DMM/TDR Cable Fault Locator

User Manual

Preface

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

This manual applies to this DMM/TDR Cable Fault Locator. If there are any changes, please forgive us not to inform you. The copyright of this manual belongs to our company. Without our permission, any units and individuals cannot modify this manual as well as cannot copy and spread it especially for profit. Our company reserves the right to let violators shoulder the legal obligation.

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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 digital multi-meter (DMM) 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 time domain reflectometer(TDR) and digital multi-meter (DMM) 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, loop resistance, AC/DC voltage, capacitance.
- 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) Time Domain Reflectometer(TDR)

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

2) Digital Multi-Meter(DMM)

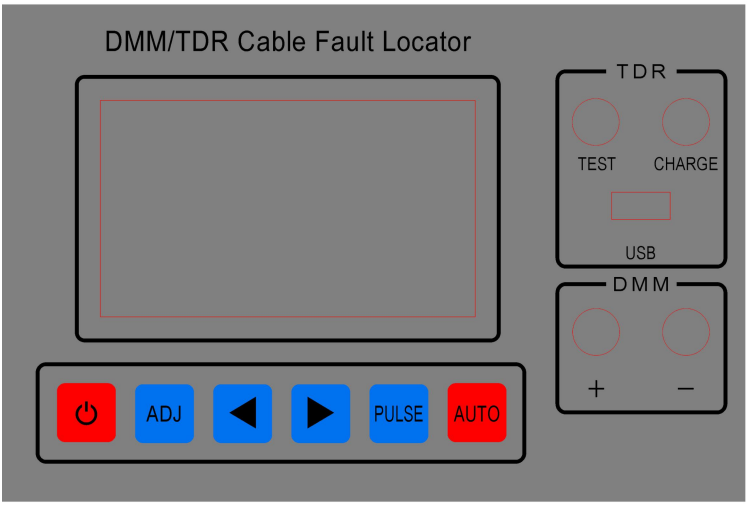
- DC Voltage: -400V~400V; resolution is 0.001V
- AC Voltage: 0V~290V
- Capacity : 0nF~1000nF
  Accuracy: 0nF~10nF: ±2 nF
  10nF~1000nF: ±2 %±2 nF
- Loop Resistance: 0Ω~20kΩ
  Accuracy: 0Ω~100Ω: ±3%±4Ω
  100Ω~500Ω: ±3%
  500Ω~20kΩ: ±2%
- Insulation Resistance: 0MΩ~30MΩ
  Accuracy: 0~1.0MΩ: ±0.1 MΩ
  1.0MΩ~30MΩ: ±10%±0.5 MΩ

3) General

- Charging time(h): 4
- Continued operating time(h): 8
- Dimension(mm): 220*160*90
- Weight(kg): 1.3

4. Configuration

1) Panel Setting



- : The switch of power supply
- **AUTO:** After pressing this key, the instrument will do the TDR testing automatically.
- **PULSE:** Under the TDR testing, press this key and then the instrument will process manual pulse testing; under the DMM testing, press this key and then the instrument will return to the TDR interface automatically.
- **ADJ:** Adjust testing parameters

- ◄ ►**:** Under the TDR testing, it is used to move the cursor to locate the faults..
- **USB:** It is used to communicate with U-stick..
- **TEST:** It is used to insert and connect the TDR testing lead lines.
- **CHARGE:** The port for charging the instrument.
- **+ :** Connect with red test line of DMM
- **- :** Connect with black test line of DMM

2) TDR Testing Line

Under the TDR testing, just to use these two lines with red clip and yellow clip to connect with the cable under test.

3) DMM Testing Line

There are red&black test leads for DMM function. Under DMM test mode, connect the red lead with “+” port and connect the black lead with “-” port. Then you can do the relative 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.

● **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.

When the lines have faults, you should firstly use the DMM function of this instrument 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.

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 20μs, the sending end get the reflection pulse. If the pulse transmission velocity in the electric cable is 201m/μs, the fault distance L is

$$L = 201 \times 20/2 = 2010m$$

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. Auto Testing

Press “  ”, 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/μs, when you perform intelligence testing, the user shall check whether need to adjust the velocity (see “**VOP**” 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.

Note: Adjust the **Range** and **VOP** 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 Memory Temporarily

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 Waveform in Memory

Users can compare the current waveform with the already stored waveform in memory. 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 Waveform to U-Disk(Optional)

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 Waveform to U-disk

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 File

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.

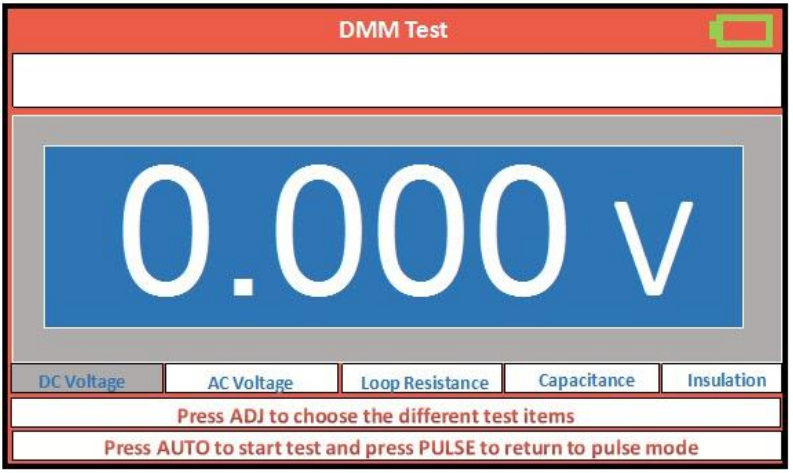
Chapter III Digital Multi-Meter

The built-in DMM can test the DC/AC voltage, loop resistance, capacity, insulation resistance of a cable. The engineer can use this function to check whether there is dangerous voltage of a cable; whether there is 48V of a telephone line; or evaluate the cable length.

Press "**Adjust**" until "Press ◄ or ► to enter DMM test" appears. Now press "**◄**" or "**►**" to enter DMM test mode.

Now press "**Adjust**" to choose the testing items. After the testing item is selected, press "**Auto**" button once to test the selected testing item. Long press "**Auto**" button for 3s, the buzzer of our instrument will send out a loud

sirens; at the same time, our instrument will do the test of selected testing item continuously.



1. DC Voltage

By using DC voltage test, you can check whether there is signal in the line. This test is only applicable to DC voltage and the test range is -400V~+400V. When it is out of the testing range, "**Testing is out of range**" will appear.

2. AC Voltage

By using AC voltage test, you can check whether there is

high AC voltage in order to avoid the engineers' danger. If there is AC voltage in the line, please carefully take the alligators off the cable to avoid the electric shock. This test is only applicable to AC voltage and the test range is 0V~+290V. When it is out of the testing range, "**Testing is out of range**" will appear.

3. Loop Resistance

By using loop resistance test, you can evaluate the cable length. Or if you know the cable length, by using the loop resistance value, you can judge whether the cable connection is normal.

If "**Testing is out of range**" appear, it means the test lines alligators don't connect well or the cable doesn't loop; or the loop resistance is out of test range, please test again after checking the test alligators or make the cable loop well.

If there is voltage(more than 2V) in the cable, the prompt "**Voltage in the line**" will appear. It means there is voltage in the cable and you can't do the loop resistance test. Please check the cable and test again until there is no voltage in the cable.

4. Capacitance

If "**Testing is out of range**" appear, it means the capacitance in the cable exceeds the capacitance range or there is faults in the cable. Please check the cable and test again.

If there is voltage(more than 2V) in the cable, the prompt "**Voltage in the line**" will appear. It means there is voltage in the cable and you can't do the loop resistance test. Please check the cable and test again until there is no voltage in the cable.

If there is voltage(more than 2V) in the cable, the prompt "**Voltage in the line**" will appear. It means there is voltage in the cable and you can't do the capacitance test. Please check the cable and test again until there is no voltage in the cable.

5. Insulation

By using insulation testing function, you can the insulation value in the cable. If the insulation value is small, it means there is bad insulation problem.

If there is voltage(more than 2V) in the cable, the prompt "**Voltage in the line**" will appear. It means there is voltage in the cable and you can't do the insulation test. Please check the cable and test again until there is no voltage in the cable. If the insulation value is out of the range, "**Insulation>30MΩ**" will appear and it means the insulation condition is good in the cable

⚠ **Note:** The instruments will have dangerous voltage about 100V when you test insulation. Please be careful and don't touch the alligators.

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.