

How to Find a Wet Section With the CopperPro

What does water do to the telephone cable?

When water enters the telephone cable, the *capacitive* and *resistive* characteristics of Tip, Ring, and the Shield are affected. Given enough time, the water will affect the quality of any service deployed over the copper pairs in that cable.

Initially, the water changes the capacitive characteristics between Tip, Ring, and the Shield causing a pair's capacitive distance measurement (**Opens Test**) to become much larger than normal. A dry cable pair that normally shows a distance of 1363 feet may show greater than 13,000 feet because water adds capacitance between all three legs.

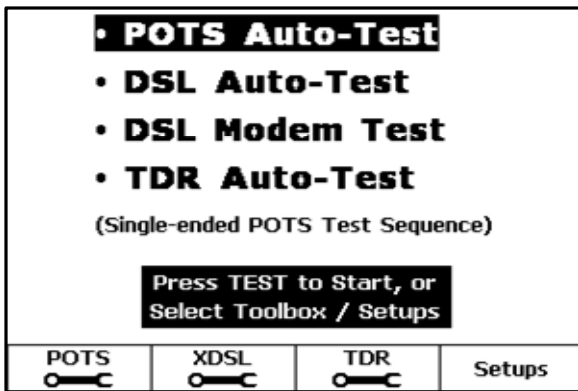
The water also changes the resistive characteristics between Tip, Ring, and the Shield causing a pair's insulation resistance measurement (**Shorts & Grounds Test**) to become much less than normal. A dry cable pair that normally shows an insulation resistance measurement of greater than 999M Ohms may be less than 500M Ohms because water decreases the insulation resistance between all three legs resulting in high resistance shorts, grounds, and crossed-battery. Given enough time, the water will eventually make contact with bare copper resulting in low resistance shorts, grounds, and crossed-battery.

Insulation resistance breakdown and crossed-battery also provide the necessary ingredients to accelerate *galvanic action*. Galvanic action is an electrochemical process that causes Tip Wires to corrode resulting in partial or complete opens. Galvanic action also produces corroded splices that become open or partially open.

Unfortunately, these water induced faults can *swing* between different capacitive and resistive values causing test sets to yield different readings each time tests are run. Sometimes the crossed-battery is present, sometimes it isn't. Sometimes the insulation resistance is 500M Ohms, sometimes it is 5K Ohms. Sometimes the capacitive distance is 13,000 feet, sometimes it is 8,000 feet. *Special services such as those using HDSLx technology may lose sync as splices swing between different values.*

STEP 1: Run the CopperPro POTS Auto-Test to get a good baseline on the pair

Is crossed-battery on the pair yet (**DC Voltage Test**)? How bad is the insulation resistance (**Shorts & Grounds Test**)? Does the pair length seem reasonable and is the pair balance OK (**Opens Test**)? Is the longitudinal balance OK (**Long. Balance Test**)? Has an unbalance caused metallic noise to be present on Tip & Ring (**Metallic Noise Test**)? Is there high power influence in the area (**Power Influence Test**)? High PI has the potential to translate into metallic (Nm) noise on unbalanced pairs.



The **POTS Auto-Test** is on the main screen along with three other popular testing tools. The Setups for this test can be modified prior to running. There are 3 toolboxes at the bottom of the screen: POTS Toolbox, XDSL Toolbox, & TDR Toolbox.

Select **POTS Auto-Test**, then press RUN.

The test results screen:

POTS Auto-Test		Failed DC Pass Threshold	
Test	Results		
AC Voltage	: Pass		
DC Voltage	: Fail		
Shorts & Grounds	: N/A		
Opens	: Fail		
Long. Balance	: Fail		
Metallic Noise	: Pass		
Power Influence	: Pass		
Load Coils	: N/A		
Loop Devices	: N/A		
Loop Cur. & Gnd Ω	: N/A		
VF Loss/Slope	: N/A		
Details		Save Results	Setups

The water has provided a path from the Rings of adjacent POTS pairs to the faulted pair (crossed-battery).

Crossed-battery prevents the Shorts & Grounds Test from running.

The water has caused a capacitive unbalance (NOTE: The Opens Test may not run if crossed-battery is too high - N/A).

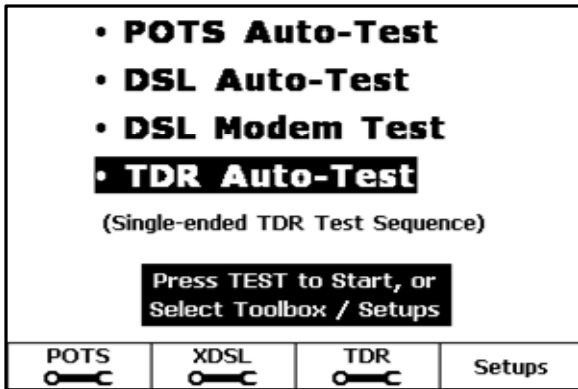
The water has disturbed the longitudinal balance of Tip & Ring relative to Ground.

STEP 2: Use the TDR to locate hard shorts / grounds and water

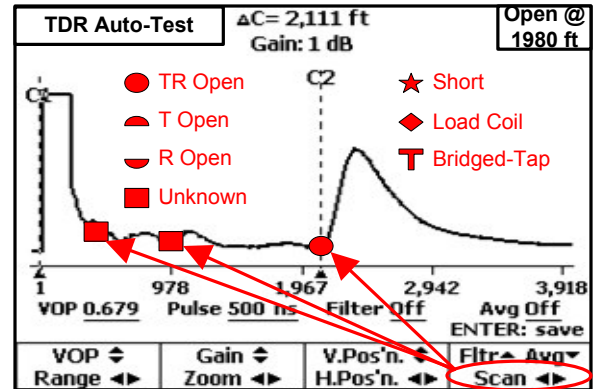
The TDR can be used to locate hard shorts / grounds and water. A skillful TDR user has learned to discern the difference between MAJOR and MINOR reflections. Go after the MAJOR reflections. Don't waste time on MINOR reflections caused by good splices, gauge changes, etc.

The **TDR Auto-Test** is an excellent tool for beginning TDR users. It takes a snapshot of the pair. It uses a *signature reflection recognition algorithm* to automatically identify / mark certain reflections. It automatically ranges / zooms:

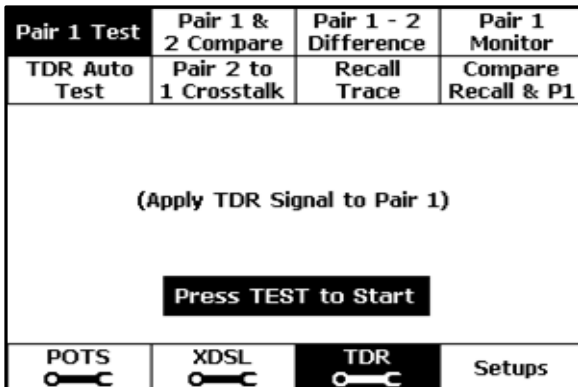
The **TDR Auto-Test** is on the main screen. Select the **TDR Auto-Test**, then press **TEST**:



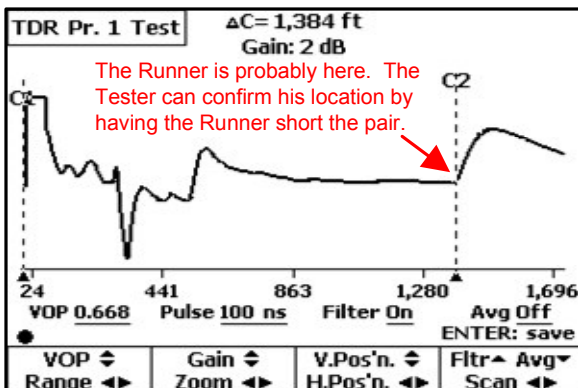
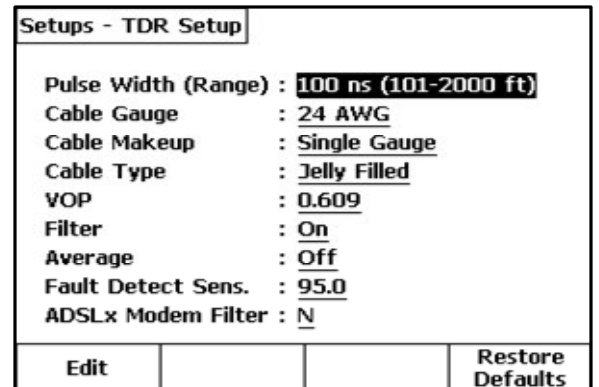
TDR Auto-Test results:



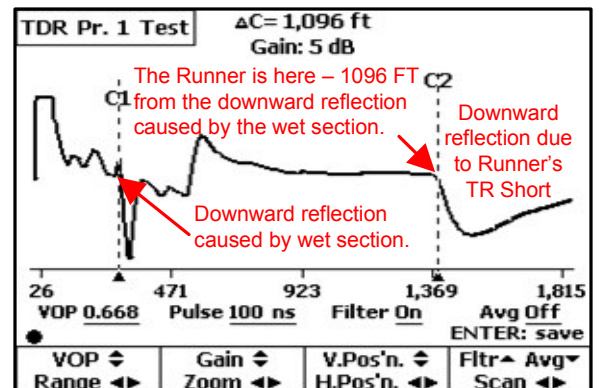
The **TDR Pair 1 Test** is an excellent tool for experienced TDR users. This tool is inside the TDR Toolbox. It runs in real-time. If a Tester and Runner are available, the Runner can drive to the opposite end of a test pair. The Tester can run the **Pair 1 Test**, ask the Runner to apply a TR Short, then watch for a downward reflection marking the Runner's position. The Tester can adjust the C1 and C2 markers to determine how far the Runner is from the downward reflection caused by the wet section.



After reviewing / changing the **Setups**, Select the **Pair 1 Test**, then press **TEST**



The Tester should watch for the Runner's TR Short, then determine the Runner's distance to the wet section



STEP 3: Use the RFL to locate a wet section

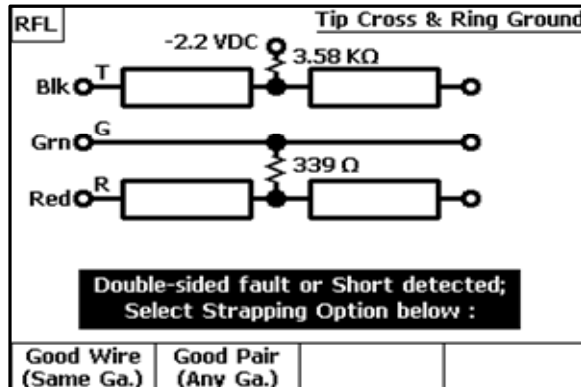
If the reflections caused by the wet section are not visible on the TDR, then use the CopperPro's **RFL** to locate the wet section. The **RFL** analyzes the test pair, and identifies the types of resistive faults present. Only one TG, RG, Tip Cross, Ring Cross, and TR resistive fault will be shown, each representing the cumulative effect of multiple resistive faults distributed along the entire wet section.

The **R.F.L.** Test is inside the POTS or XDSL Toolbox. Press TEST to run:

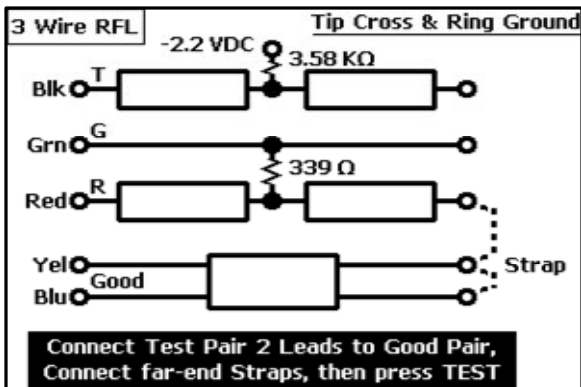
Voltage	Shorts & Grounds	Opens	R.F.L.
Load Coils	Leakage Stress	Loop Devices	Tracing Tone
VF Noise	VF Loss	VF Long. Balance	Send VF Tone
POTS Auto Test	Dial-up Tests	Terminated VF Tests	Loop Cur. & Gnd Ω
(Measure Distance to Resistance Fault Using Strap)			
Press TEST to Start			
POTS	XDSL	TDR	Setups

Resistive Fault Locate Test

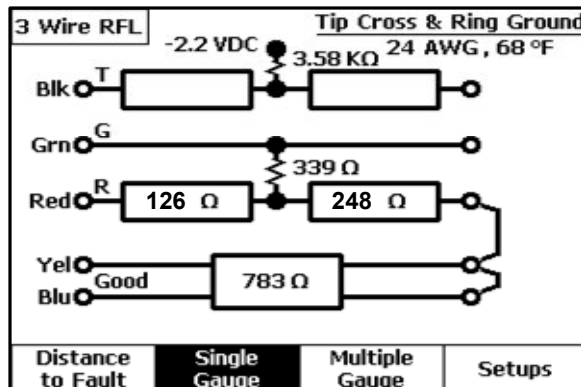
Select a strapping option such as Good Pair (Any Ga.), then press TEST:



Connect up both sides of the test pair as in the example below, then press TEST:



Initially, the RFL shows resistance readings. In this case, the best accuracy will be obtained by pressing Multiple Gauge, and using the plat to supply length / gauge for each of the sections. Press MULTIPLE GAUGE:



The plat is used to supply length / gauge for each section. Enter the data, then press BACK, then press DISTANCE TO FAULT:

Section	Length	Gauge	Load Coil	Strap Dist.
1.	3026	26 AWG	N	N
2.	214	24 AWG	N	
3.	6076	26 AWG	N	
4.	0	24 AWG	N	
5.	0	24 AWG	N	
6.	0	24 AWG	N	
7.	0	24 AWG	N	
8.	0	24 AWG	N	
9.	0	24 AWG	N	
10.	0	24 AWG	N	

Distance To Fault (DTF) = 2,950 Feet; Strap To Fault (STF) = 5,895 Feet; Strap To Fault (STF) = 5,895 Feet

