FLUKE networks

Application Note

Guide to Choosing the Right Cable Test Tool to Meet Your Testing Needs

New cable test tools, designed to perform various tasks at various price ranges, are emerging at a rapid rate in today's competitive market. All cable test tools are useful for specific applications and users, but not all meet TIA/ISO performance standards and certification warranty requirements. It's important to know the distinction between the three cable test categories so you can choose the tester that truly performs the tasks you need.

The three categories for cable test tools

Cable testers are designed with a variety of focused feature sets for particular fieldwork tasks. Depending on what task the test tool performs, they can be classified into one of three broad hierarchical categories–certification, qualification, or verification. While some features overlap between test tools, each group answers a unique question:

1. Certification testers
Does the installed cabling link comply with TIA/ISO standards?
2. Qualification testers
Can this existing cabling link support the desired network speed or technology?
3. Verification testers
Is this cable connected correctly?

A closer look at certification

Certification is the most rigorous of all cable testing. Used primarily by commercial datacom contractors and network owners, certification tools are the only tools that provide "Pass" or "Fail" information, in accordance with TIA and ISO standards. A certification test tool makes many types of measurements across predefined frequency ranges and compares the detailed results to standards. The results from these measurements determine if a link is compliant with a category or Class of cable (for example, Cat 5e/6 or Class E(A)/F). Certification is the final step required by structured cabling manufacturers to grant their warranties for properly certified projects. While verification and qualification tools typically test the channel configuration, certification tools are able to also test the permanent link, which is commonly installed by commercial datacom contractors. Additionally, certification test tools support optical fiber test options, provide advanced graphical diagnostics and offer feature-rich reporting capabilities.

	Certification	Qualification	Verification
	DTX CableAnalyzer™	CableIQ™	MicroScanner²
Primary user	Datacom contractors, network owners	Network technicians	Network technicians
Meets warranty requirements from structured cabling manufacturers	✓		
Meets TIA/ISO Level III or IV Accuracy requirements	✓		
Provides Pass/Fail results compliant to TIA/ISO standards	✓		
Provides documentation reports with all measurement data (MHz, dB, NEXT, ELFEXT, RL)	✓		
Advanced troubleshooting: measures distance to performance defect (NEXT, RL, ELFEXT)	✓		
Tests existing cable to see if it supports network speed e.g., 10BASE-T, 100BASE-TX, VoIP, Gigabit Ethernet		✓	
Network connectivity trouble-shooting: views link configuration (speed/duplex/ pairing) and detects what's at end of cable		✓	
Troubleshooting: distance to connection problem	✓	✓	
Basic troubleshooting: distance to a break, short	✓	✓	✓
Continuity and wiremap	✓	✓	✓
Power of EtherNet 802.3af detection	✓		✓

Table 1 - A Comparison of certification, qualification, and verification test tool functions

DTX CableAnalyzer™, CableIQ™, MicroScanner²

Fluke Networks offers the most comprehensive line of premises network testing tools for the certification, qualification and verification of copper cabling systems.

When to use a certification tester

If you're a commercial datacom installer who needs to prove to the network owner that all cabling has been installed correctly, and meets TIA or ISO link specifications, you must certify it. If you are a network owner who wants to check third party installations, a certification tool is your only option. If you are in a troubleshooting environment, and need to show unequivocally that the link under test is failing category 5e, 6 or 6A performance requirements according to TIA or ISO standards, your only choice is a certification tool. Certification tools are vital if there is ever any discrepancy or debate with a cabling supplier or installer regarding the performance of installed cabling. If you have a mixture of fiber and copper cabling, and often need to test both, certification tools do that best.

To receive the support and financial security of a manufacturer's warranty, certification to TIA/ISO standards is your only option. Anything else makes the installer liable for the performance of the installation – which can be quite costly. For example, a large 1000 link installation could represent a $100,000 (USD) project – a hefty liability if manufacturer warranty is not obtained.

Certification and the role of standards

Certification encompasses well-defined cabling performance test procedures that are defined in the ANSI/TIA-568-C.2 standard or the ISO/IEC standard 11801 (Ed. 2). The TIA standard defines these levels of performance in categories such as, category 5e, category 6, category 6A the ISO standard defines classes of performance such as Class C, Class D, up to Class FA. The standards define a test procedure to certify that an installed link meets all the performance criteria of a given category or class. The same test parameters are defined for all data communication categories or classes; the significant difference among the categories is the level of performance as defined by the Pass/Fail limit values and the frequency range over which the measurements are to be evaluated. Cat 6 or Class E defines the link performance over a frequency range from 1 through 250 MHz. Cat 6A oe Class E(A) defines the link performance over a frequency range from 1 to 500 MHz. The ISO standard furthermore defines the test bandwidth of Class F and Class FA links over the frequency range form 1 through 600 MHz.

Certification also prescribes that the test result data for each link should be collected in the field and these results for all test parameters are stored and available in print or electronic format for future inspection.

Certification testers must meet TIA/ISO accuracy requirements - Level III or higher

Because of the important functions performed by certification testers, industry standards define the performance criteria for cabling components, as well as for accuracy levels for certification testers. The definition and compliance with tester accuracy specifications is based on two models: (1) the comparison of the field tester's results to the results obtained with laboratory reference equipment and (2) mathematical accuracy models based on the laboratory measurement of critical performance parameters unique to a test tool.

Fluke Networks' DTX CableAnalyzer™ Series underwent a rigorous evaluation by an independent and technically qualified laboratory, Underwriters Laboratory, Inc. (UL and Intertek (ETC)). DTX Series testers passed

Test Parameter	TIA-568-B	ISO 11801:2002
Wiremap	✓	✓
Propagation delay	✓	✓
Delay Skew	✓	✓
Length	✓	Information only; not a pass/fail test
Insertion Loss (IL)	✓	✓
Return Loss (RL)	✓ (except Cat 3)	✓
Near-End Crosstalk (NEXT) Loss	✓	✓
Power Sum NEXT (PSNEXT)	✓	✓
Equal-Level Far-End Crosstalk (ELFEXT)	✓	✓
Power Sum ELFEXT (PSELFEXT)	✓	✓
Attenuation-to-Crosstalk Ratio (ACR)	Information only	✓ (except Cat C)
Power sum ACR (PSACR)	Information only	✓ (except Cat C)
DC Loop Resistance		✓

Table 2 - Certification test parameters

TIA/ISO accuracy requirements with significant margins and showed perfect compliance with the ISO Accuracy Level IV requirements, as well as with the TIA Accuracy Level IIIe requirements. The TIA Level III are used to certify the performance of the upcoming 10 Gigabit Ethernet link specifications.

Powerful diagnostics to identify the defect(s) in a link

Certification test tools are also the most sophisticated cable troubleshooting tools to provide advanced diagnostics when a cabling link fails the performance test. Fluke Networks' DTX-1800 and DTX-1200 pinpoint the location and nature of the problem along with instructions for inspection and corrective action. These diagnostics not only apply when the link-under-test exhibits a break, an open circuit, or a miswire, but also when performance parameters like Return Loss or Near End Cross talk (NEXT) are not satisfied. The DTX testers are the only certification testers to translate these failures into plain language troubleshooting instructions. Rather than re-terminating every connector or replacing components in an ad hoc fashion, the technicians can inspect the link at a very precise distance from the tester and can see the possible reasons for the failing test result at that location. This troubleshooting information can save many hours of unproductive probing, guesswork, unnecessary replacements of components, or re-terminating a number of connections.

Understanding the relationship between Category/Class and network application

The industry standards define generic performance levels that are independent of any network technology or application. In order for an application to be supported by the installed cabling, you must select a cabling category or class that meets or exceeds the bandwidth requirements of the desired network applications. Today Cat 6A or a Class F cabling system supports all existing network technologies designed for use on twisted pair cabling systems. For example, a Cat 6A system supports all existing Ethernet applications from 10BASE-T (10 Mbit per second data rate) to 10GBASE-T (10,000 Mbit per second data rate). This relationship between applications or technologies and cabling categories also means that only a standards-compliant certification tester can distinguish between categories and prove the installed cabling system delivers the desired cabling performance.

Certification tools take very precise measurements on parameters defined by the TIA and ISO standards. Documented results from a high-accuracy certification tool are the only means of meeting the requirements of manufacturers' warranties.

A closer look at qualification

Qualification is a new category of testers designed to meet the emerging needs of network technicians who need to upgrade to higher network speeds as well as troubleshoot connectivity problems. Qualification testers determine if an existing cabling link can or cannot support certain network speeds and technologies (10GBASE-T, VoIP, Gigabit Ethernet) and allow the network technician to quickly isolate cabling problems from network problems. These qualification tools, like Fluke Networks' CableIQ™ Qualification Tester, are more powerful than verification tools, but do not perform the battery of tests required to be considered a certification tool.

Qualifying network bandwidth

If you have two cables of unknown capability and both cable A and cable B pass the verification wiremap test. A qualification test may show that cable A is only capable of supporting 10BASE-T, while cable B is able to support Gigabit Ethernet. Cable A would have passed a verification test, which only tests for proper wiremap and length. However, using it on a 100BASE-TX or Gigabit network could result in excessive collisions and errors, decreasing performance and increasing downtime.

Isolating cabling problems from network problems

Qualification testers allow network technicians to perform a series of troubleshooting steps to better isolate cabling from network problems. A first step in troubleshooting a network connectivity problem might be to check the speed and duplex settings of connected devices. If the tester shows the settings are matched, but the problem persists, a qualification test can be performed. Performing a qualification test will allow the technician to identify whether insufficient cabling bandwidth is the cause of the problem. For example, the tested link is only qualified to support 10BASE-T or lower.

If a link does not qualify for 100BASE-TX or 10GBASE-T, diagnostics can be used to determine the nature and location of performance faults. For example, there may be a performance-related connection fault where a patch cord meets the wall jack. This information can be used to troubleshoot the cabling link, and quickly get the network back up to speed.

These additional troubleshooting capabilities that extend beyond the capability of verification testers allow network technicians to close trouble tickets faster or to ensure smooth network upgrades. However, qualification tools do not perform certification required by cable manufacturers and the TIA/ISO standards.

When to use a qualification tester

If you are a network technician, and have undocumented cabling and need to see if it will support your 10GBASE-T network, a qualification tool is the right choice. If you have an existing network and are doing small adds, moves, and changes, or you are setting up a temporary network and just need to qualify it for a specific network technology, a qualification tool is a good option.

Qualification tools will tell you what services can be successfully deployed on a given link. This example shows a link suitable for VoIP, 10BASE-T and 100BASE-TX, but unacceptable for 1000BASE-T.

A closer look at verification

Verification test tools perform basic continuity functions (for example., wiremap, toning). These verification test tools sometimes include additional features such as a Time Domain Reflectometer (TDR) to determine the length of the cabling link or the distance to a break or a short circuit in the link-under-test. They may also support continuity of twisted-pair links as well as coaxial cabling links and check coaxial connections. Verification tools may also detect and report that the cable under test is connected to an active device like a hub or switch. Verification tools are ubiquitous, simple to use, low-cost tools that are often the first line of defense in finding cabling problems.

Verification tools are especially valuable as a quick and easy screening tool when performing large-scale installations. They can be used to verify that cables have been correctly wired and terminated, and to find breaks and shorts before the certification tests are performed. Eliminating connectivity problems before the certification tests can save valuable time and can significantly reduce the overall costs of testing.

On the fiber side, a simple Visual Fault Locator (VFL) could be considered a verification tool as it verifies contiguous fiber connections and fiber polarity.

When to use a verification tool

Verification tools are typically used by any technician who pulls and terminates cable or performs basic moves, adds and changes. These tools are used as a first line of defense in finding connection and wire-pairing faults.

Verification tools are simple, low-cost devices that check the basic connectivity of the installed links.

See each tool in action, take a virtual test drive

Take a look at each testing technology and see the difference for yourself. To take a virtual test drive of the DTX CableAnalyzer certification tool, CableIQ Qualification Tester, and MicroScanner 2 Cable Verification Tester, go to **www.flukenetworks.com/coppertest**

Fluke Networks
P.O. Box 777, Everett, WA USA 98206-0777

Fluke Networks operates in more than 50 countries worldwide. To find your local office contact details, go to **www.flukenetworks.com/contact**.

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Printed in U.S.A. 9/2012 2408218B D-ENG-N