CABLE FAULT LOCATOR Handheld Graphical
TDR Model TDR-44
Operation Manual

elma instruments

Contents

WARNING:
The safety condition is not to connect Fault locator to the energised cable, even this equipment does not generate any hazardous voltage to other circuit.

1. Introduction

The Fault Locator is a pulse-echo cable test set which provides a visual indication of

cable faults such as open circuits, shorts and bad connections up to 3000m (9500 ft.) on metallic cables. The principle of operation is that a pulse transmitted into a cable is reflected by any imperfection.

The speed at which the pulse travels down the cable is depend upon the dielectric (insulation) of the cable and the Fault Locator can be set to suit any type of cable dielectric. A list of typical propagation velocity factor values is given in table A. and a type of cable fault can be determined as section 5. of this manual.
The Fault Locator is available with 120 ohm output impedance and 0.67 defaults PVF

2. Batteries

The unit operate from 6 AA size batteries. Instruction for place / replace batteries are as follows

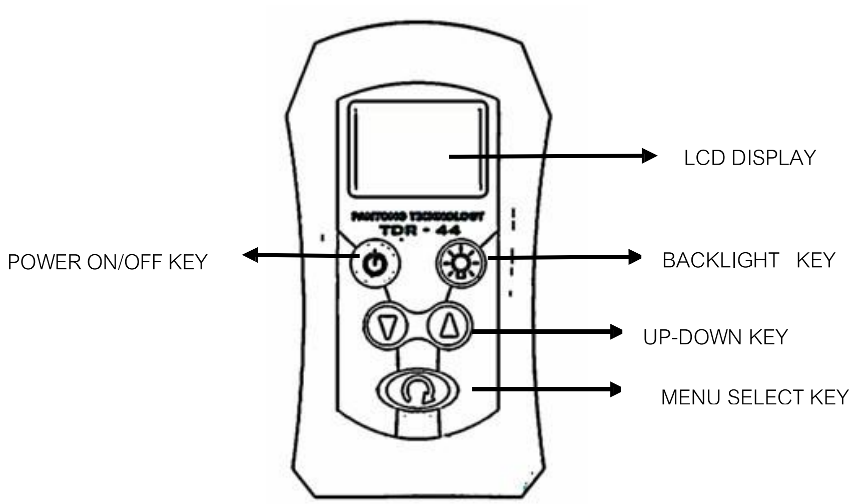
1) Unscrew the two screws which secure the battery cover on rear side of unit case
2) Lift off the cover
3) Remove old batteries or place new batteries by following polarity mark on the battery pocket
4) Replace battery cover and secure two screws by not over-tightening it

3. SAFETY RULES

Though this tester does not generate any hazardous voltages, to circuits to which it can be connected could not be dangerous. Always check that the circuit to be tested is de- energised before connecting the tester. Electrical circuits can be dangerous if there is a lack of caution and /or safety practices. Do not use leads, probes or clips that are damaged or in need of repair with the tester.
Double check the lead connections before making a test.

4. OPERATING INSTRUCTIONS

The display module consists of a 128 X 64 pixel, liquid crystal graphics display with LED back-lighting. A visual representation of the reflected pulse is provided on a single trace. The break point can be aligned with the cursor by using the arrow keys when in locate mode and the distance to fault is displayed in meters or feet. The instrument powers up in the locate mode with 3000 meters range selected, and the propagation velocity factor set at the optimum for each cable fault locator. In this mode the arrow keys control the cursor line. The Displayed Range can be altered by selecting Range mode with the menu select key. There are four ranges and an auto-range, on auto-range the cursor will scroll to the next range when a predetermined point on the display is reached.



Operates key

Power on/off key	Switch on and off the unit. The unit have auto powering down If the key is not depressed 5 minutes
Menu select key	This allows the setting up of the Propagation Velocity Factor, Cursor Control, Range select and Measure unit via the up-down arrow keys.
Backlight key	This illuminates backlight to the display when depressed.
Down key	The down key reduces the Propagation Velocity Factor, scrolls the cursor left, scrolls down through the Ranges and toggles measure unit between Metres and Feet with the appropriate menu selected. When the Locate Mode is selected and the key pressed twice and then held the cursor scrolls at a faster rate than normal in the direction indicated.
Up key	The Up key increases the Propagation Velocity Factor, scrolls the Cursor right, scrolls up through the Ranges and toggles measure unit between Metres and Feet with the appropriate mode selected. When the Locate Mode is selected and the key pressed twice and then held the cursor scrolls at a faster rate than normal in the direction indicated.

4.1 FAULT LOCATION

The following general points should be observed when checking a faulty cable:

(1) Carry out the safety checks listed under the SAFETY RULES.

(2) The instrument measures the length of cable, not the length of the cable path. Buried cable loops, snaking cables and other irregularities need to be taken into account.

(3) Measurements will be greater on wet cables.

(4) Do not connect the instrument to a cable pair that is to be 'burned' with a breakdown test set.

4.2 FAULT LOCATION ON CABLES WITH KNOWN PROPAGATION VELOCITY FACTOR

In many cases, the cable layout and characteristics are known and the fault location and analysis should be simple and quick. Under these conditions, the procedure is as follows:

(1) Disconnect the faulty pair from service if possible.
(2) Connect the faulty pair to the line terminals of the tester. (3) Press the 'ON' key to power up the tester.
(4) After the initialisation period set the required propagation velocity factor by means of the arrow keys when in PVF Mode. Listed in Table A. are typical values of propagation velocity factor for various cable dielectrics. Use the menu select key to select metres or feet for the cursor value.
(5) Inspect the trace for a fault pulse and reduce to the minimum Range where the fault pulse is clearly visible.
(6) Change to locate mode and operate the cursor keys to position the cursor line at the start of the break point of the fault pulse , for example trace as shown in Fig.1
(7) The distance to the fault may now be read directly from the cursor value, which is at the bottom centre of the LCD display. This reading can be in meters or feet depending on the parameter selected.

NOTE: The test lead length is automatically removed to give a direct reading of the cable length, therefore the test leads supplied with the instruments must always be used.

Dielectric Type Typical PVF

Paper Oil filled (PILC)	0.50 to 0.56
2Cross linked poly (XPLE)	0.52 to 0.58
Jelly filled poly	0.64
Polyethylene (PIC)	0.67
PTFE (Teflon)	0.71
Paper (Pulp 0.083 uf/mile)	0.72
Paper (Pulp 0.072 uf/mile)	0.88
Foam Poly	0.82
Air space Coaxial	0.94
Air	0.98

Table A

4.3 DETERMINING UNKNOW PVF

If the cable dielectric / propagation velocity factor is not known, the PVF setting can be determined from using a known length of the same type of cable or distance to a known point in the same cable

a) Measure the apparent distance to end or known point with any PVF value, using the normal procedure as section 4.2 above
b) Press Menu Select Key to PVF mode
c) Adjust Up-down key until the measured distance is agreed with the known distance
d) The PVF shown will be determined as for this type of cable

5. Type of cable fault

The Fault Locator instruments are suitable for locating a variety of faults and cable conditions. A selection of these is outlined below:

5.1 SHORT CIRCUITS

(1) Shorts between two conductors of a cable pair. The reflection has the downward Polarity pulse, Fig.1

(2) Sheath shorts are caused when a conductor in a cable makes contact with the metallic sheath of the cable. To locate a sheath short, first disconnecting the sheath from earth, connect one terminal to the sheath, the other to the conductor.

(3) Crosses occur when conductors in the different pairs are crossed at a junction box. Crosses produce waveforms similar to shorts, but with reduced amplitude. Crosses can be located with the tester connected to one pair, but a more distinctive fault pulse is obtained if it is connected to the crossed conductors.

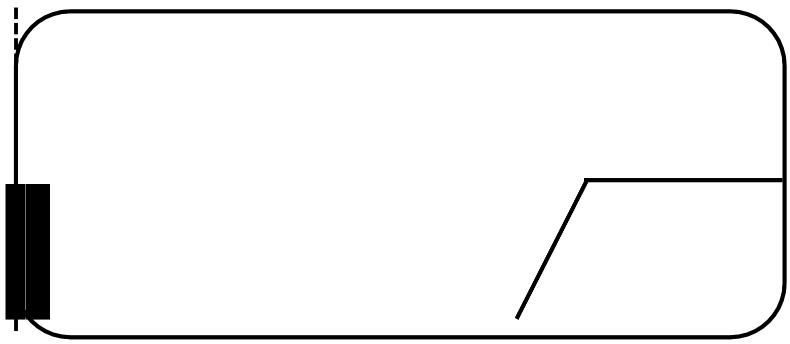


Fig. 1

5.2 OPEN CIRCUITS

(1) Opens are caused when one or both. Conductors of a pair are disconnected or broken. The reflection is upward polarity pulse, Fig.2

(2) Open sheaths are caused by a break in the cable sheath. To locate such faults, connect the line terminals to the sheath and to as many cable conductors as possible to reduce the clutter on the screen. This fault produces a fault pulse whose amplitude depends on the resistance of the break.

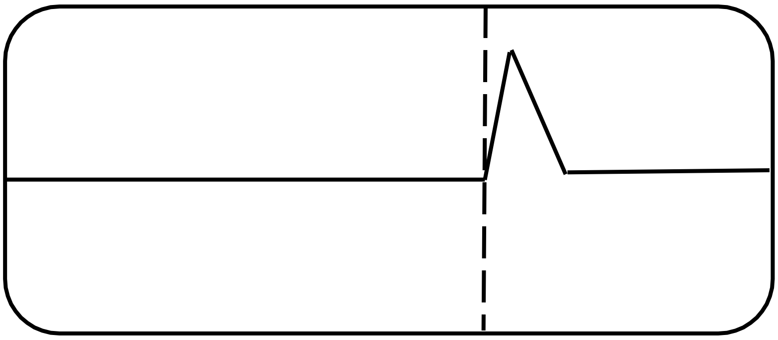


Fig. 2

5.3 High Resistive joint / splice

Joints or splices are caused by poor connections when the cables are connected at a junction box. The reflection is similar to that for an open conductor, its amplitude being dependent upon the quality of the joint or effective resistance. Fig 3. Besides, A transition from low impedance to high impedance cable also cause same reflection.

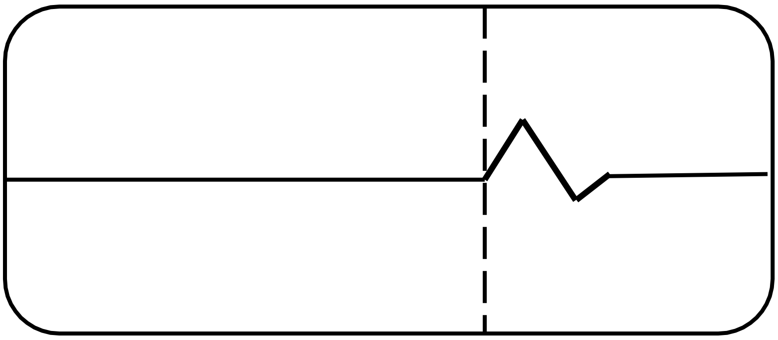


Fig. 3

5.4 Split

Splits occur in cables when the pair is untwisted. This normally occurs at cable junction points, and as such they are not really faults. They are, however, one of the main causes of clutter on the trace. The split, when the pair is untwisted, causes an upward fault pulse and the re-split, when the pair becomes twisted, causes a downward fault pulse Fig 4. As the split and re-split are normally close together, i.e. in the junction box, the two fault pulses almost coincide, so that they appear on the fault trace as a weak agitation.

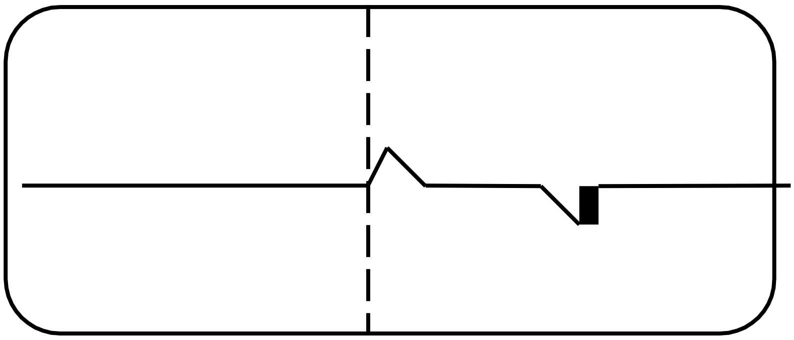


Fig. 4

5.5 Low insulation and Water ingress

These faults are due to contamination of the insulation medium by moisture ingress through a cable. This gives a reflection like short conductor fault pulse, where the moisture starts, followed by a small open-type fault pulse where the moisture ends. In some cases, where the moisture increases gradually with distance, these fault pulses broaden out into a gentle shell or dip in the horizontal trace, Fig 5. Caused the amplitude of next event curve in display right-side of this water ingress point become lower. Water in jelly-filled cable may produce only very small fault pulses due to the restricted volume of water. Besides, a transition from low impedance to high impedance cable also cause same reflection.

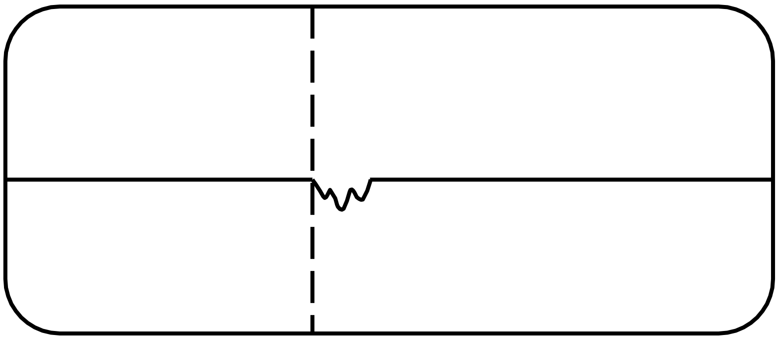


Fig. 5

5.6 Low /Water at Cable joint

This fault is similar to item 5.5 but happen at Cable joint which contaminated by wet environment.
Fault trace is as Fig. 6 which after splice be followed by small sine or square that decreasing gradually.

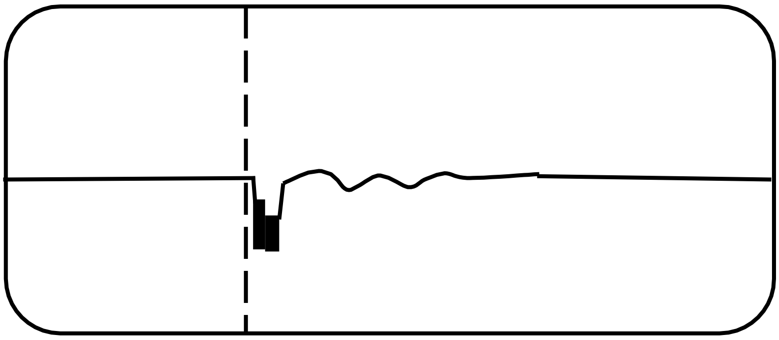


Fig. 6

5.7 Bridge tap

Bridge taps occur when another pair of conductors is connected to a pair in the main cable to form a branch or party line. At the branch or bridge junction, a short conductor downward reflection will occur due to the characteristic impedance haft sharing at that point and follow by upward reflection caused by end of the tap as shown in Fig 7.

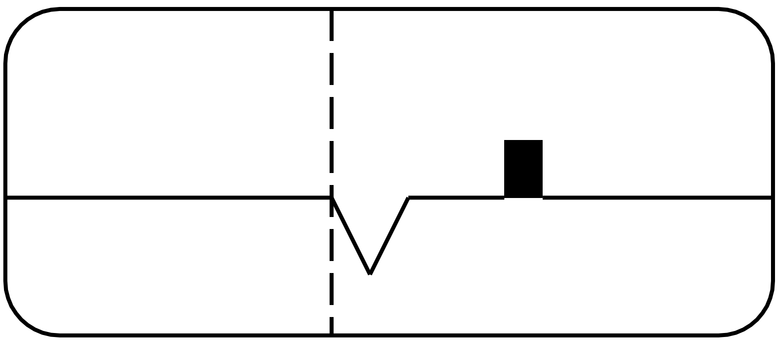


Fig. 7

5.8 Load coils

Load coil are used on telephone lines to increase the line inductance, so improving the transmission characteristics of long lines. TDR generally will not test pass load coil so the inductive load coils appear as open circuits to the cable fault locator, so the upward reflection will be displayed as Fig 8.

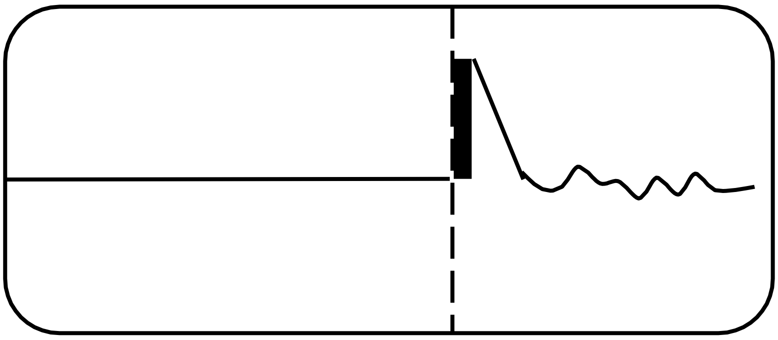


Fig. 8

6. Specification

6.1 Technical specification

Measure Range:	100, 300, 1000, 3000m and Auto range
Accuracy:	0.9% of Range
Resolution:	1% of range
Gain:	Auto Set across screen
Output Pulse:	5V nominal in open circuit
PVF:	Variable from 0.01 to 0.99
Output impedance:	120 Ohm
Pulse Width:	Automatically varied
Connectors:	Two 4mm safety terminals
LCD Display:	128x64 graphic LCD with backlight
Update Rate:	Once per second
No touch shutdown:	5 minutes
Display view area:	44x62 mm
Power supply:	Batteries 6 AA alkaline or nickel- cadmium cells
Battery Low indicator:	6.5V nominal

6.2 Environment

Operating temp:	-20 to +60’C
Storage temp:	-30 to +70’C
Humidity:	93%

6.3 Physical

Case Dimensions:	210 X 100 X 50 mm
Case Material:	Fiberglass Nylon 6/6
Weight:	550g (with batteries)
Leads:	2 metres safety plug and Alligator clip

7. Accessories

7.1 2 meters test lead Safety Plug 3 mm to Alligator Clip
7.2 Soft vinyl carry case
7.3 Operation manual

8. Repair and servicing

This instrument is not a user serviceable item other than the replacement of batteries. In the unlikely event of failure please return to the nearest distributor or Manufacturer

Manufacturer address:

Pantong Technologies Co.,Ltd

99/213 Moo 10, Bangkrang, Muangnonthaburi

Nonthaburi 11000, THAILAND

elma instruments