PCLD-800T Cable Fault Locator

User Manual

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Preface

First, we will show our sincere thanks to you for choosing and using Cable Fault Locator. Before using it, please read through this user manual carefully.

This manual applies to Cable Fault Locator. If there are any changes of, please forgive us not to inform you.

Contents

Chapter I Summary

1. Introduction

This completely automatic Cable Fault Locator is a successful high-tech product, which adopts ARM, FPGA and Dot Matrix Color LCD display technology. This tester combines with both pulse reflection testing (TDR) and intelligent bridge testing (Bridge) for measuring the exact fault location such as the broken line, cross faults, earthing, poor insulation and poor contact of the lead covered cables as well as plastic cables.

It is an effective tool to reduce troubleshooting time, improve work efficiency and reduce labor intensity of line maintenance staff. It also can be used in line projects acceptance and inspection of electrical cables.

2. Features

- Large color LCD Display (480 x 280 dot); humanized operation interface; six function keys and simple operation.
- Both pulse reflection testing (TDR) and intelligent

Locator bridge testing (Bridge) can test broken lines, crossing lines, poor insulation and other types of faults.

- Manual testing function is preserved.
- Full English Menu is easy to master and use.
- With megameter and ohmmeter, it enables to test insulation resistance and loop resistance.
- With USB Port, it is easy to upload testing data to computer
- With USB Port, it is easy to upload testing data to U-disk and you can analyze the data on computer.
- Rechargeable lithium battery, intelligent charging without duty.
- Small dimension, light weight and portable design.

3. Specifications

1) Pulse reflection testing(TDR)

- Max range: 8 km (OPTIONAL 16KM,32KM)
- Dead Zone: 0 m
- Testing Accuracy: 1m
- Pulse width: 40ns-10μ s with automatic adjustment
- Automatic impedance balance adjustment
- Automatic and manual gain adjustment

2) Intelligent bridge testing(Bridge)

- Max poor insulation resistance: 100 MΩ.
- Testing accuracy: ±1%×cable length
- The max length of testing cable: 9999m
- Charging time: 4 hours
- Continued operating time: 8 hours
- Dimension: 220×160×90 (mm^3)
- Weight: 1Kg

4. Configuration

1) Panel setting

- **ON/OFF** : The switch of power supply
- **Auto:** Press this key the instrument will do the testing automatically.
- **Pulse:** Under the pulse reflection testing, press this key and then the instrument will process manual pulse testing; under the bridge testing, press this key and then the instrument will enter the pulse reflection testing interface automatically; users can also complete the operations with the help of menu prompt.
- **Adjust:** Adjust testing parameters
- ◄►: Under the pulse reflection testing, it is used to move the cursor; under the electric bridge testing, it is used to adjust relevant parameters; users can also

complete the operations with the help of menu prompt.

- **USB:** It is used to communicate with host computer.
- **Test:** It is used to insert and connect the testing lead lines.
- **Charge:** The socket for charging the instrument.

2) Testing line

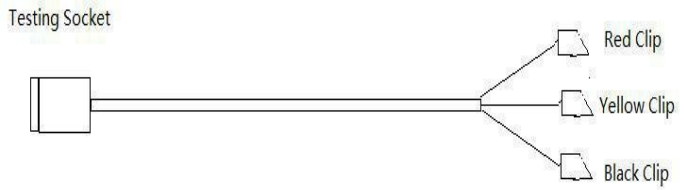

Figure 1.4.1

There are three clips at the end of testing lead line in total.

Under the pulse reflection testing, just to use the two lines with red clip and yellow clip; under the intelligent bridge testing, use the total three lines. The detailed usage method will be introduced in the following chapters.

3) Switching between pulse reflection testing and bridge testing

Press "**ON/OFF**", turn on the instrument, the testing mode will be automatically selected to be pulse reflection testing. Press "**Adjust**" until **Press ◄or► to Enter into Bridge mode** shows reverse color display, press "◄" or **"►" to enter electric bridge testing. Under electric bridge testing, press "Pulse" to enter the pulse reflection testing.**

5. Testing Steps

1) Diagnosis of fault characters

The characters of telecom cable faults can be simply divided into the following several kinds:

● **broken line:**

One or many cable core line are broken and the communication is interrupted. This kind of fault should be tested with the pulse testing.

● **crossed line:**

It can be divided into the earthing, self-crossed and other-crossed lines, which mean the core line to the lead cover, between the identical couple of core lines, the insulating layer between the different couple of lines and the core is destructed; the insulating resistance drops to the very low degree (below several hundred to several thousand ohms), even can cause short-circuits; the

communication quality comes under serious influences. This kind of fault can firstly is used the pulse testing method. When the waveforms are difficult to distinguish, and then change it to the electric bridge testing.

● **Bad insulation:**

When the cable core insulation material is invaded by water or humidity, the insulating resistance will drop and cause low communication quality or even blocks. This kind of broken line is similar to self-crossed, other-crossed lines and the earthing. The fault resistance is big (above several thousand ohms) and the fault degree is light. Usually, if the insulating resistance is smaller than 2M ohms, the communication quality will be affected; it needs to carry on the elimination. This kind of fault generally cannot be tested by pulse testing but needs to change to the bridge testing.

When the lines have faults, you should firstly use testing board, megameter or multimeter to find the character and serious degree of cable fault, so as to choose the most suitable testing mode.

The testing personnel are familiar with the line direction and fault conditions, which is helpful to fix the cable fault point rapidly. After the fault happened, they will carry on comprehensive consideration about fault time, range, the around environment, the location between joint, the weather and other possible problems. Then roughly

judges the segment cable according to the testing results.

2) Choose testing mode:

When the fault resistance is smaller than several hundred to several kilo ohms, we call it low resistance, otherwise, it is called the bad insulation or the high-resistance fault. High-resistance and low resistance have no explicit boundary.

The pulse testing is suitable for testing broken lines and low resistance crossed lines. Sometimes, the serious insulation can also use pulse testing. The pulse testing operation is direct-viewing, simple, no need the coordination of other end, it is should be firstly used when testing.

The bridge testing can test the high-resistance bad insulation faults, but it needs to find a good line, moreover, it needs the coordination of the other end. The test preparatory work is also quite tedious. You should use the bridge method after confirming that the pulse testing can not test the fault.

3) Fault range finder:

During testing, it should firstly cut off the lines or equipment on both sides of the cable to be tested. Perform testing firstly in the equipment to fix the smallest segment of fault, and then carry on the repeated testing

on-the-spot to locate the precise fault point.

4) Fix cable fault:

You can locate the precise location of fault on the basis of the testing results and the comparison of map data. When the map material is not entire or contains errors, you can estimate the approximate position of fault according to the grasped cable situation.

Then you can combine with the around environment to analyze the fault reasons until find the cable fault. For example, there is a joint in the estimated range; it can approximately judge that the fault is in the joint. The further the range is, the bigger the testing errors are.

Chapter II Pulse Testing

Pulse testing is for testing broken lines and low-resistance fault.

1. Testing principles

Pulse testing is a kind of remote testing method; one can locate the fault point without testing on the field or testing with end-to-end coordination. The principle of the

theory is:

The instrument emits a pulse to the line, when the line has faults, the pulse reflection will change. If the come and back time can be measured, the location of the fault point can be detected.

Suppose the pulse transmission velocity in electric cable velocity is V, the come and back time that the pulse travels between the test point and the fault point is T, the fault distance is L, then:

$$\because \quad 2L = V\,T$$

$$\therefore \quad L = V\,T/2$$

For example, the sending end transmits a pulse to the cable, after 20μ s, the sending end get the reflection pulse. If the pulse transmission velocity in the electric cable is 201m/μ s, the fault distance L is

$$L = 201 \times 20/2 = 2010\text{m}$$

2. Steps of locating fault point

Diagnosis of fault characters

To insure the accuracy of the testing of fault point, the testing personnel shall diagnose the fault characters correctly and then choose the most suitable testing mode. The characters of telecom cable faults can be simply divided into the following several kinds:

1) Broken line

One or many cable core line are broken.

2) Crossed line

The insulating resistance between the different couple of lines drops and causes the communication amplitude drops.

3) Earthing fault

The insulating resistance between the core line to the lead cover drops and causes low communication quality

4) Crosstalk noise

When the cable core insulation material is invaded by water or humidity, the insulating resistance will drop and cause low communication quality or even blocks.

5) Bad insulation

The insulating resistance between different couple of lines and the core drops to a very low level, the communication quality comes under serious influences.

Fault Testing

Cut off the cable to be tested both sides lines or equipment. Make sure the cable to be tested is free of voltage. Using this instrument to do intelligence testing first, if the fault cannot be detected and then you can change to manual testing.

Locating fault point

The tester will Judge the approximate location based on the testing result, then check the cable, cable gland, cross

boxes, etc., depending on the actual situation.

3. Intelligent Testing

Press "**on**", connect the testing lead line and fault cable line. Press "**Auto**" and then the instrument will show the testing result.

Note: The default setting wave velocity is 200m/μ s, when you perform intelligence testing, the user shall check whether need to adjust the velocity (see "**Adjust wave velocity**" in the next section).

4. Manual Testing

The relevant setting and parameters will demonstrate on the underneath of the display screen. Press "**Adjust**" to adjust the setting and parameters.

1) Gain

Press "**Adjust**", until "**Gain××**" shows reverse color display. Then press "◀" or "▶" to adjust the amplitude (1~99 adjustable), Press "**Pulse**", the screen will display the wave after gain adjustment.

2) Range

During manual testing, **Range** decides the maximum testing distance of the instrument, so the range value shall be chose as longer than actual length of the cable to be tested. To adjust the Range, repeatedly press "**Range**", until "**Range**××" shows reverse color display. Press "◄" or "►" to adjust the Range.

3) VOP

The precision of the wave velocity, directly affect the precision of the testing result. So the wave velocity shall be calibrated according to the cable characters. Press "**Adjust**", until "**VOP** × ×" shows reverse color display. Then, press "◂" or "▸" to adjust the wave velocity.

Adjust the **Range** and **Wave Velocity** according to the characters and estimated length of the cable to be tested. Appropriately adjust the wave amplitude to make the waveforms on the display screen to be observed easily. Move the cursor to inflection of the reflected waveform. The fault distance will demonstrate on the underneath of the display screen.

4) Zoom in and Zoom out

Users can zoom in or out the waveform when zoom value is not "1". Continuously press "**Adjust**" till Zoom is selected. Then the prompt box will display "press ◄ or

► to zoom the wave"; users can zoom the wave by pressing "◄" or "►". Press "**PULSE**" when zoom to the proper size, and then users can move the cursor to fix position; press "**PULSE**" to the original state.

5) Save Waveform to RAM

The waveform should be saved to RAM when comparing the fault line and good line under manual testing. Continuously press "**Adjust**" key till **SAVE** is selected; and then "press ◄ or ► to save wave" will be displayed in the prompt box. Users can save the current waveform by pressing "◄" or "►".

6) Compare Current Wave with stored Wave in RAM

Users can compare the current waveform with the already stored waveform in RAM. Continuously press "**Adjust**" till **Both** is selected; "press ◄ or ► to both display" will be displayed in the prompt box. Press "◄" or "►" to display two waveform at the same time. The current waveform is yellow, and the already stored waveform is green.

Notice: the button can not be selected under certain state and it means in such state, you can not do this operation. See the detailed operation on screen.

5. Save File

Press "**Adjust**" until "Press ◄ or ► to do file management" appears. Now press "◄" or "►" to enter into save file mode. And then you can not only save and test the current file but also check and analyze the previous wave files.

1) Save File

When you choose "Current Test", press "**Auto**" to test the current cable. Press "**Adjust**" to save the current file and "Press ◄ to quit file mode, press ► to save current wave" will display.

Under this condition, press ◄ to quit to the file mode; press ► to save the current file to U disk.

2) Check and Analyze the previous wave files

Press "**Adjust**" until "Press ◄ or ► to do file management" appears. Now press "◄" or "►" to enter into save file mode. And then you can check the previous wave files. When you are interested in any wave files, you can press "**Auto**"" to analyze the current wave file.

Under this mode, you can do some operation of the saved file. And the operation method is same as cable operation method. For detailed operation steps, you can refer to the manual testing chapter.

Chapter III

Intelligent bridge testing

The fault resistance of bad insulation is very high (above several thousand ohms) and is much bigger than characteristic impedance of cable; the pulse reflection is weak and is not easy to judge the fault point. At this time it needs to carry on bridge testing. The bridge testing in this instrument also has the simple megameter and the ohm meter functions.

1. Testing principles

As we know, there are certain resistances in the cable core line and resistance value in the unit length is same. Suppose the resistance of entire core is R, if you can test the core resistance from the fault to one end (test point) is Ra, and the core accurate length L is known, suppose the

distance is La. Then:

$$La = (Ra/R)\ L$$

The core line resistance will be affected by changing temperature and different line diameter, but these influences are same in the cable span. Use the Ra/R ratio calculation method can eliminate these influences.

During testing, firstly, the instrument calculates Ra/R automatically, and then input some data manually to calculate La. This instrument adopts the intelligent electric bridge technology, so the user only needs to connect lines, inputs data and the length of partial line diameter; press "**Auto**", and the fault distance will be calculated.

2. Bridge testing steps

1) Wiring:

The bad insulation faults divides into bad insulation of the core to the earth (earthing), the bad insulation between identical line couple and two core lines (self-crossed) and the bad insulation of different line couples (other-crossed) and so on so you must have an explicit judgment before wiring. We firstly take the bad insulation between core line and earth for example to introduce:

● Before the test, it is better to fix the fault point in the smallest sector, like between two cross boxes. We carry on testing on one end in this sector, and wiring coordination on the other end. Here, we call the end, which carry on the testing end and the other is coordination end.

● Find out a core line, which has smaller insulation resistance to earth (note: it is a single line) for the testing fault line, cut off its both sides lines or equipment.

● Find out a core line, which has good insulation to earth (also a single line) for testing assisted line. Cut off the lines or equipment on both sides. The insulation resistance of the good line to earth is at least 100 times than the fault line to earth. The bigger, the better.

● Connect good line and fault line in the coordinate end. (i.e. coordinate end loop).

● Connect the black clip, which is in the end of the testing line to the earth. Connect the yellow clip to the core line and the red clip connects to the fault core line. As shown in Figure 3.2.1

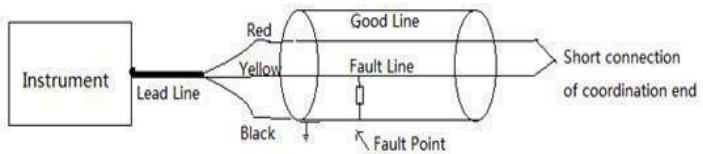

Figure 3.2.1 wiring of earthing fault

- Except the line connection of black clip is different, the connection of other clips of wiring method of the bad insulation between identical line couple (self-crossed) and the bad insulation between different line couples (other-crossed) are as same as previous ones. Wiring method is as shown in Figure 3.2.2 and Figure 3.2.3

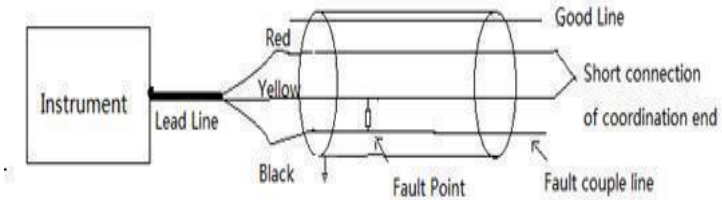

Figure 3.2.2 wiring of self-crossed fault

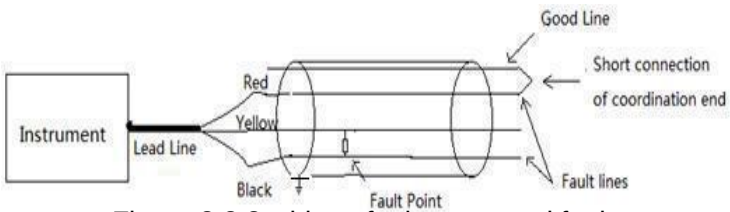

Figure 3.2.3 wiring of other-crossed fault

- In the wiring process of bridge test, there should not have any mistakes of the judgment of faults, the selection of good line and fault lines, the good short connection of core line in the coordination end, the wiring of the three clips. Otherwise, the testing is easily failed.

2) Testing:

- If the wiring has no mistake, press “manual”, the instrument starts to test.

The instrument test line insulation resistance and loop resistance firstly. As shown at the top of the screen.

If there is no short connection on the coordinate end, then it is demonstrated the insulation resistance value and “no loop” of the red and yellow clips to the black clip. By now it needs to inspect whether the wiring is correct or not, then test again.

Compare the values of two insulation resistances to distinguish the good and fault lines. The resistance of good line is big, and even to infinity (∝ indicates infinity, similarly hereinafter), the insulation resistance of fault line is quite smaller.

If the wiring is correct, the testing will carry on continuously, and finally obtain the ratio value of fault distance and cable length. Next, input cable span to get the fault distance. The entire test procedure probably needs one minute.

3) Data inputting and calculation

The last step is only test out the ratio value of fault distance and cable span. It needs to input manually to get the data such as cable length, and then calculate the fault distance (please note: the cable length here refers to the cable length in the testing fault sector, say the cable

length from testing end to coordinate end). The cable length can be obtained through checking installation materials or the pulse testing of this instrument.

For example, the known length of the testing fault section 986 meters, after testing, according to the following steps input:

Press “Adjust”, the first place in “line span =0000m” is twinkle to prompt you to input data in this place. Because the cable length is 986 meters, the first place need not to modify.

Press “Adjust”, the second place in “line span =0000m” starts to twinkle.

Press “▶” for nine times or press “◀” for one time, the demonstration becomes: fault distance/line span =0900m”

Press “Adjust” again, the third place in “fault distance/line span =0900m” starts to twinkle.

Press “▶” for eight times or press “◀” for two times, the demonstration becomes: “fault distance/line span =0980m”

Press “Adjust” again, the fourth place in “fault distance/line span =0980m” starts to twinkle.

Press “▶” for six times or press “◀” for four times, the demonstration becomes: “fault distance/line span =0986m”.

The instrument will automatically calculate the fault

distance during the data inputting.

3. Functions of megameter and ohmmeter

Electric bridge test method has megameter and ohmmeter's function that is to test line insulation electric resistance and loop electric resistance.

1) Function of megameter：

Under electric bridge test interface, test by co-operating the black clip with any red clip of the conductive test line.

For example, if test one core line's ground insulation resistance, connect the black clip with ground, connect the red clip with the core line which is ready to be tested, Press "**Auto**" after the line is well connected; wait for a moment and the test result will be shown at the top of the screen.

If the insulation electric resistance is 3.6MΩ, connect the red clip with red conductive line, it will show "red & black 3.6MΩyellow&black∝ no loop".

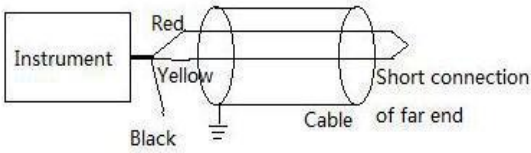

Figure 3.3.1 Connecting method of megameter

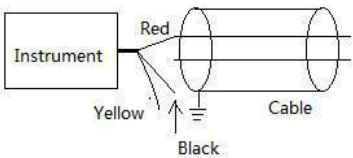

Figure 3.3.2 Connecting method of ohmmeter

2) Function of ohmmeter：

Under electric bridge test interface, loop electric resistance can be tested by using red clip co-operated with yellow clip, the wiring method is shown as Figure 3.3.2, the far ends of the tested core lines must be connected, red clip and yellow clip connect with two core lines accordingly (the two clips can be mutually exchanged), press "**Auto**" key, wait for a moment and the test result will be shown at the top of the screen. If the loop resistance is 1360Ω， then it will show "insulation ∝ loop resistance1360Ω".

3) Testing experiences

- Under electric bridge method, connect the lines carefully and each step should be done strictly according to the manual. If “test failed” is shown at last, then check it step by step from the beginning.
- It’s better to repeat testing it for several times, and compare the test results to see whether they are consistent with each other, then figure out the average value to be the final result. If the test results are quite different and without regularity, it may be caused by strong disturbance, then wait until the line is relative free and then test again.

Chapter IV Charge

Current battery power is showed at the top-right of the screen. If the battery power is inadequate, please use the instrument charger to charge it.

The indicator light of the charge adapter will be red when charging; and it will turn green after it’s fully charged.

The charge time shall be no longer than four hours.

Chapter V Notes

- Keep display screen away from direct sunlight. The contrast ratio of LCD will drop when temperature higher than 60ºC and it will return to normal when temperature is lower than 60ºC.
- Before testing, better measure the voltage of fault cable to be tested, in order to avoid test errors or damage the instrument
- Do not hit LCD screen.