sub-menu details:

Main menu	Submenu
Range	200m、 400m、 800m、 1.5km、 3km、 6km、 12km、 25km、 50km、 100km

VOP	XLPE cable,oil paper cable,plastic cable,VOP+,VOP-
Scale	Global,zoom in,zoom out
Copy	1/2/3 zone copy,1/2/3 zone compare
Staff	Scale switch,new staff,contact setting,fault setting,full length setting,contact delete
Docu.	Local storage,USB disk storage,main unit to USB,docu.recall
Operate	system setting,screen correct

\*Operation example:



Observe the waveform, seems the fault point may located on the first half of the waveform, so the distance 1.5km range is too large and then adjust the distance to 400m.

### Touch operation as below:

Click **Range** button displayed the optional range. Click **400m** button, exit after chosen. Now the range change into 400m as in below fig.4. The device auto test again after modify the range. The testing waveform as below Fig.2.4

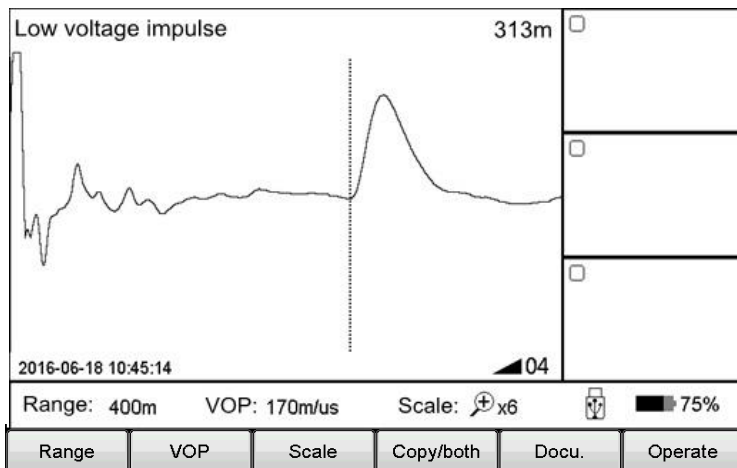


Fig.2.4 Working interface

### Mechanical button operation as below:

Click **≡/⏻** **Power/Menu** button to enter the **Menu** mode. Current menu will highlight in the main menu and automatically appear pop-up sub-menu. Use the multiple function button Left/Right button to choose main menu as **Range**, and use the Up/Down button to choose the sub-menu as **400m**. Press **Enter** button to change the range as 400m and automatically exit the sub-menu. Check the testing range, it's 400m so the modify is successful and will automatically exit the **Menu** mode. If no execution any sub-menu and click the **≡/⏻** **Power/Menu** button again, it will exit the **Menu** mode.

Summing up above points, menu operation steps are as below:

- choose the main menu, and press the corresponding sub-menu

- choose the sub-menu, and press the corresponding button

In the following,we will all use the way **Menu** — **sub-menu** to introduce the operation steps. ( For example, **Range** — **200m** )

**Basic operation**

2.4.1 Choose the testing range

Testing range is the device measuring distance.

**For TDR or ARM(multiple impulse method):**

For the initial testing, the range should be hundreds meters longer than the cable complete length, for example,if the cable is 1400m, it's suggested to choose 3000m but no 1500m. If the suspect point is close, it is suggest to reduce the testing range.

**For Impulse current mode:**

When initial testing,the range should be triple of the cable length. For example, if the cable is 200m, it is suggested to choose 800m.If the suspect point is close, it is suggest to reduce the testing range.

**For testing range chosen:**

Choose Range menu to choose different range, total 10 levels from min. 200m to max. 100km,refer below Fig. 2.5

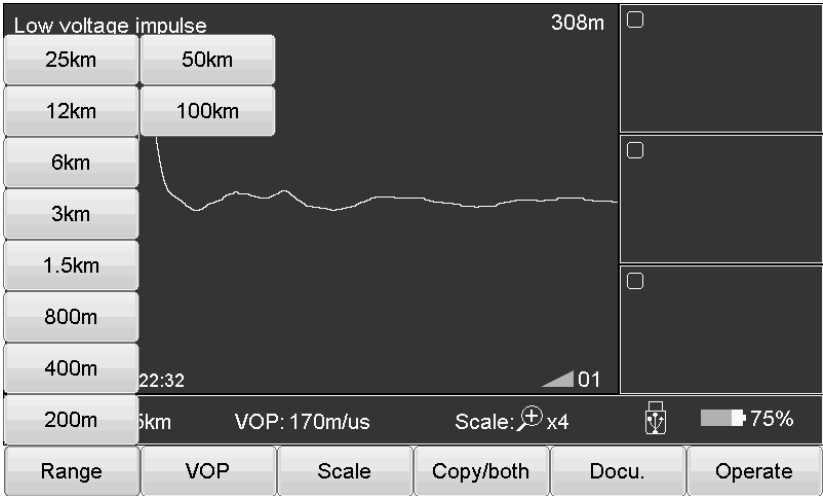


Fig.2.5 Range chosen interface

## 2.4.2 Adjust the waveform

Device adopts the traveling wave method to do fault locating.

Through **VOP** menu to set and adjust wave velocity. Refer Fig.2.6.

Steps:

Click the VOP menu and choose different waveform velocity or directly to adjust the velocity to a suitable value.

- Cross linked(XLPE): Cross linked polyethylene cable,170m/us
- Oil paper: Impregnated paper insulated cable,160m/us
- Plastic: Plastic cable,201m/us
- Rubber: Rubber cable,220m/us

Use the **VOP+** & **VOP-** button to adjust the velocity. Under this interface,if click **VOP+** or **VOP-** button,the sub-menu can't automatically disappear. Click **VOP** button or other screen position, the sub-menu will automatically disappear.

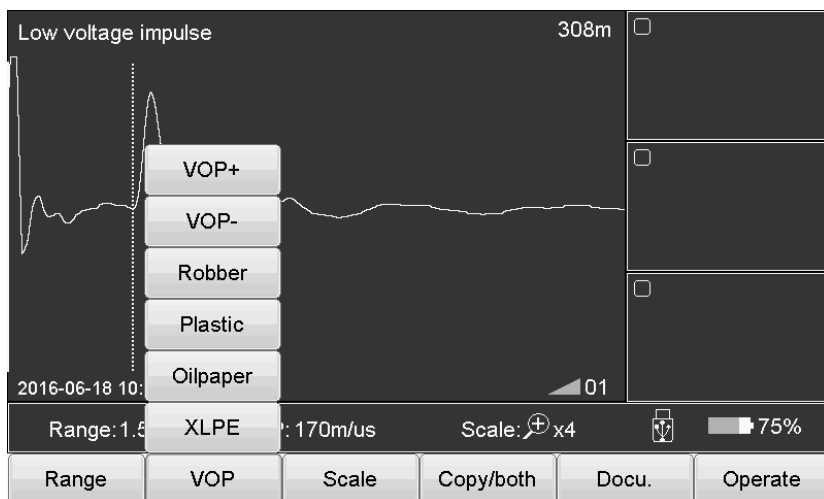


Fig.2.6 Waveform velocity adjustment

### 2.4.3 Scale operation

If need to check the waveform velocity details, and analysis the waveform, we could choose the scale operation to scale and check the details.

Chose the main menu **Scale** and to zoom in/out as shown in Fig.2.7

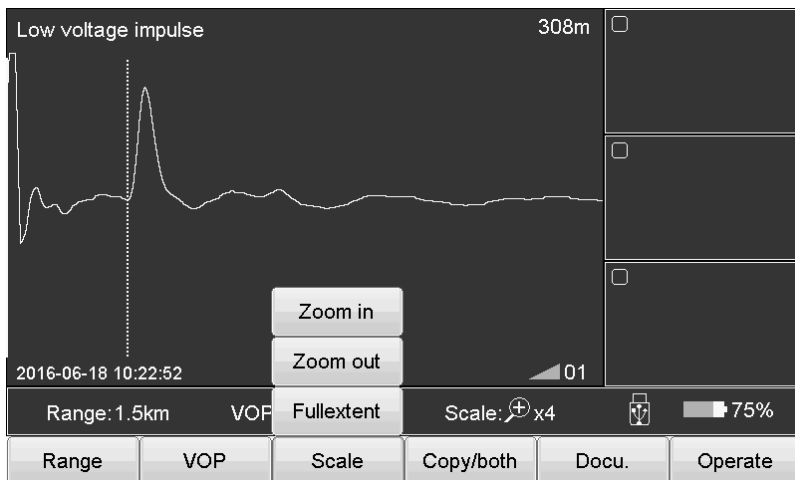


Fig.2.7 Scale operation

Steps:

Choose **Scale** menu, then choose **Full extent**, **Zoom in** or **Zoom out**

**Full extent** restore the complete waveform

**Zoom out** zoom out and display part of the waveform centered on dotted cursor. Move the dotted cursor to left/right and it will automatically page turning when reach the border.

**Zoom in** zoom in and display part of the waveform centered on dotted cursor. Move the dotted cursor to left/right and it will automatically page turning when reach the border.

## 2.4.4 Copy/both operation

If need to compare the waveform, it is suggested to use the the **Copy/both** button. The device could temporarily storage 3 waveform and display the waveform in the Copy Window. Refer Fig. 2.8

**\*ICM (impulse current mode) doesn't have this function**

Sub-menu introduction:

**zone 1 copy**: Temporary storage the waveform in window 1 on the right. Other copy buttons are similar function.

**zone 1 Both**: Display the waveform of window 1 into the main window. Other both buttons are similar function.

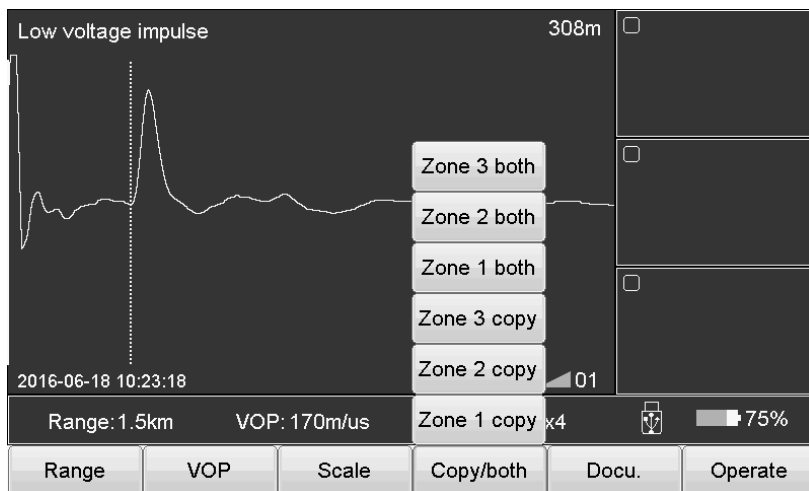


Fig.2.8 Copy/ both button introduction

Touch operation:

Through slide special shapes in the screen, device will distinguish different functions. The shapes of waveform copy and waveform both function are below shapes in the pic.

**Zone 1 copy**: Sliding from main window to the Zone 1.

**Zone 1 both**: Sliding from Zone 1 to the main window.

Other operations are same. Sliding again to exit the compare..

Double click the Copy windows to compare the waveform or exit the comparing.

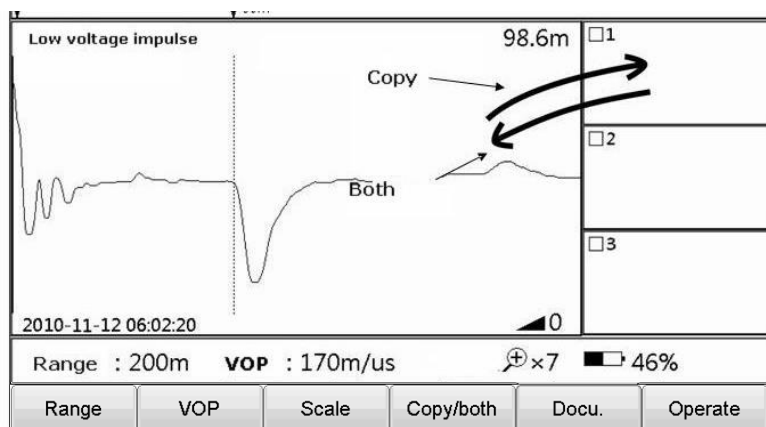


Fig.2.9 Copy/ both touch operation



## 2.4.5 Docu.Operation

Different methods will be for waveform management.

Choose the **Docu.**, the operation as below Fig.2.10

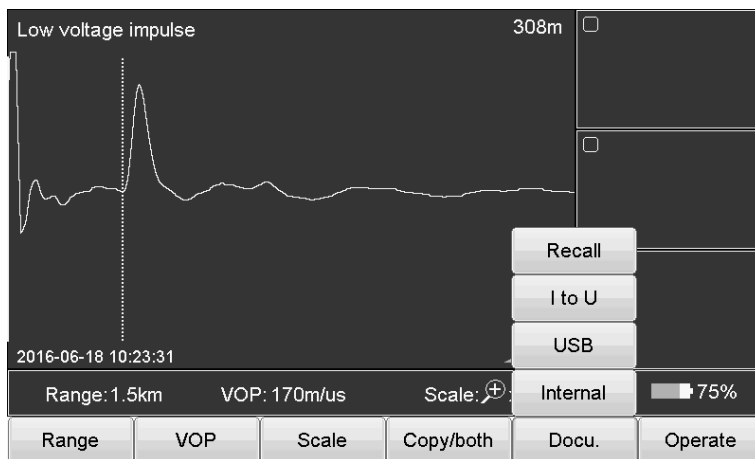


Fig.2.10 Docu. operation

Button introduction as below:

**Internal**: Storage the wave in the device. The stored file name is default as 'working mode English abbreviation & wave storage date.All are xxx.wav file

Low voltage impulse mode: TDR

Impulse current mode: ICM

Multiple impulse mode: ARM

**USB**: save the data into the USB disk.

I to U: insert the USB disk into the USB port. Click this button to export data to USB

Recall: Open the waveform file stored in the device. Click this button to appear the file windows as below Fig. 2.11

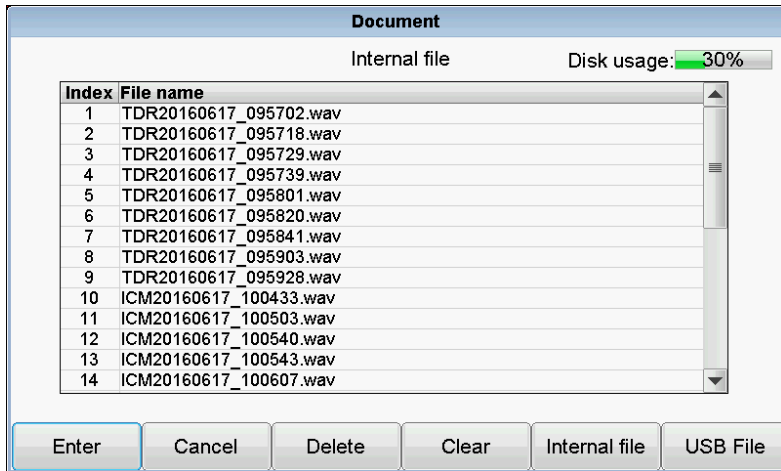


Fig.2.11 Recall waveform file

Button introduction as below:

**Enter**: highlight the chosen waveform and the waveform will display in he main windows

**Cancel**: cancel operation or exit from this file window

**Delete**: delete the chosen file and press ↓↑ to choose file. After click it, the prompt information will appear.

**Clear**: clean the waveform file in the device(can't be restored)

**Internal file**: choose the files stored in the device

**USB file**: Chose the files stored in the USB disk, valid when insert the USB disk

**USB usage**: indicates the files storage in the device. If reach 100%, new waveform can't be logged. Delete old waveform before store new waveform.

## 2.4.6 Parameter setting

Operate below steps:

Operate — System setting, pope window appears as below Fig.2.12  
It's for impulse current delay setting, multiple impulse delay and date setting.

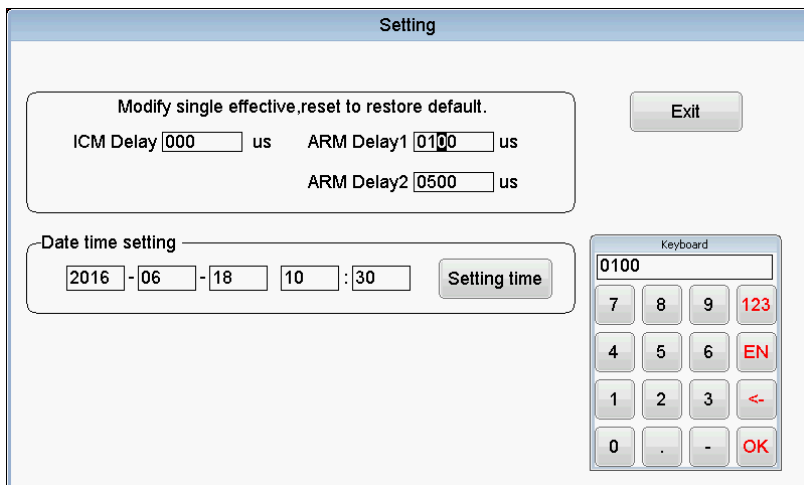


Fig.2.12 System setting windows introduction


Steps as below:

- Click the parameters need to modify
- Use the number keyboard to modify the parameter value
- Click the OK to confirm the modify

## 2.4.7 Delay adjustment

When use the impulse current mode and the multiple impulse mode to test, it is needed to adjust the delay. Details refer following chapter.

## 2.4.8 Exit testing

When use the impulse current mode and the multiple impulse mode to test, press  Test button to enter the triggering condition. Press this button again to exit.

#### 2.4.9 Waveform movement

Move the cursor to the left end of the waveform, then continue to move to the left, the waveform will move to right for half screen. Similar as in the right operation.

#### 2.4.10 Cursor movement

Under the normal mode, move the cursor position through **5Multiple** function button.

Left and right button is used for cursor movement.

Long time press to move fastly, short time press to pinpointing.

#### 2.4.11 Cursor movement operation (touch operation)

Use the stylus to press the cursor, drag the cursor to suitable position. Or double click the target position by stylus, the dotted cursor will move this position.

Or use touch screen to roughly position. And then pinpointing by the multiple button.

#### 2.4.12 Data setting

Date is the retrieval tag of stored waveform, so it's important to make sure the device time is correct. If there's error, it's needed to set again. Steps as below:

Choose **Operate** — **System setting** to set the data in the pop-up window. Refer Fig.2.12

### 2.4.13 Fault distinguish and work mode selection.

Before distance locating, we should first judge the cable fault to choose the suitable detecting method, steps as below:

Use tramegger to measure the insulation resistance of each phase -earth and phase-phase of cable terminal. If the tested result is 0, to use the multimeter to test resistance again. If the tested result is very high, reach normal insulation level, check whether cable is break by method: short circuit three phase and short circuit to the earth in one end of cable, then test in another end of cable to distinguish whether it's break.

Fault type and the distinguish method as below

No	Cable Fault	Representation	Testing method
1	Low resistance /short circuit fault	Tramegger value : 0 Multimeter value: < 200Ω	Low Voltage Impulse
2	Break fault	Conductor disconnection	Low Voltage Impulse
3	High resistance fault	Tramegger : 0 Or: Tramegger : 0 Multimeter: ≥200Ω	Impulse current
4	Flashover fault	Tramegger: insulation normal Withstand voltage test:no	

Adopt different testing methods, different testing connection lines are needed.

The work mode of generator also need to adjust, our HVSG-500GN device could recognize different signal sources and automatically adjust the working mode.

During different working mode, the operation menu has different function, in the following chapters, we'll give a detailed introduction.

#### 2.4.14 Touch screen calibration

During the usage,if find touch position is not accuracy, it is needed to do screen calibration. Click **Operate** — **screen correction** ,refer below

Fig.2.13

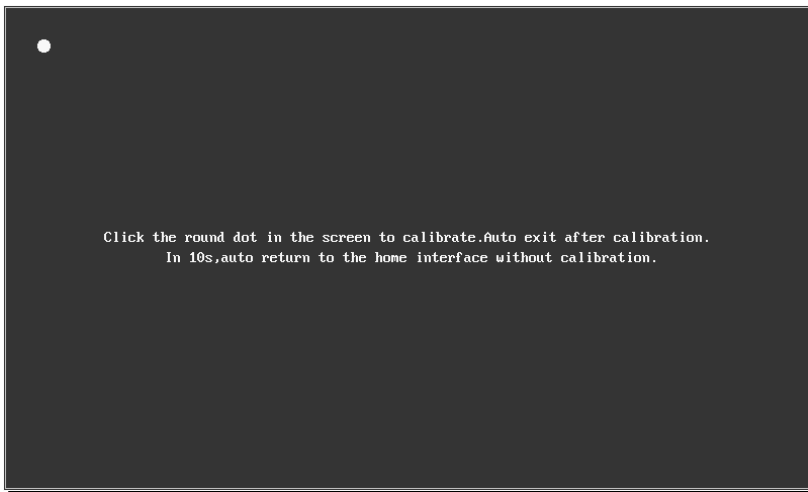


Fig.2.13 Screen correction

### 3. LOW VOLTAGE IMPULSE MODE

#### 3.1 GENERAL :

This method is used for the cable low resistance fault, short circuit fault and break fault. It also can be used to measure the cable length and the wave velocity. This is also a useful method to distinguish the cable intermediate head, T-junction and terminations.

#### 3.2 WORKING PRINCIPLE:

Inject low voltage impulse into the cable when testing, and this impulse will transmit into the impedance mismatch point along the cable, such as the short circuit point, fault point and intermediate joint. Then the impulse will reflect and this will be recorded by device, as the Fig.3.1 shows

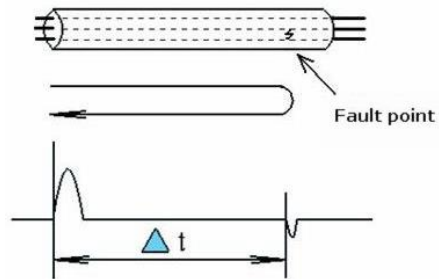


Fig.3.1 principle diagram

$\Delta t$  :Time from pulse transmitted to reflection received

$V$ :Impulse transmitting velocity

$L_x$ : Cable fault point distance

Suppose the impulse velocity is  $V$ ,the cable fault distance  $L_x$  is

$$L_x = \frac{V \Delta t}{2} \quad (1)$$

Mismatch point reflectance  $\rho$ :

$$\rho = \frac{(Z_i - Z_c)}{(Z_i + Z_c)} \quad (2)$$

Here,

$Z_i$  : Input impedance of fault point

$Z_c$ : Characteristic impedance

From (1),we could know:

The polarity of the open circuit fault reflected impulse is same as the

transmitted impulse

But the polarity of short circuit is opposite from the transmitted impulse  
We could determine the fault through the polarity of reflected impulse as  
fig.3.2 shows.

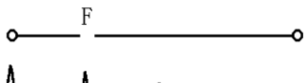
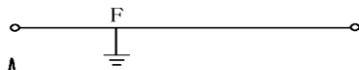


Fig.3.2 Left: break fault reflected waveform



Right: low resistance/short circuit fault reflection waveform

### 3.3 TESTING STEPS:

#### 3.3.1 Wiring

Use the discharging rod to discharge all the phases of the cable.  
Insert the low voltage impulse testing lines into the device **Signal** interface,  
and connect the two clips to the fault phase and ground, or to the two fault  
phases. Fig.3.3 shows

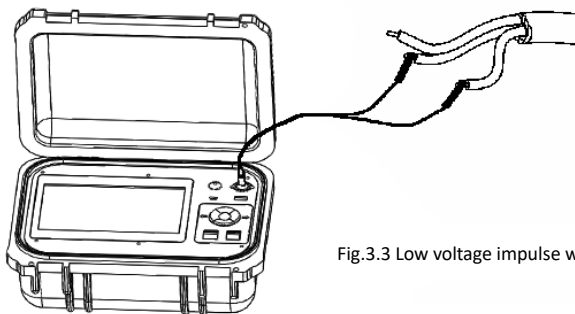


Fig.3.3 Low voltage impulse wiring diagram



### 3.3.2 Choose the detecting range

For the initial setting, the range should be several hundred longer than the cable length ,for example, the cable is 1400m,the range should be 3000m,not 1500m.In the following if find the possible fault point close, user could narrow the range.The device will detect again when range changing.

### 3.3.3 Setting the waveform velocity,some reference for common power cable

XLPE cable ,170m/us

Oil impregnated paper cable,160m/us

Plastic: Plastic cable,201m/us


Rubber: Rubber cable,220m/us

Data distortion may exist, please correct wave velocity if need accurately location. Method refer Page 21

### 3.3.4 Adjust the gain

Under normal mode, press Multiple function button up/down button (for Gain+/-) to adjust the signal gain to make the impulse reflection large but not distortion.

Device will automatically test every time the gain changed.

Press  Test button to test again.

3.3.5 Fault pinpointing

Press Automatically cursor position. Hand adjustment is optional.  
Under the normal mode, use Multiple function button Left /right function to move the cursor. Press the enter of multiple function button to switch from solid cursor and dotted cursor. Move dotted cursor to the reflected impulse starting point, the value displayed in the top right corner is the distance from fault point to the testing end. (if cursor is in other position, the value is meaningless). Refer below Fig. 3.4

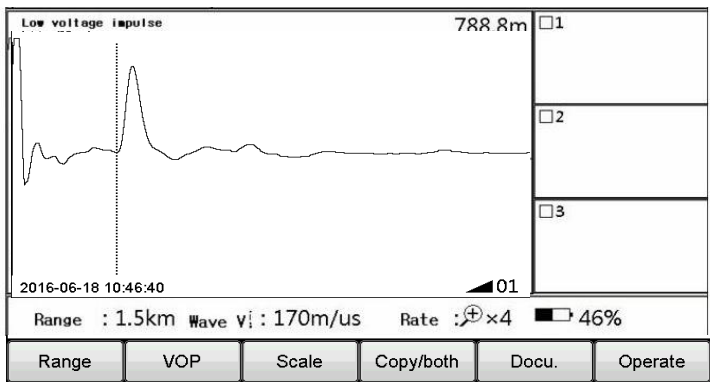
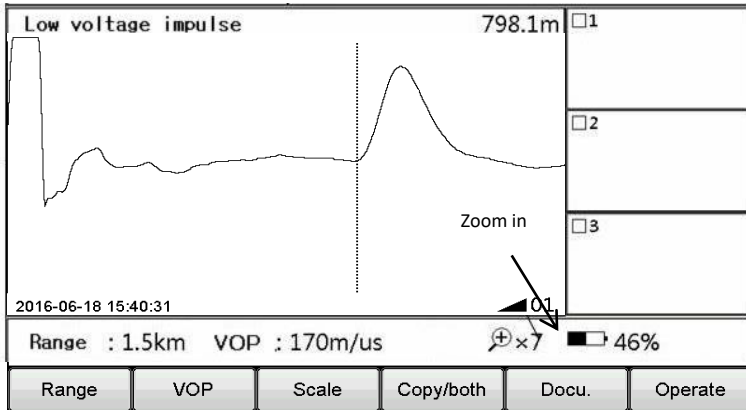


Fig.3.4 Low voltage impulse typical waveform

### 3.3.6 Accuracy locating

Use the scale function to zoom the waveform to get clearer waveform as Fig.3.5 shows.



### 3.3.7 Relative distance locating

If need the distance from the fault point to the reference point, operate as below:

- press left/right of the **Multiple function** button to move the cursor to the fault point.
- press **Enter** to switch the solid cursor and the dotted cursor.
- press left/right of the **Multiple function** button to move the dotted cursor to the fault point. The value is the relative distance.

Check Fig.3.6 for reference

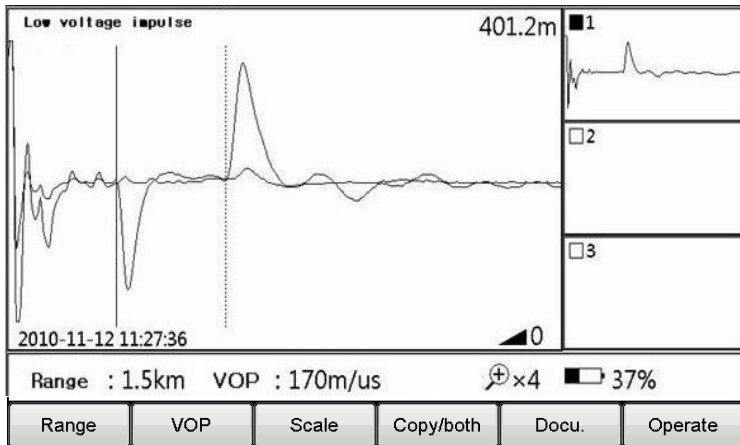


Fig.3.6 Relative distance locating

### 3.3.8 Waveform comparison

Through comparing the reflected waveform of the fault phase line and good phase line, it's easy to recognize the fault point.

Steps:

- Test the good phase of cable to get a waveform.
- Click **Copy/both** button — **Zone 1 copy** to store the current waveform in the device. The waveform will display in the window 1.
- To press the **Test** button again to get the fault waveform.
- Choose the **Zone 1 both** to display the two waveform in the main window in different color. The start of the bifurcation is the fault point position. Refer Fig.. 3.7

Above waveform compare is a short circuit fault and open circuit fault compare,the below waveform compare is cable near -terminal faulty phase and good phase compare

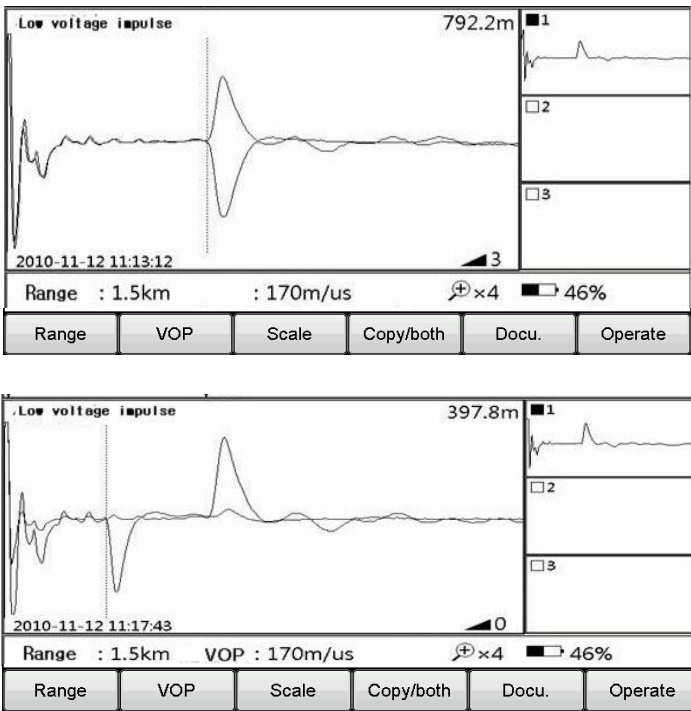


Fig.3.7 Relative distance locating

### 3.3.9 Waveform velocity correct

Known the cable length, it's possible to correct the waveform velocity. Details: Prepare a same material cable which we know length. Measure the distance of opposite end open circuit and short circuit and compare with the device result. Adjust the result to be same with the real length to correct the velocity

## **4. IMPULSE CURRENT MODE**

### **4.1 GENERAL :**

This method applies to the high impedance fault and flash over fault, and if use this method, we also need high voltage generator.

### **4.2 PRINCIPLE :**

#### **4.2.1 Basic principle**

When the insulation Resistance of the fault point is too big, common above 10 times cable characteristic impedance,  $R_f > 10Z_c \approx 200\Omega$ , the reflect factor is too small to distinguish the reflection impulse.

Use the high voltage generator to apply high voltage to the faulty cable and breakdown the faulty point and discharge. The discharging impulse will be reflected repeatedly between faulty point and testing terminal. Device will record this signal and test the time difference and calculate the faulty point distance.

There're two methods to sample the discharging impulse signal: voltage sampling and current sampling. The current sampling method is impulse current method which use current coupler to sample the returning current on the cable sheath. This method is safe because high voltage isolation.

#### 4.2.2 Direct flashover method

DC high voltage breakdown method to test the flashover fault.

For flashover fault, the insulation resistance is very high but when withstand voltage testing ,the voltage rise and make breakdown fault .

Principle diagram as Fig.4.1

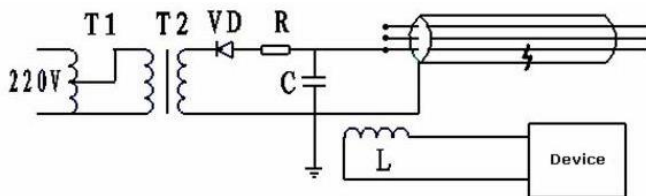


Fig.4.1 Direct flashover method principle diagram

Introduction:

T1:voltage regulator

T2:high voltage transformer, capacity is about 1kV

VD is high voltage silicon stack

C is high voltage energy storage capacitor,above 2 uF

L is the current coupler

Adjust the T1 to rise output voltage until breakdown the faulty point

Waveform as below Fig.4.2

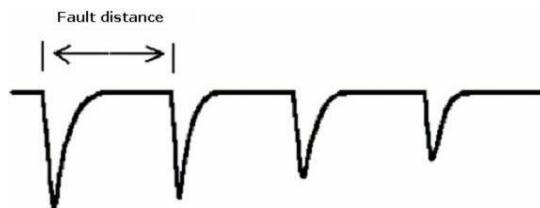


Fig.4.2 Direct flashover method waveform

### 4.2.3 Impact flash method

If the resistance of cable fault point is not very high, but the current leakage of fault point is big, we have to use impact flash method. It's also used for most of the flashover fault. Principle diagram as below Fig. 4.3

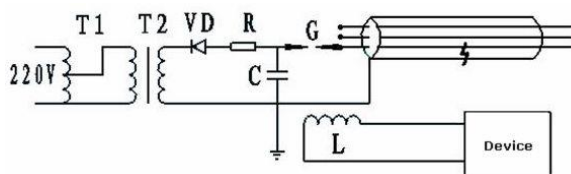


Fig.4.3 principle diagram



4.3 TESTING STEPS:

4.3.1 Wiring: Matched with HVSG-500GN high voltage signal generator.  
Refer below Fig. 4.4

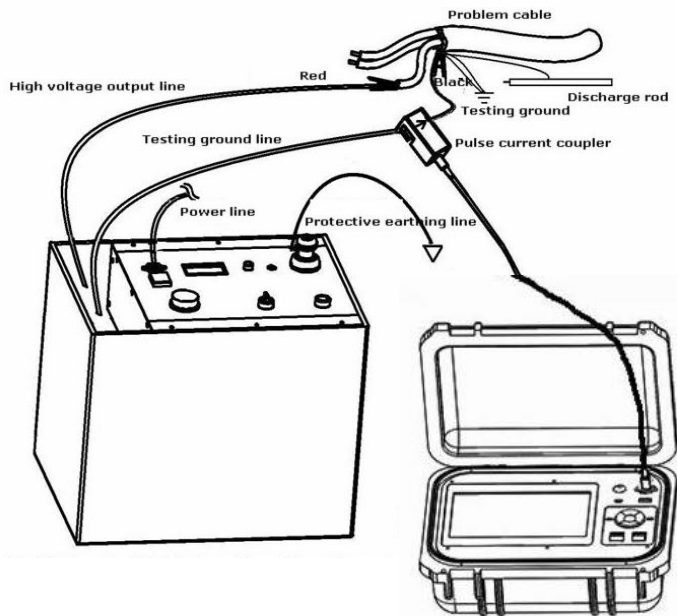


Fig.4.4 matched with HVSG-500GN generator

Connect the two clips of high voltage generator with the target cable.

If phase-earth fault, the black clip must be connected with the testing ground. Hang the impulse coupler on the testing grounding line. Noticed the arrow of the coupler is pointed to the cable and the grounding line is the straight. After connect with the coupler, work mode become to Impulse current mode. Change the discharging mode of HVSG-500GN generator into DC mode. If use the impact flash method, use the generator as By hand or period.

Device also can work with other brands HV device,wiring method as below Fig. 4.5

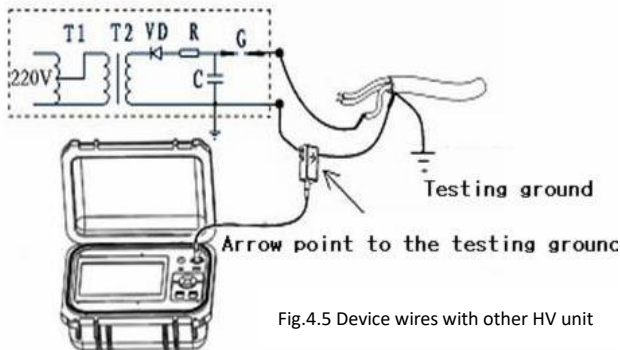


Fig.4.5 Device wires with other HV unit

#### 4.3.2 Choose the testing range:

##### **Attention!!!**

- Completely discharge before wiring
- Connect with protective ground line of generator, don't connect the ground directly
- When phase-ground fault, the black clip of HV unit HVSG-500GN must be connected with the testing ground. When phase-phase fault, please ground the black clip with the connection of the cable core. Otherwise will bring equipment damage and safe accident.
- The arrow of coupler should point to the cable ground direction
- Try to straight the ground line near coupler


Different from low voltage impulse method, the range menu under the impulse mode is from 1.5km and when testing, to adjust it according the range. Common the locating range should be about 3 times as the testing range.

Check the HV dial, if the voltage drops obviously when discharging, the fault point discharges but not get discharging waveform, it means the faulty point breakdown delay maybe very long. And now we should extend the range and test it again. If still can't get the discharge waveform we need to adjust the breakdown delay, details refer below 4.3.7

### 4.3.3 Waveform velocity setting

Choose suitable velocity according different cable material

### 4.3.4 Gain measurement and adjustment

Press  **Test** button, the device enter waiting condition. After generator discharging to the cable, the device triggers, collect and display waveform. If the waveform is too small, we should increase the gain and test again until find the suitable waveform.

**\*when under the condition of waiting triggering, press **Test** button again to exit triggering, Under the waiting condition, the screen menu is forbidden t to operate.**

4.3.5 Cable fault pinpointing

Move the solid cursor to the initial point of the first discharge impulse, then move the dotted cursor to the beginning of the second impulse , the distance between the two cursors will be the fault point distance from the testing end. Fig.4.5 is a group of typical Direct flashover waveform.

Power effect and it causes the reflected waveform front upward.  
The cursor should be set in the beginning of the upward.

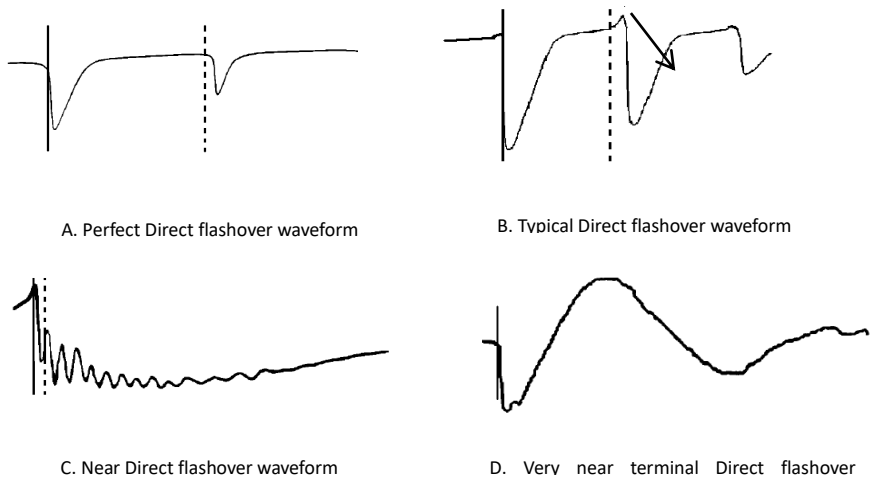
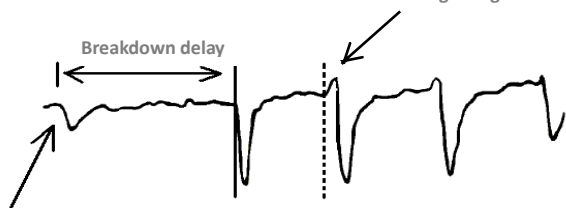
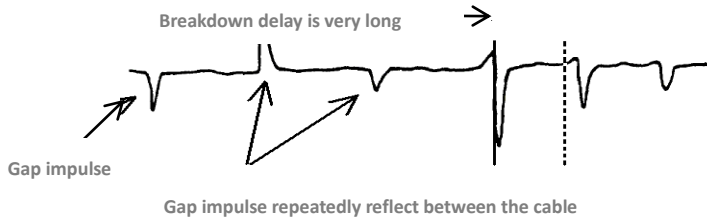


Fig.4.5 Direct flashover waveform reference

Power effect and it causes the reflected waveform front upward.  
The cursor should be set in the beginning of the upward.



### A. Perfect Impact flash waveform



### B. Longer delay Impact flash waveform



### C. Near distance Impact flash waveform



### D. Very near distance terminal Impact flash waveform

#### 4.3.6 Cursor position attention

- Difference between the two methods is impulse from gap discharge for the typical impulse voltage breakdown method .And this discharge will cause time delay
- Because the stray inductance, the reflection impulse often has upward crest. Pls locate the dotted cursor on the initial point of this crest.
- Use the zoom in function for accurately location
- Common the distance value is a little longer than actual distance.
- The point must be breakdown before testing. We can say it's breakdown when:
  - Sphere gap discharge with clear crackle and stronger spark;
  - Otherwise the discharge with hoarse sound and weak spark.
  - Voltage indicator will have a wide swing if breakdown; Otherwise swing is light.
  - distinguish by the waveform. Below is the typical waveform of no breakdown.

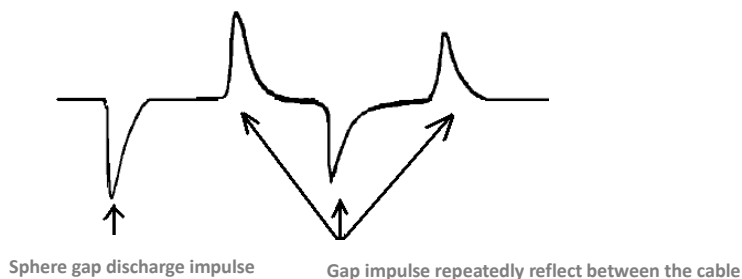


Fig.4.7 Typicla waveform reference of no breakdown

#### 4.3.7 Breakdown time delay setting

Sometimes the fault point get wet,the time delay will exceed the range that device could record.Then we'll manually set the delay time.

Choose Operate - System setting ,to enter the delay discharge adjusting interface.

## 5. MULTIPLE IMPULSE MODE

### 5.1 MAIN INTRODUCTION

This method is more suitable for cable high impedance fault and flashover fault. To use this method, a high voltage generator(both our device and other brands are ok) and our PCLC-900C multiple impulse coupler is needed.

### 5.2 PRINCIPLE

In fact, the multiple impulse method is the modify of the secondary impulse method. The multiple impulse method is to transmit several low voltage impulse in the power arc period and choose the most suitable waveform by manual mode or automatically mode. It will make the distinguish and measurement easier.

Secondary impulse method principle:

Apply HV to the cable to breakdown the fault point and generate arc. The AC resistance of arc is low and can be seen as low resistance fault. To extend the arc continue time and to transmit low voltage impulse to the cable, the power arc in the fault point will reflect the impulse to the testing end. The waveform seems as low voltage impulse low resistance fault waveform, refer Fig.5.1

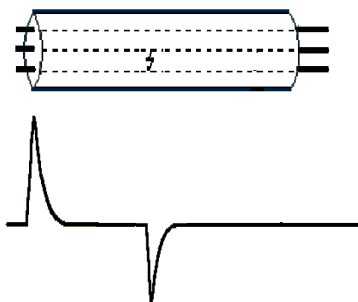


Fig.5.1



When the arc extinguishing, the fault point will recovery to a high resistance condition again. Then transmit low voltage impulse to the cable again to get a reflect waveform with open end as the Fig.5.2



Fig.5.2

To display the two waveform together, a obvious difference will happened in the fault point, such as in the Fig.5.3. Now it's easy to distinguish and test the fault distance

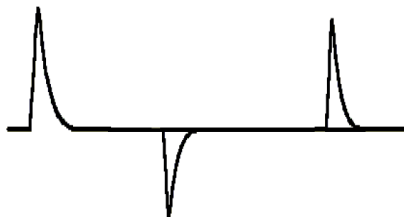


Fig.5.3

## 5.3 TESTING STEPS

### 5.3.1 Wiring

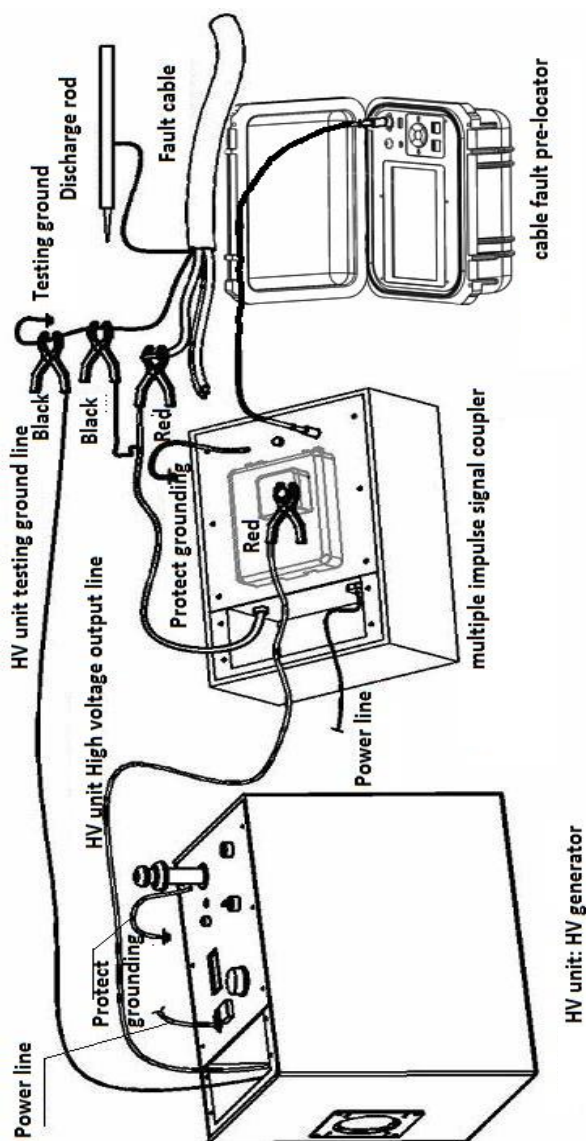


Fig.5.4 multiple impulse method wiring reference

Use the multiple impulse method, it is needed to work together with high voltage generator (other brand generator is also ok) and a multiple impulse coupler (our item PCLC-900C). Wiring as above Fig.5.4

Details:

- Connect the high voltage output clip (the red one) of generator with the input of the coupler (PCLC-900C).
- Connect the PCLC-900C coupler HV output clip with the cable fault phase.
- Connect the HVSG-500GN HV unit and PCLC-900C coupler testing ground clip (black) with the cable testing grounding.
- Connect the multiple impulse testing cable with the PCLC-900C **Locating** port and PCLD-901D pre-locator **Signal** port
- Switch the discharge way of generator to PERIOD or HAND OPERATION

**Attention!!**

- Completely discharge before wiring
- Connect with protective ground line of generator and coupler, don't connect the ground directly
- When phase-grounding fault, the black clip of generator must be connected with the testing ground. When phase-phase fault, pls grounding the black clip with the connection of the cable core. Otherwise will bring equipment damage and safe accident.


### 5.3.2 Choose the testing range

For the initial setting, the range should be several hundred longer than the cable length ,for example, the cable is 1400m,the range should be 3000m,not 1500m.In the following if find the fault point seems close, user could narrow the range.

### 5.3.3 Setting the waveform velocity

Set suitable velocity according different cables.


### 5.3.4 Test and adjust the gain

Press  Test button to enter the waiting condition. When the high voltage generator discharge to the cable, the device will delayed transmit multiple low voltage impulse, and when the arc extinguishing it will transmit again, and to display these waveform in different colors. If the waveform amplitude is too same, we need to turn up the gain, otherwise to turn the gain until to get a suitable waveform.

\*when in the condition of trigger, press TEST again to exit the WAITING condition. The screen menu is forbidden to operate.

### 5.3.5 Choose the most suitable waveform

After one time test, the device will display the waveform in different color and display them in the main window and TS (temporary storage) windows.

In these waveform, the white waveform is the cable complete length waveform after press  Test button.

As below fig.5.5, the multiple waveform is temporary storage in the COPY ZONE 1,2,3. Double click the COPY ZONE to open and close the waveform

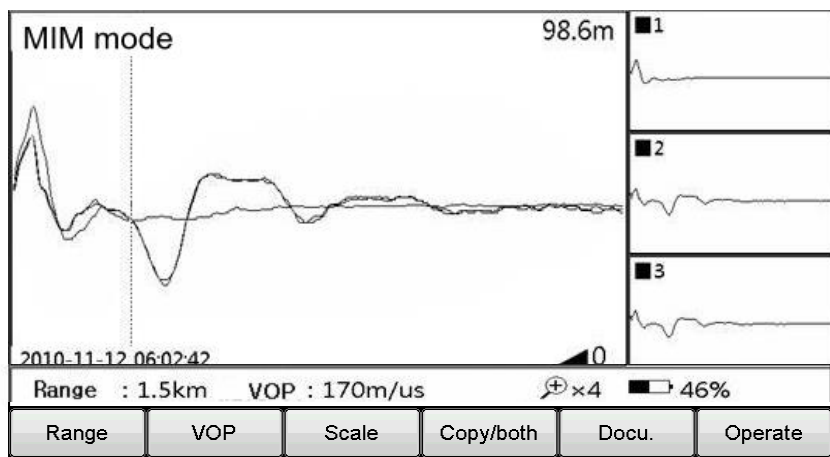


Fig.5.5 multiple impulse method interface

### 5.3.6 Fault point locating

Use the Multiple function button to move the dotted curve to the starting pointing of the fault reflection impulse, the value in the top right corner is the distance between fault point and the testing pointing.

The scale function is also very useful for locating.

### 5.6.7 Testing delay adjustment

If test didn't get the useful waveform, we could try to adjust the TESTING DELAY then test again.

There are time delay for the multiple impulse method.

Delay 1:time period of fault point arcing and the secondary testing

Delay 2:time period of secondary testing and third testing, and the time period of third testing and the fourth testing.

**\* the first testing is the low voltage impulse testing waveform**

## **6. COMPUTER ONLINE**

### **6.1 COMPUTER ONLINE**

PCLC-901D can communicate with the computer.

After online,user could use computer to operate the device,to do complex waveform analysis.and transform the internal waveform into the computer for data filing,classifying and management.

Connect device with computer by blue touch method and start the communication software,then after computer issue order,the device enter remote operation mode.

The details pls check the software docu.

**\* This is optional function**

## **7. CHARGE AND MAINTAINANCE**

### **7.1 CHARGE**

When the battery level is low user should to charge or change battery. Or when the level is too low, the device will power off.

Insert the charger output port into the device charging port. Standard power is 220V.

The indicating light on the charge indicate the charge status:Red indication means continue,the green light means finished.The charge time is about 4 hours,it's not strict and will not damage the battery.

It's better to charge after the power run out.

### **7.2 WARRANTY**

If device quality problem,the device main unit,accessories and charger is 3 years warranty. Battery is 1 year warranty.

If broken by error operation and over the warranty period,we will maintain and only charge for the basic cost.

If below problems,try below steps first:

Can't power on: check battery level

Auto power off:Check device battery or restart device again

Auto power off at once after power on: check the battery level

If still problem or other problems contact us at once.