Testing Electrical Interconnect Systems

Current Test Requirements Equipment Trends • Developments

Robert Maccarone,
Mgr., Global Sales & Marketing
CableTest Systems, Inc.
www.CableTest.com

ATE systems (above) incorporating advanced graphic user interfaces (right) are necessary for verifying raw cable integrity.

Global market events have had a strong impact on test requirements and automated test equipment (ATE) used to verify electrical interconnect assemblies. Macro forces ranging from homeland security to labor shortages and rising oil prices have been driving manufacturing work into lower-cost regions such as Asia and India. With this, we've seen movement away from manual testing, the adoption of standardized test methods and the implementation of networked systems and database-stored test results.

Equipment trends are being driven by demand across all markets for systems that are easy to use, scaleable and repairable with minimal tech support. Equipment must not only be reliable, it must be readily re-configurable, compatible with leading database formats for data security and often must be compatible with other manufacturer's test programs. This is occurring at all stages of manufacturing, from raw cable production to assembly of wiring sub-systems, to the eventual maintenance, repair and overhaul of complete assemblies.

Raw Cable

Raw cable makers are under constant pressure to minimize costs in today's competitive market. These reductions may come from reduced scrap or more efficient throughput, but not at the cost of quality. A defect in the insulation or shielding of a subsea data cable is simply not acceptable. Therefore, ATE systems for verifying raw cable integrity must offer accurate fault location, high-energy AC voltage sources to quickly and safely HiPot miles of bundled wire, simple graphic user interfaces for operator control and modular test fixturing for fast workstation re-configuration. Similar trends and ATE requirements are seen in the contract manufacturing sector.

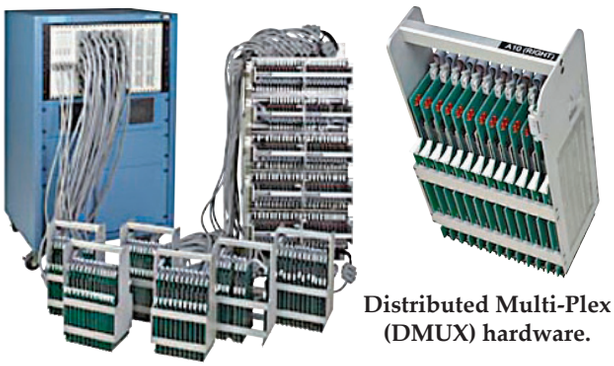
Contract Manufacturing

While manufacturing capabilities are being moved out of North America, Europe and the UK, most design and development work is still being handled locally. Consequently, standardization of test procedures, test equipment, data format/storage, maintenance and spares is becoming ever more critical to the multi-nationals' successful production and test strategy. Global contract manufacturers will often share test equipment among facilities that may be spread around the world, with each site manufacturing products that can range from custom cable assemblies to telecom enclosure systems.

The need for this level of ATE versatility in the contract manufacturing sector is further compounded by increasing product complexity. An example is demand from the mil-aero, medical and telecom sectors for smaller, lighter interconnect systems has lead to advances in miniaturization such as 'nano' connector technology. Manufacturing these products requires stringent control of critical specifications including insulation quality and signal integrity. Flex circuits using nano connectors often require a combination of precise parametric, functional, low and high voltage tests up to 500 VDC/350 VAC. In military and aerospace applications, a 1 m^2 midplane can house over 10,000 ball grid array (BGA) connections and require 100% test coverage for opens and shorts.

Today's interconnect ATE systems may be required to validate complex harnesses carrying power, coax, signal and high-voltage lines in one facility, and then be re-configured to perform opens, shorts and parametric tests on backplanes in another facility using the same test platform and software. The **CableTest** MPT wiring analyzer exemplifies this capability. It can accommodate mixed high and low-voltage switching for validating connectors, cables and harnesses, and can also test any backplane or rack. The latter is achieved using its Distributed Multi-Plex (DMUX) technology that joins paddle cards and resident switching modules to simplify fixturing and nearly eliminate interface cables.

In the contract manufacturing area, an ATE system's



Distributed Multi-Plex (DMUX) hardware.

portability, ease-of-use, scaleability and commonality of spares is key to its survivability. This is similar to military requirements for highly standardized and flexible ATE systems that may be used in a production environment, a service depot or on a vessel at sea.

Military

As the military sector continues its integration of air, land and sea forces to achieve joint capabilities, demand is growing for ATE systems that also offer increased standardization, modularity and scaleability. Perhaps more so than in any other sector, ATE versatility is critical in every sense—the ATE system must be easy to transport, easy to use, easy to integrate with standard databases and other test equipment, and it must be easy to troubleshoot and repair.

Easy-to-transport ATE system for military applications.

Beyond need for ease-of-use, duty-specific performance is essential for ATE systems used in military applications. For land-based field-service tasks, environmental control systems are becoming critical as sand and dust ingress could render a test system inoperable in a matter of hours. In a manufacturing environment, aircraft wiring systems often require the ATE to offer multi-bus switching architecture for performing complex functional tests, while UAV connectors and rocket launch controls often require ATE systems to perform sub-ohm resistance measurement, ultra-fast open capture scanning (sub-10 µsec during environmental stress screening), and insulation resistance testing beyond 10 GΩ at 500 VDC. Where these tests may have previously been carried out by an engineer using manual test equipment, the same task can now be performed by a technician or operator using a single ATE system with a simple yet powerful graphic user interface.

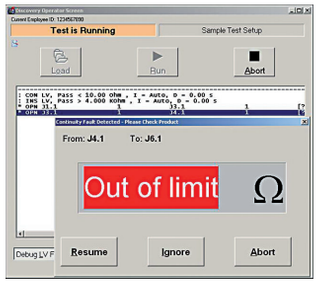
MRO

Similar test requirements exist in the aircraft Maintenance, Repair and Overhaul (MRO) sector, where airlines strive to reduce operating costs through improved maintenance strategies, and where MROs often strive to meet demand with qualified support staff in short supply. As a result, MROs continue to rely on ATE systems for improved test traceability, fault location and ultimately rapid aircraft turnaround.

Used for aircraft MRO, ATE systems provide improved traceability, fault location and rapid aircraft turnaround.

In recent years, MRO demand has lead to commercialization of time-domain reflectometry (TDR) tools that identify, locate and characterize wiring faults through a single harness connection. Although this test often requires the operator to have interpretive skill, it can eliminate the need to isolate a cable or harness which is often either impossible or impractical.

Global events and advanced manufacturing technologies are playing a major role in the development of new test requirements and advanced ATE systems for electrical interconnect systems. Modularity, flexibility and ease-of-use are now as important as ATE reliability, accuracy and range. Thanks to advances in multi-bus switching architecture, software development tools and hardware interface technology, today's ATE systems are well equipped to respond to the challenges faced by the manufacturing, military and MRO sectors. *www.CableTest.com*



Today's ATE systems are equipped to meet the challenges in the military and MRO sectors.

Company Profile...

Since 1982, **CableTest** has been redefining the testing of cables, backplanes, connectors and wire. The company is a recognized pioneer, working closely with customers to create better products including highly-versatile modular systems and application-specific customized solutions. CableTest offers test equipment with innovative capabilities, allowing faster and more accurate testing. CableTest equipment is used globally in the aerospace, automotive, contract manufacturing, medical, military, telecom and transportation industries. **www.CableTest.com**