









COPPER TESTING

Testing copper is not an easy task. Knowledge, experience and good analytical skills are required to be able to determine the root cause of complex copper-loop issues. For this reason, EXFO developed a wide range of intelligent copper testing functions to help locate, identify and fix issues affecting telecom network performance. From simple validation tests to advanced fault-finding features, this guide provides an overview of EXFO's copper test functions and their applications.


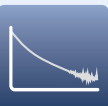



DIGITAL MULTIMETER (DMM)

The purpose of the DMM is to perform basic resistance/voltage measurements in order to determine the physical characteristics of the copper loop and determine if basic copper faults are causing service problems.

FEATURE			APPLICATION		NETWORK LIFECYCLE STEPS							
					INSTALLATION	QUALIFICATION	MAINTENANCE/ TROUBLESHOOTING	ADVANCED TROUBLESHOOTING	PRODUCT COMPATIBILITY	MAXTESTER 800 SERIES	FTB-600 SERIES	
	Voltage	To measure the presence of voltage on a copper pair. During qualification and troubleshooting, the pair under test must be disconnected at both ends to make sure there is no voltage present on the line. If there is voltage, then there is a contact (low insulation) with another live pair.			✓	✓	✓		✓	✓		
	Resistance	To measure the resistance (ohms) of the loop. This test calculates the resistive length of the cable of the line under test and verifies that there are no interruptions by applying a low voltage to the line. It also requires a strap at the far end. For an insulation resistance test, be sure to use an appropriate setup.			✓		✓	✓	✓	✓		
	Resistance Balance	To measure the difference in resistance (ohms) between the A/Tip and B/Ring of a copper pair. This test checks that no high-resistive fault problems are being generated by corrosion or poor connections. It also requires a strap to ground/earth at the far end of the loop.					✓	✓	✓	✓		
	Capacitance	To measure the capacitance value (nF or uF) of the loop. This test calculates the cable length of the line under test. It requires an open state at the far end. It also provides a capacitance balance measurement that can yield important information on possible splits, bridge taps and poor grounding impairments.			✓	✓	✓		✓	✓		
	Insulation Resistance (Stress/ Leakage)	To assess the insulation quality of the copper pair and ensure that there is not any leakage, nor any contact faults with other wires or ground/earth. This test identifies problems in a cable by applying a high voltage to the A/Tip and B/Ring and ground/earth, and observing whether or not the resistive value rises or falls. It also requires an open state at the far end.			✓		✓	✓	✓	✓		
	Station Ground	To check the earth/ground quality in a specific location in relation to that of the central office. This test uses A/Tip, B/Ring and ground/earth leads to calculate the insulation resistance between the wires and the ground. If the CO is a floating exchange type without a ground reference, the test may provide inaccurate results.					✓	✓	✓	✓		









FREQUENCY TESTING

The purpose of frequency testing is to measure the characteristics of the pair under test in the frequency domain.

FEATURE		APPLICATION	NETWORK LIFECYCLE STEPS						
			INSTALLATION	QUALIFICATION	MAINTENANCE/TROUBLESHOOTING	ADVANCED TROUBLESHOOTING	PRODUCT COMPATIBILITY	MAXTESTER 800 SERIES	FTB-600 SERIES
	Load Coil Detection	To measure the presence of up to five load coils on a copper pair. It is important to note that load coils were once used to extend the reach of normal voice (POTS) lines. This test makes sure that a cable is loaded properly, or when prequalifying DSL loops, it makes sure that all load coils have been removed from service.	✓	✓			✓	✓	
	Single-Ended Attenuation (SEA)	To measure loss at all frequencies up to VDSL2 (30 MHz) from one end of the circuit without the use of a FED or second technician. This test uses a special signal Tx and an advanced algorithm to determine the attenuation of copper pair over a selected frequency range. The SEA test is complementary to PSD and serves to verify that the line can support DSL services.	✓	✓	✓	✓	✓	✓	
	VF Longitudinal Balance	To determine how balanced the A/Tip and B/Ring are from each other to the ground/earth. This test applies a common mode signal to both wires of a pair and measures the level of noise rejection between them. This determines the pair quality for the passing service.		✓		✓	✓	✓	
	WB Longitudinal Balance	To measure the ability of a circuit to reject noise across wideband frequencies. This test is used to evaluate ground conditions, poor splices or insulation breakdown. It can be used for all types of DSL, but because the bandwidth of VDSL2 is so much wider than ADSL, this test must be performed at the maximum frequency of the service being qualified (up to 30 MHz for VDSL2 on the FTB-1; the limit on the MaxTester is 17 MHz).	✓	✓	✓	✓	✓	✓	
	Tx/Rx Tone	To transmit or receive a tone generated to/from the opposite end. This test uses the Send Tone part (Tx) to transmit a tone over the line and calculate the insertion loss of the pair in dual-end mode using a receiver device at the remote end. It also uses the Receive Tone part (Rx) to calculate the insertion loss of the pair in dual-end mode using a transmitter device at the remote end.	✓	✓	✓		✓	✓	

NOISE TESTING

The purpose of noise tests is to perform voice frequency (VF)/wideband (WB) noise and level measurements.



			NETWORK LIFECYCLE STEPS						
			INSTALLATION	QUALIFICATION	MAINTENANCE/TROUBLESHOOTING	ADVANCED TROUBLESHOOTING	PRODUCT COMPATIBILITY	MAXTESTER 800 SERIES	FTB-600 SERIES
FEATURE	APPLICATION								
	VF Noise	To measure the voice-frequency noise on a subscriber's telephone line. The industry standard is less than -70 dBm (20 dBmC) of noise at the customer's end.	✓	✓	✓			✓	✓
	Power Influence	To determine the effect of the main (50/60 Hz) field from power cables on the pair under test. The 50/60 Hz field and its harmonics are measured and compared to the industry standard of -10 dBm (80 dBmC) (maximum value). This helps calculate the amount of noise that is caused by power generation from the power company.		✓		✓		✓	✓
	VF Impulse Noise	To identify noise sources external to the copper pair. This test determines the level and number of impulse noise violations in the voice-frequency band from external sources, like high voltage motors near telephone lines and microwave ovens. This is a single-end measurement.		✓	✓			✓	✓
	WB Power Spectral Density (PSD) Noise	To check the ambient noise on a circuit prior to provisioning to ensure it will support the rate requested by the customer. This test helps avoid providing service that will be unreliable and cause further technician visits. It tests the entire VDSL2 bandwidth (30 MHz).	✓	✓	✓	✓		✓	✓
	WB Impulse Noise	To measure the number of noise impulses on a line that is caused by sources outside the copper plant. A violation can be plotted in an Impulse Noise Histogram. ¹ The histogram attaches a "time" component to the noise measurement for the FTB-600, allowing a technician to determine how many violations occurred, and more importantly, when they occurred. This is a single-end measurement.		✓	✓	✓		✓	✓
	Impulse Scope	To capture and analyze impulse noises on a line with the option of performing simultaneous frequency and time domain analysis. This test allows a technician to define the signature of the noise and locate the possible source.				✓			✓
	Impulse Duration and Disruption (IDD)	To capture and analyze impulse noises on a line with statistical data to help fine-tune the impulse noise protection (INP) level on ADSL2+/VDSL2. This test creates a histogram of the distribution of fast and slow impulses over time with high-level duration and disruption (IDD) times.				✓			✓
	NEXT	To measure the near-end crosstalk attenuation between two pairs. Under good conditions, the crosstalk attenuation of the pairs should be high. However, in the case of unbalance, split pairs or low insulation, there could be strong noise from one pair to the other. With the tester connected to the pairs, this test requires an open state at the far end.	✓	✓	✓			✓	✓

Note

1. Applicable only to the FTB-1.

FAULT LOCATOR

The purpose of the fault locator is to provide a fault-location toolbox.

FEATURE	APPLICATION	NETWORK LIFECYCLE STEPS						
		INSTALLATION	QUALIFICATION	MAINTENANCE	ADVANCED TROUBLESHOOTING	PRODUCT COMPATIBILITY	MAXTESTER 600 SERIES	FTB-600 SERIES
	Resistive Fault Locator (RFL)			✓	✓	✓	✓	✓
	TDR	✓	✓	✓	✓	✓	✓	✓



Notes

1. Only available in the FTB-600 Series.

2. The manual and XTalk modes are only available for the FTB-1.



The purpose of EXFO's smartR™ features, Pair Detective and FaultMapper is to assist field technicians by giving them access to two intelligent tests capable of determining the line condition and identifying common circuit faults.

FEATURE	APPLICATION	NETWORK LIFECYCLE STEPS						
		INSTALLATION	QUALIFICATION	MAINTENANCE	ADVANCED TROUBLESHOOTING	PRODUCT COMPATIBILITY	MAXTESTER 600 SERIES	FTB-600 SERIES
	Pair Detective	✓	✓	✓	✓	✓	✓	✓
	FaultMapper			✓	✓	✓	✓	✓

EXFO COPPER TESTING PORTFOLIO



The MaxTester 600 Series:

Compact, rugged and user-friendly handheld test solution dedicated to the installation and maintenance of your copper infrastructure.

- › MAXTESTER 610 – Wideband Copper Tester
- › MAXTESTER 635 – Wideband Copper, xDSL and Multiplay Tester



The FTB-600 Series:

Platform-based multitechnology test solution designed for the advanced technician performing expert-level copper troubleshooting.

- › FTB 610 – Wideband Copper Test Module
- › FTB 635 – Wideband Copper, xDSL and Multiplay Test module

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