

Repair and Warranty

The instrument contains static sensitive devices and is not user serviceable. If an instrument fails, or its protection has been impaired, it should not be used but sent for repair by suitably trained and qualified personnel.

New instruments are guaranteed against breakdown due to manufacturing or component defects for 12 months after the purchase date by the user.

Note: Any unauthorised prior repair or adjustment to the instrument will automatically invalidate the warranty.

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The company reserves the right to change specifications or designs without prior notice.

TX2002

TDR Cable Fault Locator / Toner

Operating Instruction



Safety Warnings

This instrument meets the safety requirements of IEC61010-1:1995. It is designed for use on de-energized circuits only. Connection to mains supply voltages may result in damage to the instrument and/or may present a hazard to the operator. The operator must assume responsibility for ensuring his or her own safety. The instrument is protected against connection to telecom network voltages according to BS/EN61326-1.

Warning

Only use the unit with non-energised or de-energized and suitably isolated circuits. Connection to line voltages may damage the instrument and could be hazardous to the operator.

If the instrument is not used in the manner specified in this manual the protection provided by this equipment may be impaired.

Symbols used on the instrument



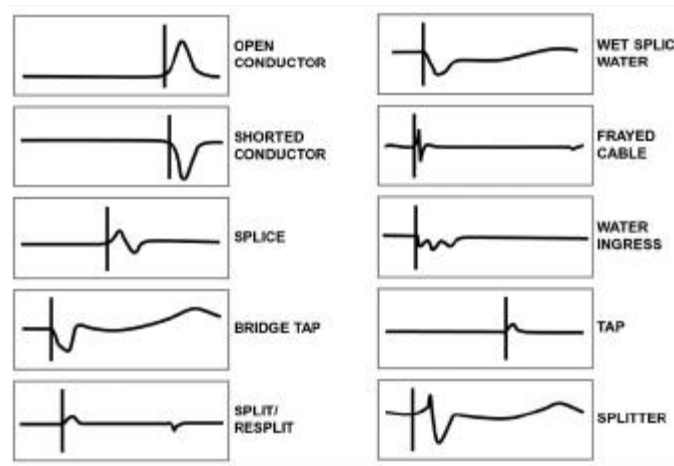
Caution:- Refer to accompanying notes



Equipment complies with current EU directives

14. Typical Fault Displays

The following diagrams show typical TDR fault traces to assist in the identification of faults using the TX2002.



15. Typical Cable Vp and Impedance values

Type	Vp	Z	Type	Vp	Z
Cat5 STP	72	100	T/Pair Jelly PE	64	100
Cat5 UTP	70	100	T/Pair PE	67	100
Coax Air	98	50/75	T/Pair PTFE	71	100
Coax Air Space	94	50/75	T/Pair PVC	58	100
Coax Foam PE	82	50/75	T/Pr Paper 72nF	88	100
Coax Solid PE	67	50/75	T/Pr Paper 83nF	72	100

Scan Rate	Single Shot or 6.7 pulses per second (operator selectable)
Power Supply	6v (4 x AA cells)
Battery life indication	Low Battery Indicator
Auto Power Down	3 minutes
Battery Life	Standby mode >4000hrs Continuous scan (6.7/sec) >7.5hrs
Storage Temperature	-20 to 70 deg. C (-4 to 158 deg. F)
Operating Temperature	0 to 40 deg. C (32 to 112 deg. F)
Altitude	2000m max.
Dimensions	165 x 90 x 37mm
Weight	350gms (12oz)
Ingress Protection	IP54
Safety	IEC61010-1 EN60950
EMC	BS/EN61326-1
CE	Compliant with current EU directives

* Measurement accuracy of +/-1% assumes the instrument setting for velocity of propagation of the cable under test to be accurately set, and homogeneity of the velocity of propagation along the cable length. Accurate positioning of the cursor is also required.

Standards

Safety:	IEC61010-1:1995
EMC:	BS/EN61326:1998
ESD	EN61000-4-2
EM	EN61000-4-3
Burst	EN61000-4-4
Conducted RF	EN61000-4-6

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1. Product Introduction

The TX2002 is a handheld Time Domain Reflectometer (TDR) designed for identifying and locating faults on power and communication cables, given access to one end only.

The TX2002 is able to measure cable length, and indicate the distance to cable faults, to a range of 3500m (11700ft), on virtually any type of cable.

The TX2002 shows a reflection profile of the cable under test as an oscilloscope-like trace on a 128 x 64 pixel Graphical LCD. A movable cursor can be aligned with features of interest and the distances read off.

The TX2002 has a selectable impedance facility allowing it to be matched to the cable under test. This automatically eliminates the transmission pulse from the display, enabling easier identification of short range faults.

The Velocity of Propagation is adjustable between 1% and 99% enabling accurate calibration to the cable under test.

The TX2002 incorporates an oscillating tone generator, that is detectable with a standard tone probe, for use in the tracing and identification of cable pairs.

2. Principle of Operation

The TX2002 works by measuring the time taken for a signal to travel to the far end of the cable under test, or to an intermediate fault, and return.

The velocity at which the signal travels (Velocity of Propagation Vp) will depend on the characteristics of the cable.

Based on the selected Vp, and the measured travel time of the test pulse, the TX2002 calculates and displays impedance anomalies and their distances along the cable.


13. Specifications

Ranges @ Vp=70%	220, 440, 870, 1750 & 3500m 670, 1470, 2900, 5830 & 11700ft
Range Selection	Automatic range selection against cursor position
Minimum Cable Length	4m (12ft)
Measurement Accuracy	+/- 1% of range*
Measurement Resolution	Approximately 1% of selected range
Measurement Sensitivity	Minimum 3 pixel return on a fault at 2km (6000ft)
Velocity of Propagation	Adjustable from 0% to 99% in 1% steps
Cable Impedance	Selectable between 50, 75 & 100Ω
Display Resolution	128 x 64 pixel Graphical LCD
Display Backlight	Electro luminescent
Tone Generator	Oscillates between 810Hz & 1110Hz
Transmitted Pulse Height	+5v into an open circuit or +1.5v into 50 Ohm load
Transmitted Pulse Width	25ns min to 2.15us dependent on range

The injected signal oscillates between 810Hz and 1110Hz six times per second.

This signal can be detected with a conventional inductive tone probe and enables cable tracing and identification.

The auto-shutdown facility is disabled in Tone Generator mode so that the tone may be injected into a cable for an extended period of time while tracing takes place.

To exit Tone Generator mode press the **TDR/**  key again.

11. Battery Replacement

The TX2002 is powered by 4 x 1.5v AA cells which are provided. Alkaline replacement cells are essential to ensure instrument performance.


As the batteries near the end of their life an indicator will appear on the instrument display.

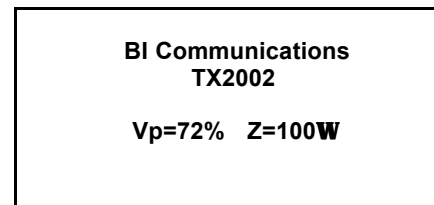
To replace the battery cells first switch off the product and disconnect from any cables, then remove the battery compartment cover by loosening the 2 fixing screws.

12. Backlight

The LCD display is fitted with an electro-luminescent backlight to enable easy viewing under a variety of different lighting conditions. The backlight is switched on and off with the * key.




3. Getting Started

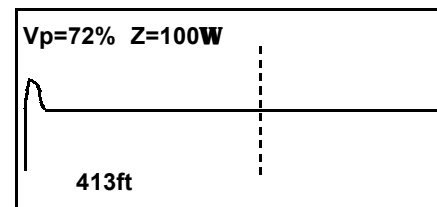
The unit is switched on and off using the  key, after which the “home” screen below will be displayed.



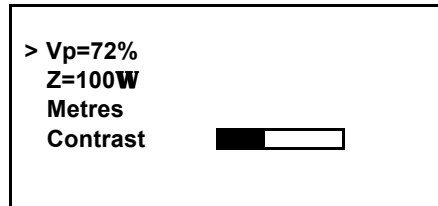
An auto shutdown feature turns the unit off automatically three minutes after the last key press in case the operator forgets, and in order to preserve battery life.

4. Setting up

After the TX2002 has been switched on, pressing either of the “cursor keys”  , or the test key  will take the operator directly into the test screen. An example is shown below.



To enter set-up mode hold down the **TDR/** key, and at the same time press the **▼** key. A typical set-up screen is shown below.



The arrow selector ">" is moved down the screen by pressing the **▼** key.

To change the item indicated by the arrow ">" press the **◀** and **▶** cursor keys.

Vp can be set in the range 1% to 99%
 Z, the cable impedance, can be set to 50, 75 or 100Ω
 The measurement units can be set to Feet or Meters

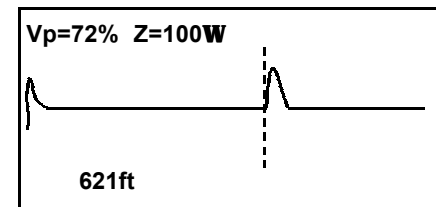
To exit set-up mode and save the settings press the **TDR/** key.

When the TX2002 is switched off it will remember the set-up parameters, including the last selected Vp and Z settings.

This feature is useful in the situation where the operator is performing many tests on the same type of cable.

Correct measurement of fault distances is also dependent on the cursor being positioned accurately by the operator.

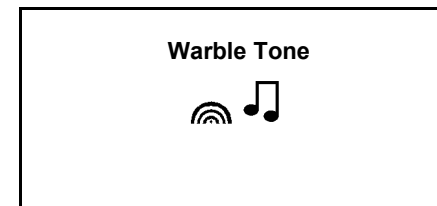
When locating faults with the TX2002 the cursor should be positioned at the beginning of the feature on the cable waveform as shown below.



10. Tone Generator

Press the **TDR/** key to inject a warbling tone into the cable or link under test.

The following screen will be displayed to show that a tone is being injected into the cable under test.



8. How to determine unknown Vp settings

If the TX2002 is to be used with a cable type for which the Vp is unknown, this must first be determined.

1. Take a sample of the cable at least 100m or 300ft long
2. Measure the actual length of the cable using a rule or tape measure, or some other reliable method
3. Connect the TX2002 and adjust the Vp setting such that the tester gives a correct reading of the sample length

The Vp setting can now be noted and used when measuring on unknown lengths of the same cable type.

9. Accuracy

The TX2002 is able to measure distances to faults and cable lengths to an accuracy of +/- 1%.

This measurement accuracy is based on the correct value of Vp being used for the cable under test, and homogeneity of the Vp along the cable length.

If the Vp is set incorrectly by the operator, or the Vp varies along the length of the cable, then additional errors will be incurred and the measurement accuracy will be effected.

Note:- The Vp is less well defined with unshielded multicore cable, including power cable, and is lower when a cable is tightly wound on a drum than when it is installed.

5. Attaching a cable to the TX2002

1. Ensure that no power supply or equipment is attached to the cable to be tested
2. Check that the far end of the cable is either open or shorted (not fitted with a resistive termination)
3. Attach the TX2002 to one end of the cable to be tested

The cable attachment to the TX2002 is via a BNC connector located at the top of the unit. For un-terminated cables use the crocodile clip attachment provided.

Coaxial Cable Connect the red clip to the centre wire and the black clip to the shield/screen

Shielded Cable Connect the red clip to a wire adjacent to the shield and the black clip to the shield

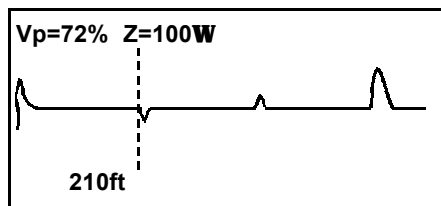
Twisted Pair Separate out one pair and connect the red and black clips to the two wires of the pair

Multicore cable Connect the clips to any two wires

6. Testing a Cable

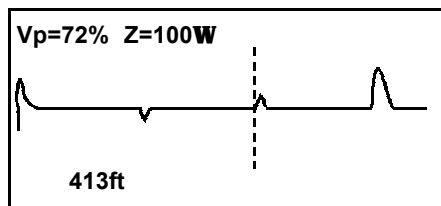
Having set the Vp and impedance (Z) to match the cable to be tested, and having now connected to one end of the cable, the TX2002 is ready to perform a test.

The following typical display shows a cable with impedance anomalies on it.



The vertical cursor line is moved left and right along the line of the trace by pressing the ◀ and ▶ cursor keys.

To determine the distance to an event position the cursor at the beginning of the event and read off the distance as shown below.



On the fault curve shown in the previous two screens a low impedance event occurs at 210ft, shown by a downward spike on the curve, and a high impedance event occurs at 413ft.

The open end of the cable is shown as a large positive spike.


7. Single shot & continuous scanning modes

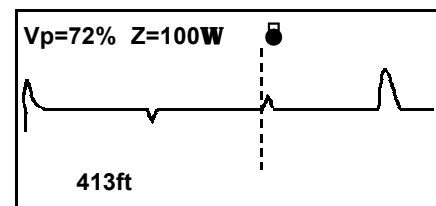
When the TX2002 is first switched on it is set to "Single Shot" mode.

In this mode the TX2002 only fires a pulse into the cable under test when either the ◀ and ▶ cursor keys or the ▼ key is pressed.

Single shot mode saves on battery life and also enables the TX2002 to be disconnected from the cable while still leaving the fault display on the screen.

To enter and then exit "Continuous Scanning" mode press and hold the ▼ key.

To show that the TX2002 is in "Continuous Scanning" mode it displays the following icon  at the top of the display and just right of centre. This can be seen on the display below.



In "Continuous Scanning" mode the TX2002 fires pulses into the cable under test at the rate of 6.7 pulses per second. In this mode the TX2002 is able to more easily identify intermittent cable faults.